

UNIT 22 HEALTH AND DISEASE

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22.1 INTRODUCTION

In the previous unit on food and nutrition we have dealt with the importance of balanced diet in maintaining health. You have also learnt that a majority of our people suffer from many deficiency diseases due to malnutrition. In this unit we will discuss how lack of clean drinking water, inadequate living conditions, poor environmental sanitation, lack of health education, etc. result in diseases. These factors affect the health of not only an individual but of the community as a whole. Disease results from a complicated interaction between man and his environment. Furthermore, physical and mental stress which greatly affect our health is also determined by the environment we live in.

Diseases can be prevented by taking appropriate social measures, and prevention of disease is perhaps far less expensive than its cure, particularly when millions of people are involved. Health education of common people, therefore, has crucial importance in the maintenance of health.

In the first section of this unit we will talk about the causes of infectious diseases, and how they are transmitted. The causes are no more a mystery. Infectious diseases are caused by tiny invisible creatures. You will know about their discovery, modes of entry into the body and the way they quickly spread from one person to another. You will also learn that our body has an elaborate defence system to fight them. In the following section we will discuss the measures necessary to prevent these diseases.

Finally you will be introduced to health care system in India. We will discuss why we have failed in establishing self-reliant health services for our society.

Objectives

After reading this unit you will be able to :

- understand what good health is,
- distinguish between infectious and non-infectious diseases,
- realise that common beliefs and dogmas related to the cause of disease are often unscientific,

- acquaint yourself with the discovery of disease-causing organisms,
- find out how disease-causing organisms invade our body and spread from one person to another,
- learn about the defence mechanism our body possesses to combat disease-causing agents,
- explain why pure drinking water, clean food, hygienic habits and environmental sanitation are necessary for the prevention of infectious diseases,
- discuss the reasons for shortcomings of the health services in rural India.
- adopt methods necessary to control the rapid spread of AIDS.

22.2 WHAT IS GOOD HEALTH

All of us have a desire to live a long life. While it is desirable to live long, it is more important to live well. Health is the greatest asset of our life, so we must all preserve it. The World Health Organisation (WHO) defines health as, "a state of complete physical, mental and social well-being and not merely an absence of disease or infirmity". So, there are three components of health namely physical, mental and social. A person, who is fit in all three respects, is said to be in a state of positive health. In our ancient literature on health, there is a similar definition. We can elaborate it and say that it is a state in which a person is able to use all his intellectual, emotional and physical resources in the social and physical environment he encounters. We may also say that a healthy person should make the best possible use of his physical and mental assets, however great or small they may be.

Health involves, first of all, a proper working of all the organs of the body, because an ailing body will always create mental tensions of its own. Mental and physical health are inter-related. Probably you have experienced that on being upset or depressed, your body becomes lethargic and weak. However, a person with a perfectly healthy body may still have social and psychological problems. But how do we know that we are mentally healthy?

The following are some of the characteristics of a mentally healthy person:

- he or she is free from internal conflicts,
- he or she is well adjusted with others and can make satisfying and lasting relationships,
- he or she has self-control and can assume responsibilities,
- he or she can find satisfaction and happiness in achievements in accordance with his or her abilities.

In this unit we do not intend to write down the rules for keeping good health. Instead, we will concentrate on how the environmental factors adversely affect our health and contribute to the spread of diseases. Before we discuss what we mean by disease, let us try the following SAQ.

SAQ 1

Fill in the blank spaces with appropriate words.

- All the organs of the body work in a person.
- A healthy person can make use of his and physical resources within the social and physical environment he lives in.

22.3 DISEASE

All of us, at one time or another, have suffered from fever, aches, vomiting, nausea, diarrhoea, flu, cold, general weakness etc. Illness can arise from a number of factors, such as failure of some part of the machine, i.e. our body, or inheritance of some tendency or malfunction from the family, or problems due to aging or due to some infection etc. As you have learnt in the previous units, it can also be due to some deficiency or even lack of nourishment.

You may be familiar with the names of some of the serious diseases such as cancer, tuberculosis, typhoid etc. A recent addition to the deadly diseases is the one called AIDS in which the body loses all natural power to fight a disease.

We could say that a disease is a departure from the state of health. Any variation in the normal structure or function of a tissue or an organ of the body could mean disease. Doctors have various methods and instruments to find out if a person is suffering from any disease. These are :

AIDS — stands for Acquired Immune Deficiency Syndrome.

- i) physical examination, like testing of eyesight or hearing the sound of heart beats, or observing the movement of the limbs,
- ii) biochemical tests performed on the tissues and fluids of the body, like testing if there is sugar in the urine or too much fat in the blood,
- iii) microscopic examination of the body fluids and/or excreta— the familiar examples are blood, and stool test etc.,
- iv) use of biophysical methods like X-rays, to detect fractures of bones, or to examine the condition of the lungs,
- v) surgery and other methods to locate diseased organs inside the body.

22.3.1 Types of Diseases

As we have indicated above, there are diseases that a person is born with, for example, a baby may have a defective heart at the time of its birth. Then there are some diseases like—hamophilia in which there is a severe tendency to bleed even from a slight cut, because the parents or grand parents had them. These diseases are called “congenital” diseases. Some physical deformities are caused to babies at the time of their birth because they are handled by untrained attendants. Then there are also diseases which are broadly grouped as :

- communicable or infectious, that is they are passed on from one person to another in various ways, and,
- non-infectious.

Communicable diseases are caused by micro-organisms and worms; examples are cholera, chicken pox, tuberculosis, malaria etc.

Non-infectious diseases are those which are not due to an external infection, and so they cannot be spread from person to person, for example anaemia, diabetes, arthritis etc. Some common infectious and non-infectious diseases are listed in Table 22.1.

Table 22.1: Infectious and Non-infectious Diseases

Infectious Diseases	Non-infectious Diseases
Common cough and cold	Diabetes
Malaria	Cancer
Cholera	Asthma
Tuberculosis	Arthritis
Chicken pox	Hysteria
Plague	Kwashiorkar
Conjunctivitis	Marasmus
Measles	Scurvy
Mumps	Obesity
Polio	Haemophilia
Trachoma	
Leprosy	
Diarrhoea	
Worms	
AIDS	

In this unit we will discuss only communicable diseases. The major problem of community health has always been their control and prevention. If they are not prevented, they sometimes spread rapidly over large areas and we say that there is an “epidemic”. Since the manner in which they spread is known, most of these diseases are preventable. Prevention of these diseases requires many social measures, such as (i) clean drinking water supply, (ii) effective sewage disposal, (iii) proper housing, (iv) clean food, (v) control of pollution, (vi) proper health services, (vii) mass vaccination programmes etc. The success of these

measures largely depends upon the personal as well as collective effort of members of the community. About 150 years ago, these diseases were very severe in countries and regions like USA, Canada and Europe also. But now they are well under control. However, as long as they exist in any part of the world, communicable diseases could reach the countries which are free of them. That is why there is a world-wide concern for their eradication from the globe.

In the following sections of this unit we provide you with preliminary understanding of infectious diseases and their modes of transmission. We will begin with the discovery of microbes as a cause of infectious diseases and learn how they invade our body and how our body combats them. With this knowledge, you will be able to appreciate different preventive measures necessary for the control of such diseases.

SAQ 2

- a) Which of the following statements are true or false; indicate by putting T for true and F for false in the given boxes.
- i) Diseases which are present from the birth are called infectious diseases. ☐
 - ii) Communicable diseases rapidly spread from one person to another. ☐
 - iii) Absence of disease is an indicator of good health. ☐
- b) List the names of five diseases familiar to you. Classify them into infectious and non-infectious diseases.

Infectious
Non-infectious

22.4 INFECTIOUS DISEASES

Some of you may have heard about the great bubonic plague, a fatal disease of the blood, spread by fleas and respiratory secretions. It occurred in epidemic proportions throughout most of Europe from thirteenth to nineteenth century. A major outbreak of plague in India occurred in 1896 and lasted for fifteen years. It swept through villages and towns and killed over eight million people. It seems that such diseases were common in ancient times. Increased trade and commerce and resultant human traffic made them reach new places all over the world. Similarly, diseases such as small pox, measles, influenza and cholera spread easily from one person to another, and from one area to another. The reason for the spread of these diseases, and many others, was not known till the nineteenth century. Till then, such diseases always left people struck with terror because their causes were shrouded in mystery. Due to ignorance, demons and evil spirits were blamed for causing these diseases. In India, it was believed that these diseases were a punishment from angry deities. A new Goddess was created and held responsible for each disease. For example "Seetla Mata" is said to cause small pox. People worshipped her to get cured from this disease. It would be interesting to note here that small pox has been eradicated from this planet due to a planned world-wide vaccination campaign. Plague outbreaks do not occur any more.

The poem given in the margin which children often sing while playing, is jointly sung at a memorial service outside the village Eyam in England to pay homage to the townsfolk who gave their lives three centuries ago to save others from the disease. These people got affected by plague. In order to stop the spread of disease they confined themselves in their village to save others.

The ring of rosies refers to the rose-shaped splotches on a plague victim. Posies were little flowers used to ward off the evil spirit. And Achoo! means sneezing which accompanied the disease. The last line means that they all died.

You must have experienced that if somebody in the family is suffering from a cough or cold you often catch it. Do you know why? Because these diseases are caused by germs or "microbes" which can go from one person to another. "Microbes" means minute organisms or germs. They are so small that we cannot see them with the naked eye. Some can be seen with the help of an ordinary microscope while others are smaller still and can be seen only under very special microscopes. Certain infectious diseases are caused by worms. We will also discuss how they spread from one person to another.

Ring-a-ring of rosies
A pocket full of posies
Achoo ! Achoo!
We all fall down

22.4.1 Discovery of Microbes

The discovery of microbes and the fact that they cause infectious diseases is one of the great advances in science, which has helped us in understanding, preventing and eradicating various diseases. Before this no-one had imagined that such tiny creatures could create havoc in the life of human beings.

Antonie van Leeuwenhoek (Fig. 22.1), a Dutch, was an expert in making lenses. He was the first person to observe bacteria about 300 years ago. Out of curiosity, he examined the water of marshy lakes, rain water, human excreta and scraping from his own teeth and was astonished to find tiny living creatures in them. He named them "animalcules". They spun about like a top or darted through water like little fish in a pond. He was perplexed, and he pondered about their origin and role. He sent his observations to the Royal Society of London. The Queen of England also came to see these "animalcules". van Leeuwenhoek also made another significant observation that the scraping from teeth, if examined soon after drinking hot coffee, contained only dead animalcules. His observations could not be explored further by other scientists because he was a very suspicious and secretive person and did not teach anyone else to make lenses.

Another class of microbes were observed in the eighteenth century, but scientists took them as idle curiosities of nature, because to blame disease on micro-organisms was to break with century old tradition rooted in religious beliefs and dogmas.

In the middle of the nineteenth century, a famous French scientist, Louis Pasteur showed that where disease was rampant, air was full of microbes, but where the air was clean, disease was uncommon. You have read in Unit 12 about the experiment Pasteur conducted to show that living organisms do not arise spontaneously. He also established that diseases were due to germs. A few years later Robert Koch of Germany (Fig. 22.2) showed that a specific kind of bacteria is responsible for anthrax, another for tuberculosis, a third for plague etc. This splendid work motivated many scientists to identify and study bacteria that were responsible for various diseases. It was found that malaria is caused by protozoan called "plasmodium" which is carried by the female mosquito *Anopheles*. Their findings often led to possible cures of the diseases. Thus, the mystery of disease was unfolded. It is worth giving a thought that if the first discovery of Leeuwenhoek was followed up instead of being ignored because it went against established beliefs, perhaps millions of lives could have been saved.

Another class of microbes are virus. Common cough, cold, and viral fever which afflict many people these days, are caused by them. They are smaller than bacteria and therefore remained a mystery till late in the nineteenth century. Virus cannot be seen with low power microscopes; they were observed only when more powerful microscopes were invented. Virus are strange objects because they behave like chemical molecules, and cannot replicate outside the living cell of the host animal. They can be crystallised like sugar or salt. But on invading the host cell, they behave like a living organism and replicate like bacteria, to cause fever or other diseases.

During the Industrial Revolution, Edwin Chadwick (1800-1890) demonstrated a close connection between disease and poor sanitary conditions. Hence, it was clear that many diseases depended on the conditions of living, which human beings experienced in society, not because they had sinned and were being punished.

We distinguish microbes into four groups (i) bacteria (ii) virus (iii) protozoa (iv) fungi. Figure 22.3 shows structure of various microbes as seen under microscopes. When a patient's blood or spit or excreta are examined, and the microbe present is identified, the disease of the patient is determined or diagnosed, and treatment can follow. In Table 22.2 we have listed some common diseases caused by different kinds of microbes and worms.

Here we have also listed diseases caused by worms. They enter the human body mainly through unclean water or food, and sometimes by puncturing the skin. They live in the gut and lay their eggs which come out in faeces. Unhygienic conditions expose people to diseases caused by worms. These worms cause loss of weight, abdominal pain and occasional dysentery. After entering the body, they penetrate other organs of the body such as the liver or the lungs. Millions upon millions of our people suffer from diseases caused by worms. One child specialist said that almost 80% of her patients have worms.



Fig. 22.1 : Antonie van Leeuwenhoek (1632-1723), opened the door to the hidden world of microbes when he first observed bacteria with the help of a lens. Although only an amateur scientist, Leeuwenhoek's keen interest in optics and his diligence led him to this important discovery.

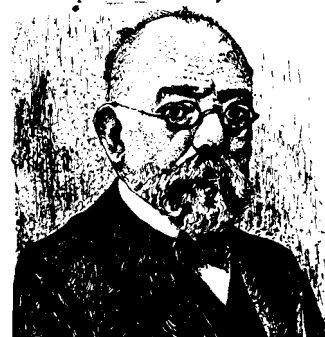
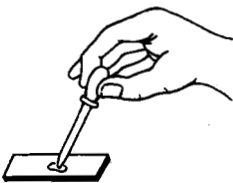


Fig. 22.2: Robert Koch (1843-1910) A brilliant German physician gave the first proof that bacteria actually cause disease. He also established that a specific bacteria is responsible for a specific disease.

Early Advocate of Sanitation, Edwin Chadwick was a lawyer in England, who in 1842 investigated sanitary conditions of the working class.




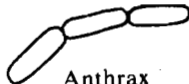





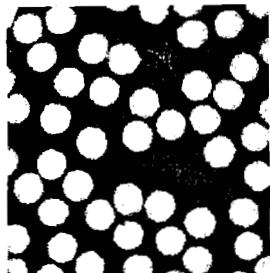

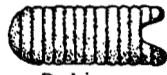




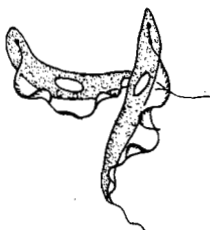






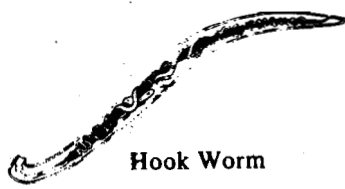
<p>Bacteria</p>  <p>Cholera</p>	 <p>Anthrax</p>  <p>Syphilis</p>  <p>Cholera</p>  <p>Sore Throat</p>  <p>Boils</p>  <p>Pneumonia</p>
<p>Virus</p>  <p>Polio</p>	 <p>Small Pox</p>  <p>Rabies</p>  <p>Dengue</p>  <p>Measles</p>  <p>Respiratory Infection</p>
<p>Protozoa</p>  <p>Sleeping Sickness</p>	 <p>Sleeping Sickness</p>  <p>Malaria</p>
<p>Fungi</p>  <p>Vaginal Disease</p>	 <p>Ring worm disease</p>  <p>Vaginal Disease</p>
<p>Worms</p>  <p>Cerebro-spinal meningitis</p>	 <p>Flat Worm</p>  <p>Hook Worm</p>

Fig. 22.3: Kinds of microbes and worms causing various diseases.

Table 22.2 : Infectious Diseases Caused by Microbes

Bacteria	Virus	Protozoa	Fungi	Worms
Cholera	Chicken pox	Malaria	Skin diseases	Tape worm, Hookworm, Pinworm (disorders mainly of the digestive system)
Conjunctivitis	Common cold	Amoebic dysentery	Ring worm disease	
Dysentery (bacillary)	Influenza	Sleeping sickness		Guinea worm
Cerebro-spinal meningitis	Measles			Filaria
Whooping cough	Mumps			
Gonorrhoea	Poliomyelitis			
Leprosy	Rabies			
Plague				
Syphilis				
Trachoma				
Tuberculosis				
Typhoid				

SAQ 3

Which of the following statements are True/False; indicate by putting T for true and F for false in the given boxes.

- i) If a clean person lives in a clean house, he will not catch infectious diseases. ☐
- ii) Diseases are caused due to fate of the individuals. ☐
- iii) Infectious diseases are caused by germs. ☐
- iv) van Leeuwenhoek saw living germs from scrapings of his teeth after drinking hot coffee. ☐

22.4.2 Microbes are Present Everywhere

You should know that invisible microbes are present everywhere, because they can survive even under very inhospitable conditions. They are all around us, in the air we breathe, in the soil, in food, in water used for drinking or bathing and on all the objects we come in contact with. You will be surprised to know that billions of them live on the skin of our body and in our mouths and intestinal tracts. One third of the dry human faeces is bacteria. However, only some of these micro-organisms cause infectious diseases. There are many others which are beneficial and their activities are of central importance to the biosphere. Without them life on earth would perish! Long before we even knew of their existence, we have been taking advantage of their activities, as in the case of making curds, and alcohol or baking cakes and bread. They decompose dead plants and animals, as well as sewage into harmless but indispensable chemicals like nitrogen, oxygen and carbon dioxide etc. They can also be used as biological factories to produce antibiotics. In fact, the famous antibiotic, penicillin was discovered from a culture of fungus. Certain kinds of bacteria live in human intestines and provide vitamin B₁₂ and vitamin K. Thus, though some microbes are harmful, others are of great service to humanity. While the knowledge of germs has grown and some of it is used to save people from disease and death, several countries have used this knowledge for destruction and warfare. You may have heard the word "germ warfare". These countries have collected deadly germs which can be spread in enemy countries to pollute air or water or even to destroy crops and forests. Such warfare, obviously, kills people, not just soldiers, and as such it is internationally prohibited.

22.4.3 How do Microbes Enter Our Body?

You have learnt that microbes exist virtually everywhere, and hence our body is constantly exposed to them. They gain access to our body through the natural openings like our mouth, nose, urinary and reproductive passages (Fig. 22.4). This can happen while we breathe contaminated air, drink impure water or eat infected or spoiled food. They reach our lips when we touch them with germ-carrying fingers or finger nails, when we drink from glasses

or cups which have not been washed well or even while wiping the mouth with dirty and used towels. We can get infected from other persons by contact while shaking hands, or otherwise touching their body. Germs can enter our body through urinary and reproductive passages during sexual activity.

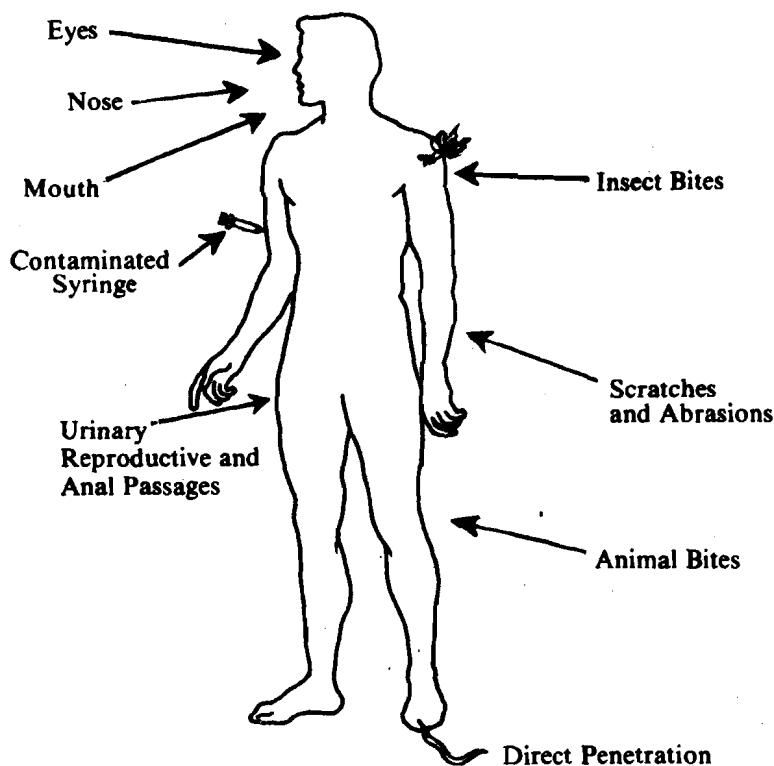


Fig. 22.4: How disease-causing organisms enter the body. .

Our eyes get germs from infected air or dust. Each of these natural openings leads to a tube which reaches other organs. Thus germs get into our body and infect our organs. The tubes are lined with soft mucous membranes which can resist penetration only when a person is in a state of good health. In case of common cold, the mucous membrane itself is attacked, and germs sit and multiply on it.

Germs are invisible invaders and it is not easy to check their entry. The major physical barrier to their entry is our skin. As mentioned earlier, a large number of them live on our skin and most of them are harmless. Some germs do cause boils and pimples, invade roots of hair and set up local infection. If the infection is not controlled it may spread deeper under the skin. If the skin is cut or scraped off by injury, bacteria get under the skin, and the wound becomes septic.

Insects are also carriers of many disease germs. The blood-sucking insects on biting, puncture the skin, and thus introduce germs into the body. For example, the female mosquito *Anopheles* injects germs of malaria; worms of filaria are also carried by a kind of mosquito. Similarly, plague and sleeping sickness are caused by bites of fleas and a fly called the tse-tse, respectively. Many worms, such as hookworm can penetrate through the skin and enter the blood stream. Eggs of pinworm enter through the mouth by contaminated fingers or infected food or water. As you know, the bite by a mad dog is almost always fatal. This is because the dog carries germs causing rabies. Dirty and infected syringes used for injections can also cause disease.

You may wonder how such tiny creatures can give all kinds of diseases. Their main strategy is that they multiply in our body very fast. Every twenty minutes bacteria can reproduce by division. In a few days, a single bacteria can produce millions of bacteria, thus, infecting millions of cells at the site of infection.

Virus can only reproduce inside the living cells. After entering the body cell, it takes over control and directs the cell to make its copies. The numerous virus so formed are released in the body, killing other cells.

Malaria

Charaka and Susruta of Ayurvedic period gave vivid descriptions of the disease and associated it with the bites of mosquitoes. In 1897 Ronald Ross who was working on malaria at Secunderabad (Andhra Pradesh) confirmed that mosquitoes transmit malaria.

SAQ 4

a) Which of the following statements are true/false; indicate by putting T for true and F for false in the given boxes.

- i) Virus can reproduce outside the living cell.
- ii) Bacteria reproduce by fission.
- iii) All bacteria are harmful.
- iv) Millions of bacteria live on our skin.
- v) Malaria is caused due to a protozoa.
- vi) Some bacteria help us produce useful materials.

☐
☐
☐
☐
☐
☐

b) Fill in the blanks

- i) The major physical barrier to the entry of germs is our
- ii) Mucous membrane can resist penetration of germs only when a person is.
- iii) Germs can reach our mouth through, and.

22.4.4 Body's Battle against Germs

You have learnt that many kinds of germs find their way to our body, then you must be wondering why we do not fall sick more often. Lots of people are exposed to germs, but only a few get sick. Does it mean that some people can put up a greater resistance to infection?

First of all, the skin and the mucous membranes of our body help us to keep out germs. There are glands in the skin which produce oily substances to provide a protective cover to the surface of the skin. Perspiration helps us to eliminate certain wastes and germs out of the skin. Perspiration also contains a special chemical known as lysozyme which destroys germs. Lysozyme is also found in tears, saliva, nasal secretion and tissue fluids. Many types of germs which happen to reach our stomach are destroyed by strongly acidic stomach juices.

The germs which gain entry into our body, reach our organs or survive in the stomach, take nourishment from our body to multiply. Then they begin to destroy our body cells and also secrete toxic or poisonous substances. Unless their activity is checked they secrete enough toxins to make us feel sick. But more often they are overpowered by our body. You will be surprised to know that our body has an elaborate defence system comparable to the defence forces of a country. This defence system is called the "immune system" and it is spread throughout the body as shown in Fig. 22.5. Defence force is in the form of special cells, called White Blood Cells (W.B.C.) which circulate throughout the body along with blood. The W.B.C. are of various types and fight the invader in a variety of ways. During many kinds of infection, an automatic increase in their total number is triggered. The number might double, triple or quadruple depending upon the severity of infection. Therefore, doctors determine the number of W.B.C. in blood by observing a drop of it under the microscope.

When germs attack our body, special types of W.B.C. migrate to the infected site and destroy the "invader" germs by engulfing them. These cells are called "engulfing cells" (Fig. 22.6a). Interestingly, when the fight is over, other type of W.B.C. are directed to move to the site to remove dead germs and dead W.B.C. The pus that is generally present at the site of infection contains a large number of dead cells and germs. Another kind of W.B.C. produce a chemical weapon called "antibodies", which attack poisons or toxic substances to make them ineffective (Fig. 22.6b). These antibodies also tag the invader so that it is easily recognised by the "engulfing cells" (Fig. 22.6c).

Yet another type of W.B.C. work as killer cells and directly destroy the invader or the infected body cell. Some W.B.C. which have for the first time encountered a specific invader are held in reserve as "trained cells" which can work for subsequent encounters effectively. The whole body defence mechanism goes into action as soon as disease germs enter the body and cause an alarm signal to be generated.

Quite often, the body is effectively able to deal with the infection and all symptoms like fever or inflammation subside by themselves. But at other times, medicine must be used to supplement the body defence mechanism. After lots of research, medicines capable of

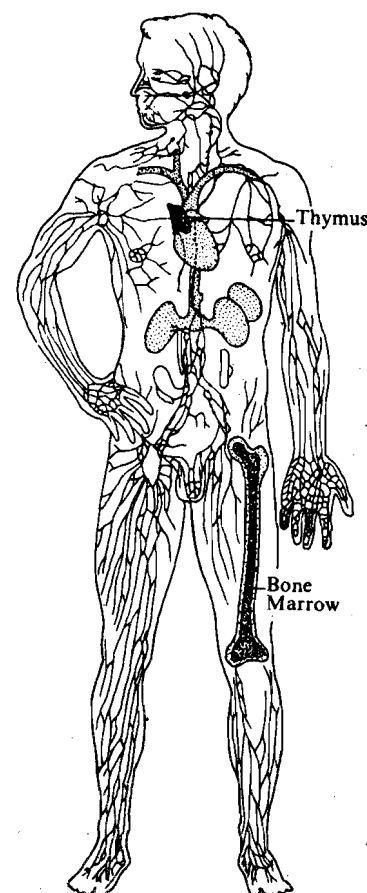
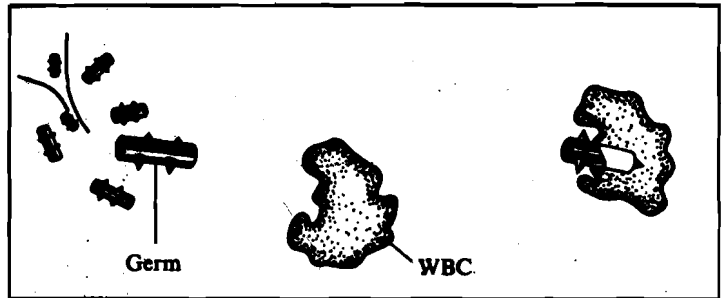


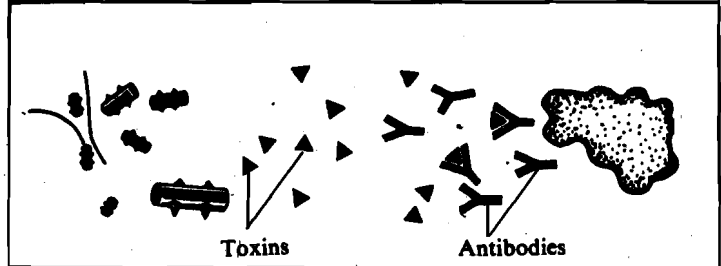
Fig. 22.5: "Immune System". White Blood Cells (W.B.C.) develop in both the thymus and bone marrow. The newly formed WBC migrate into the blood & spread throughout the body.

coping with a number of different infections have been found. It is best to consult a qualified doctor as soon as illness is discovered. Many a time people go to a doctor or a hospital when the invading germs have already caused great damage to the body system.

(a) Engulfing



(b) Neutralization of Toxins



(c) Tagging of Germs

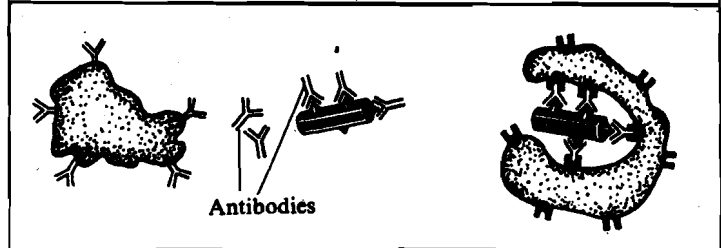


Fig. 26.6: Different mechanisms by which White Blood Cells destroy the germs.

Vaccination

Now let us see how vaccination protects us from disease.

We have mentioned above that the W.B.Cs. produce antibodies which neutralise the toxins produced by the invaders. These W.B.Cs. are of different kinds and each kind consists of millions of cells which recognise and combat a specific foreign invader. Once a class of W.B.Cs. has encountered a particular kind of invader, it develops memory and is thus trained to ward off future attacks. In this way the body becomes "immune" to that infection and the process is called immunisation.

Thus, our body regularly develops natural immunity as a variety of fighting cells are produced by actual attacks of infectious agents. Artificial immunisation is a clever idea. It is done through "vaccination", that is by artificial introduction into the body of a weak infection, which triggers off a defence mechanism, and produces W.B.C. trained to combat that particular infection.

SAQ 5

Fill in the blank spaces with appropriate words.

- W.B.C. destroy invaders either by or by producing chemicals known as which neutralise produced by the invader.
- Many diseases treated by tantriks or quacks are actually taken care of or cured by our own
- W.B.Cs. stay in blood as and throughout the body.
- A person will gain normal health if the invader is
- Drugs assist body in germs.
- Vaccination is a way to our in advance with a sample of invader.

Edward Jenner was the first person to discover small pox vaccine in 1796. He tested this vaccine on his own son.

22.5 SPREAD OF DISEASE OR TRANSMISSION

Now that we have learnt that infectious diseases are caused by various microbes and some worms, let us find out how they travel from one person to another. There are various modes of their travel, like through air, water, food, contact, insects and other carriers.

Air Borne Diseases

A number of diseases are caused due to bacteria and virus that are carried in the air. When an infected person sneezes or coughs, there is a noticeable spray of drops. These tiny droplets of liquid contain germs which can remain afloat in the air for a long period. If another person is standing by, he is likely to breathe in quite a lot of such germs and thus get infected (see Fig.22.7). One sick person can thus infect a lot of others. The common cold virus is spread in this way. In Table 22.3 are given diseases that are spread in various ways. As listed, leprosy is also spread in similar way. But it spreads only if the victim remains very close to the diseased person for a long period, and it takes very long time for the symptoms to develop. These diseases spread easily in damp closed spaces.

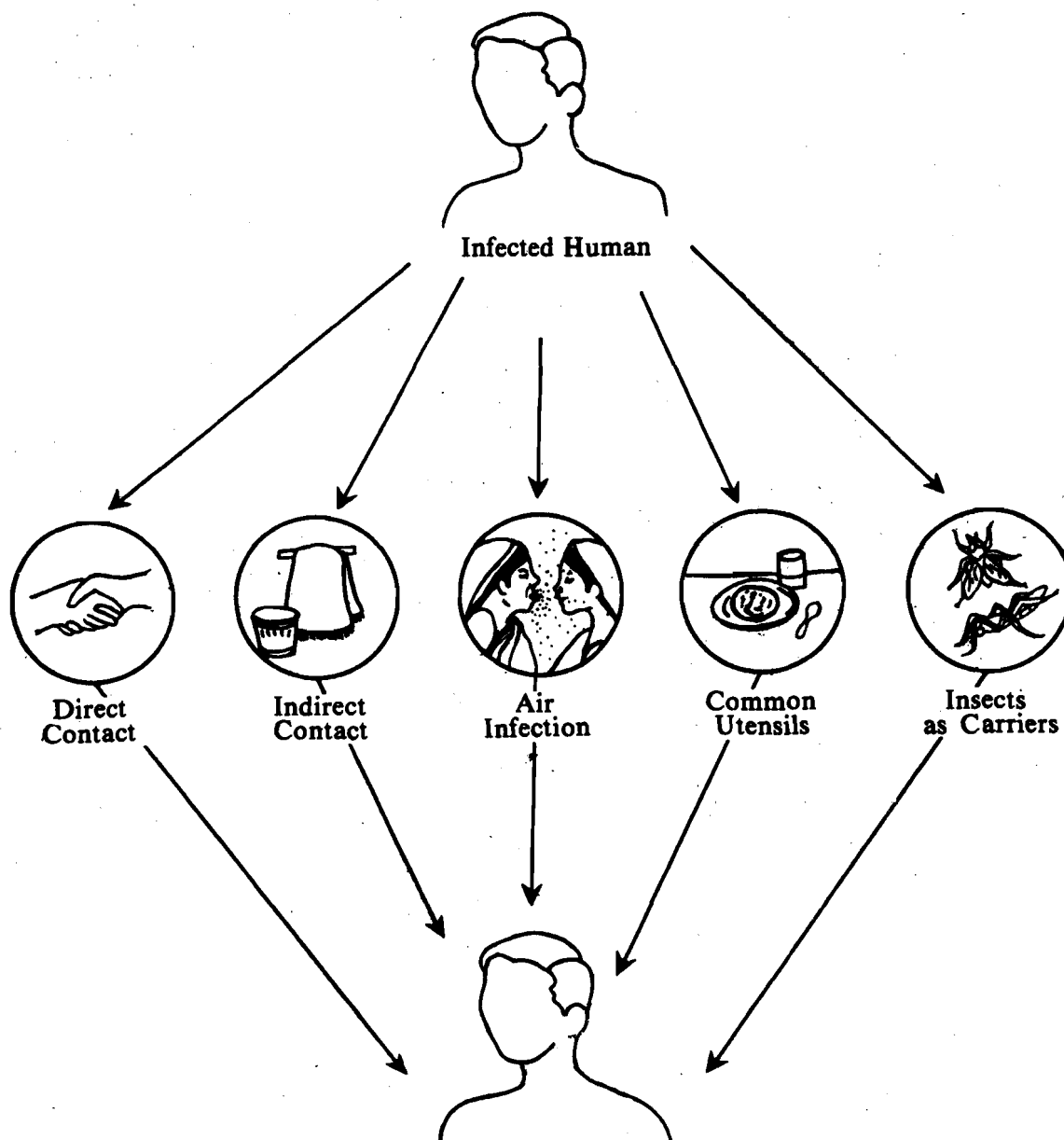


Fig. 22.7: Routes by which diseases are transmitted.

Water Borne Diseases

Diseases like cholera and typhoid, as well as diarrhoea and dysentery, are spread through water. Germs of these diseases multiply in the gut of the infected person and come out in the faeces (Fig. 22.8). Eggs of worms also come out in faeces (Fig.22.9).

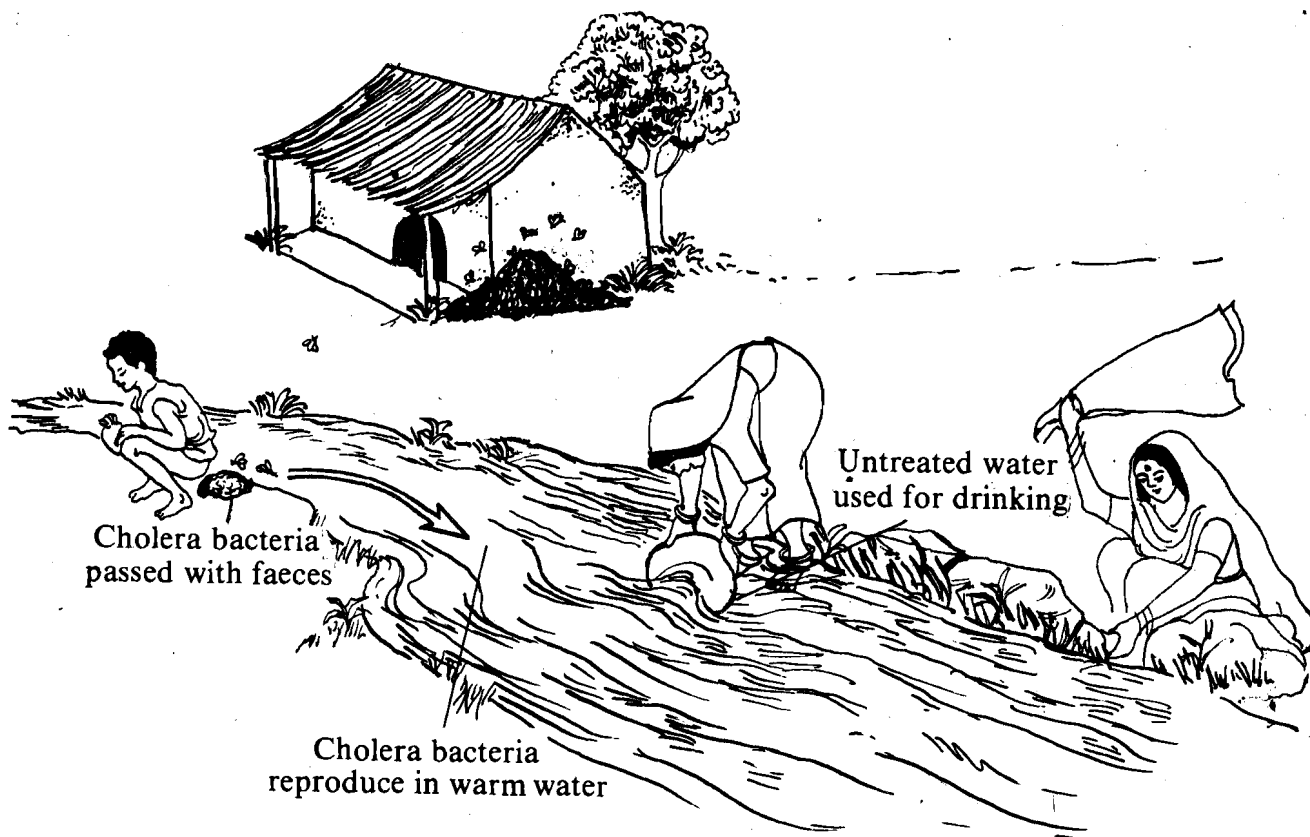


Fig. 22.8: Water source is made unsafe to drink as a result of people urinating, defecating or simply washing in it.

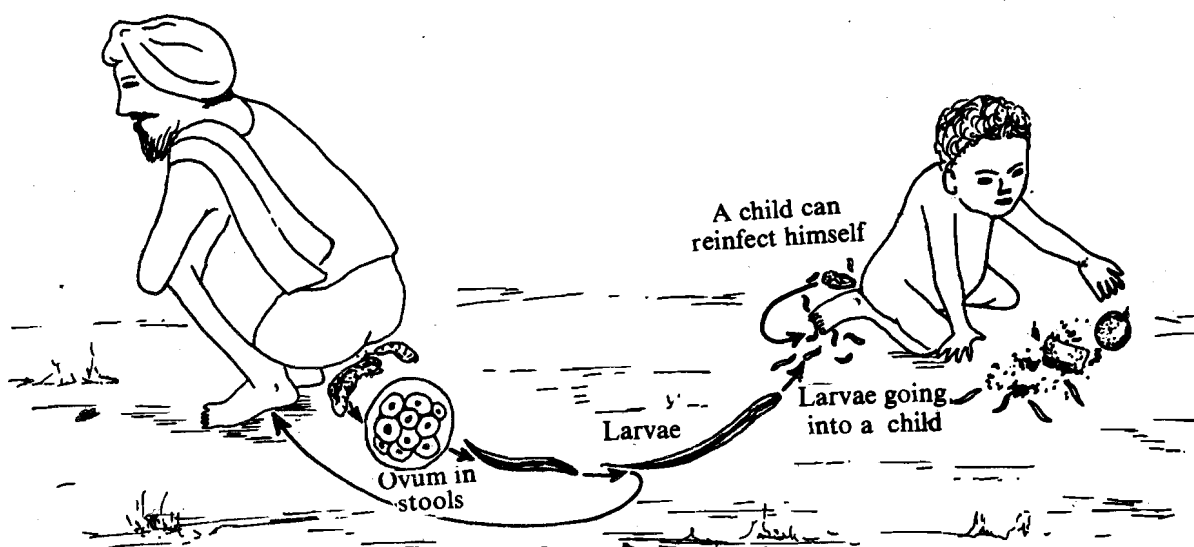


Fig. 22.9: Transmission of hookworm

If the infected faeces and urine are passed in an open field, as is unfortunately done in most of our villages, germs or eggs may be carried to the source of local water supply, such as ponds or rivers. Bathing or washing of utensils in such water, or drinking it, can infect other people. Sometimes in slum areas, the latrines are too close to handpumps and thus drinking water becomes a source of disease. It goes without saying that people who are obliged to live in such areas, or who have inherited a life style of using fields for toilet, are the ones who suffer most from water borne sickness.

The other reason for the spread of these diseases is negligence in personal hygiene by infected persons. If the infected persons do not wash their hands carefully after defecation or urination, the hands are likely to carry some germs or eggs of worms which will be transferred to other objects like food, utensils or furniture. When these objects are touched by a healthy person, the germs find their way to him (Fig.22.7).

Food Borne Diseases

If the food handler, like the cook, suffers from some infection and is not careful about washing his hands after defecation, the germs or eggs of worms will reach the food and people will get infected. Typhoid, bacillary dysentery and other stomach infections are spread in this way. Flies sitting on food always deposit germs there, which they pick up while sitting on excreta or filth. Vegetables and fruits also get contaminated by night soil which is used as fertiliser. Food, which is exposed to flies or even air for long hours is likely to pick up bacteria which easily multiply in it. Such food gets "spoiled" and could be a potent source of disease. In its strongest form it is called food poisoning. The common symptoms are abdominal cramps, nausea, vomiting, and diarrhoea. Generally bacteria are killed in heated food, but toxins produced by them are heat resistant.

Diseases Spread by Insects or Other Carriers

We know malaria is transmitted by the female Anopheles mosquitoes. Dengue fever and filaria are also caused by mosquito's bite. These insects suck blood and also inject some of it back into the body. Mosquitoes get the germs by sucking the blood of someone suffering from the disease, and transmit them to others when they puncture their skin or "bite" them. Houseflies are also carriers of germs of intestinal diseases. Similarly many fleas also spread diseases. Rats are reservoir of many diseases. Innumerable outbreaks of plague were caused by them. Lice, ticks, cockroaches, etc. also carry germs of various diseases. Guinea worm disease is quite common in India. The adult worm is about a metre long and it migrates from the stomach to the leg and produces larvae which are released in water as shown in Fig 22.9. This water then becomes infective.

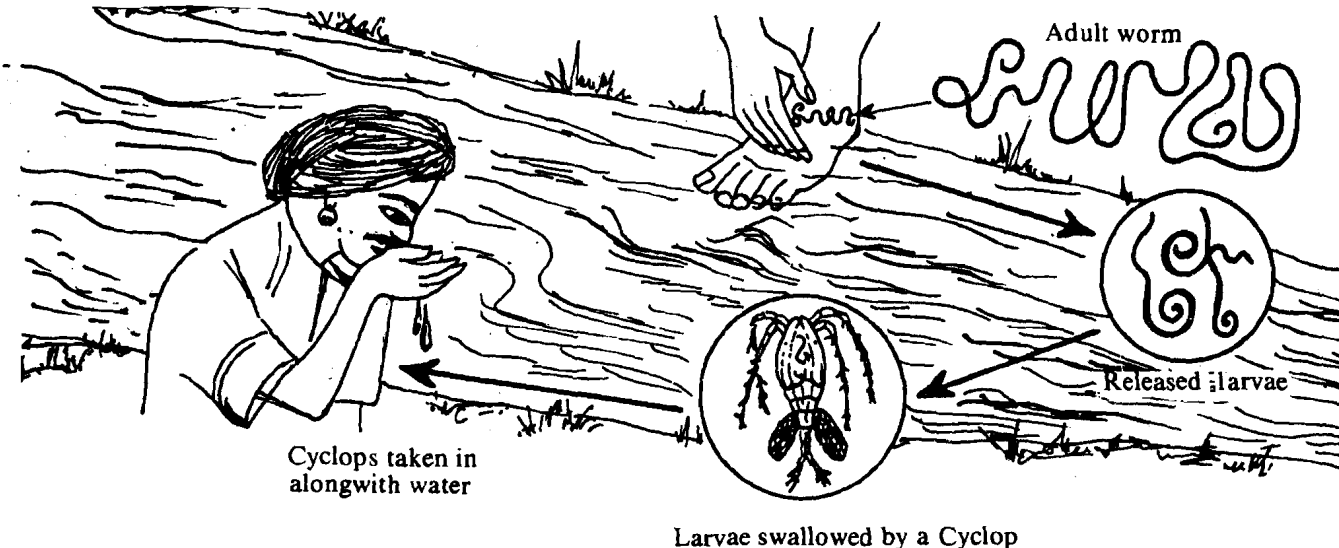


Fig. 22.10: Transmission of guinea worm.

Table 22.3: Modes of spread of some common diseases.

Air infection	Water	Food	Contact
Diseases of respiratory system	Gastrointestinal infection	Typhoid	Syphilis
Common cold	Bacterial cholera	Bacillary dysentery	Gonorrhea
Measles	Typhoid	Tape worm	
Whooping cough	Dysenteries		
Leprosy	Diarrhoea		
Cerebrospinal	Amoebic dysentery		
Meningitis	Round worm dysentery		
Chicken pox	Guinea worm		

In July 1988, cholera epidemic occurred in Delhi due to infected water from handpumps which were not deep enough, so the surrounding source of infection, seeped into them.

SAQ 6

Write the mode of spread of following diseases

Disease	Mode of spread
Chicken pox	
Cholera	
Tuberculosis	
Leprosy	
Guinea worm	
Measles	
Common cough and cold	
Malaria	

22.6 PREVENTION OF DISEASE

Now that we know that infectious diseases are caused by microbes, it should be possible to prevent diseases by controlling their transmission and properly treating them.

22.6.1 Prevention in Ancient Times

Let us begin this section by analysing some of the practices adopted in ancient India which could minimise infections. They were, for example, washing of hands before and after meals, daily bathing, not carrying footwear into living rooms, denial of permission to enter place where food is cooked, especially for persons who have not had a bath. These practices must have evolved through observation, over a long period, that certain practices helped in preventing diseases. Isolation of mother and the new-born, soon after delivery, was a common custom which also helped in preventing infection of the mother and the baby. Many of these laws of personal hygiene were codified by Manu.

Excavation of Mohenjo-daro and Harappa have revealed the existence of a covered drainage system and water supply. House drains emptied all waste water into the street drains. They also had arrangements for proper sanitation. Similarly, ancient civilisations of Egypt, Greece and China had medical systems. Egyptians had arrangements for public baths and underground drainage. The use of mosquito nets and association of plague with rats were known to them. Hippocrates, the most illustrious Greek physician of the 5th century B.C. examined significance of climate, water, clothing, eating and drinking to health. He was truly a man concerned with hygiene. The ancient Indian and Chinese system of medical care knew about immunisation also. Inoculation with live small pox germs to prevent small pox was known to them.

22.6.2 Modern Concept of Preventive Medicine

Now let us see how the current concept of preventive medicine came into being. The story began only 150 years ago.

People returning from a trip to USA, Europe or Japan undoubtedly are very fascinated and narrate modern technological advances. Another aspect they often remark on is the cleanliness observed in their cities. Would you believe that a person who throws garbage outside the house or on the road or even on the highway has to pay a heavy fine? Were these nations as clean as they are today? No, in fact, about 150 years ago, after the Industrial Revolution, working class people of western countries lived in extremely filthy conditions. Piles of refuse in front of houses, lack of sewerage, slaughter houses full of flies, etc. were similar to what we witness in the old crowded areas of Indian cities and in most of our villages today.

Till then, the western people did not know that filth was the greatest enemy of their health. During the Industrial Revolution in Europe, a close connection between disease and sanitary conditions was demonstrated. At that time as many as 30 families shared one lavatory. Outbreak of epidemic diseases like cholera was very common. It was observed that

labourers suffered a far higher incidence of disease than the middle and upper classes. As a result of these findings, the concept of state accepting responsibility of people's health appeared, and state health laws were made and enforced by the police. A major epidemic of cholera occurred in 1832 in England. Then the sanitary conditions of the working class were investigated. It led to the belief that cholera and other diseases arose from the stinking gases that accompanied decaying animal matter. Water was found to have a role in the transmission of disease.

In 1848, England promulgated its Public Health Act, which defined the role of the state in peoples' health and led to a great awareness about sanitary matters. In 1875, the Public Health Act defined the steps for a clean environment and for clean water. Other European countries and America followed suit. Steps were taken to ensure clean water, surroundings, houses and for control of offensive trades, such as carrying of garbage or excreta.

In this way, the spread of many diseases was controlled to a great extent. Clearing away decaying matter and dirt, removing breeding grounds for microbes which foul the air were taken up. However, these measures could not bring effective control of epidemics in urban areas. While these environmental measures were promoting health of the people, specific measures to prevent disease in an individual or in the community were also being attempted.

By now, microbes causing various diseases were also identified. You have learnt about their discovery in the previous sections.

In the following section we will discuss environmental controls necessary for the prevention of diseases.

SAQ 7

Answer the following questions briefly.

- i) Give two examples of how people in ancient India took measures to prevent diseases.

.....

- ii) Give reasons for prevalence of diseases among labourers during the Industrial Revolution.

.....

- iii) Why were diseases controlled by clearing away filth?

.....

22.6.3 Control of Environment

Control of environment is essential for maintaining good health. Environmental factors which are basic to individual and community health are housing, water supply, unpolluted air, and sanitation. Control of selling of exposed food is also a factor. In our country, due to limited means, many of us have little choice in matters like, where we live, the kind of water we drink and the surroundings we have to put up with, either at home, in the place of work or at public places. Often, these are not proper for healthy living. Moreover, most people lack suitable knowledge about health or sanitary habits, and there are many unhealthy social taboos. All this is due to poverty and ignorance, in particular lack of adequate health education. The health status of an average Indian is very poor. Unfortunately, not many of us care to complain to the authorities against the filth around our houses, on the roads, or in public places. Social action in this regard is also lacking.

Housing

Housing is an important component of healthy environment. Probably you are aware that housing conditions for the vast majority of people in India are not up to the standard for a healthy living. Villages have hardly any lavatories, and drainage being poor, they are surrounded by pools of unclean germ-infected water. As more and more people move to the

In England "filth" was recognised as man's greatest enemy in 1842. As a result an anti-filth crusade known as "the great sanitary awakening" began.

cities, the problem of housing becomes acute and a large percentage of people live in slums or on the street without shelter. Poor housing by itself does not cause disease, but it does contribute to spread of infections and ill health. A house should be sunny and well ventilated to ensure gentle movement of fresh air throughout the area. Proper ventilation reduces the concentration of micro-organisms to a safe level. Communicable diseases, such as lung infections, diphtheria, whooping cough and tuberculosis are often associated with poor housing. In closed rooms, the concentration of micro-organisms builds up rapidly and thus the risk of the spread of infection increases. Dampness and moisture also help in the spread of these diseases. A house should be kept free of pests such as rats, mice, cockroaches, ants, houseflies and mosquitoes because they are carriers of harmful germs.

Water

We all know that safe drinking water is essential for good health. Many of the diseases in our country are due to lack of supply of safe drinking water. Unfortunately only 18% of the population in rural area gets reasonably safe drinking water. The vast majority of our rural and urban population depends upon surface water, i.e. water from rivers, streams, reservoirs, lakes, tanks and ponds, which generally get their water from rain. Although rain water is the purest water in nature, it becomes impure as it passes through the atmosphere or flows on the ground. It gets contaminated with dust, soot, gases and micro-organisms. Therefore, surface water possesses all this contamination plus additional contamination due to human activity, such as bathing, washing clothes and utensils, or washing after passing stools. The water obtained from wells or tube wells, springs or handpumps is generally superior to surface water, because this water is filtered through the ground itself and is free of contamination, unless of course the handpump is not deep enough or is too close to a source of infection.

Earlier, you have learnt the names of the diseases which are spread through contaminated water. Disease rates are directly related to the quality of water supply. It has been shown that with the improvement of water supply in some of the States in India, disease rates have been drastically lowered.

Drinking water must be free of disease-causing agents or harmful chemicals. Human activity pollutes water supply through negligence in disposing faecal matter, sewage, industrial waste, fertilisers, pesticides and radio-active wastes. In urban areas only a small proportion of our population enjoys the facility of sewerage system. Over 70% of the people living in rural areas defecate in the open fields, leading to great hazards in spreading various bacterial diseases. Proper disposal of human excreta is an essential requirement of community health. At home, drinking water can be made safe by filtration and boiling. Filtration removes most of the suspended impurities. Disease-causing microbes are killed by boiling.

Air

Air is essential for life. Hence pollution of air is detrimental for health. Respiratory problems like chronic bronchitis and lung cancer are associated with increased air pollution. The most common pollution of air in India is by dust and smoke. In the evenings, you would find little Indian villages completely enveloped and hidden from view by a cloud of dust and smoke. The air in large cities like Delhi, Calcutta or Bombay is polluted with exhaust from scooters, motor cars/trucks. You would be surprised to know that a power station like Indra Prastha Power Station in Delhi, throws out about eight tons of ash from its chimneys everyday.

Air pollution can be controlled by prevention of escape of toxic substances into the environment from industries, motor cars or spraying of pesticides. Air can be disinfected by mechanical means, ultraviolet radiation, chemical vapour or special filters for air coming into rooms.

In residential places and offices, ventilation helps to replace polluted air. The quality of incoming air with regard to temperature, humidity and purity is also an integral part of ventilation, which ultimately provides an environment for comfort and is free from the risk of infection. We know that green plants purify air. Green belt area should be increased in big cities as they enhance the self cleaning power of the environment. A practice for growing green plants around the house is good for health.

Radiation

High doses of radiation are very harmful for human health. Do you know about the disaster created by the first atomic bombs which were exploded on two cities of Japan, Hiroshima and Nagasaki in 1945? They killed thousands of people and injured many more badly. The

effects of exposure to intense radiation took years to appear as burns or cancer in human beings. After a couple of decades, the effect on babies born to mothers who were exposed to big doses of radiation, began to show up.

Radiation is an important component of man's environment. We receive some radioactivity all the time from cosmic rays, from terrestrial and atmospheric environment and also from trace amounts of radioactive potassium, strontium and carbon present in the tissues of the body. At altitudes above 20 km, cosmic radiation is much stronger. Although, we do not find any immediate ill effects of this natural radiation on our health, one cannot be sure that they do not have long term effects.

Then there are man-made sources of radiation in modern era which have become an indispensable component of our life. Diagnostic medical and dental x-rays affect patients, doctors and technicians. T.V. sets, radioactive dial watches and luminous markers etc. add small amounts of radiation to man's environment, while nuclear power plant waste, if not disposed of properly, is a great risk to human health. Major hazards of radiation are testing of atomic and nuclear bombs.

Radiation, like x-rays, gamma rays, alpha and beta particles penetrate the body tissues and injure them. The extent of damage is related to the total dose of exposure. Higher doses affect immediately and are fatal. They affect the blood cells and soften the muscles. Acute radiation sickness is a well defined disease. Somewhat lower doses show delayed effects. They cause some cells to divide more rapidly than usual. This leads to various forms of cancer like Leukaemia or other malignant tumors. Unfortunately, some of the damages are not recognisable within the life span of the exposed person, these will become manifest in the coming generations.

Other factors

We must mention some other environmental factors which also affect our health.

Altitudes: Exposure to high altitude causes acute mountain sickness characterised by headaches, insomnia, breathlessness, nausea, vomiting and impaired vision. Acute pulmonary oedema at high altitude is a serious condition and is observed above 4,000 metres. In this, the patient develops cough, irregular breathing, mental confusion, hallucinations, and even coma.

We know that temperature varies during a day, over the seasons, and in various places. It depends on altitude. It is affected by the direction of wind and closeness to sea. However, heat gained by the body should be equal to the amount of heat lost by it. Too high or too low temperature causes not only discomfort, but human beings suffer from many disorders as a result of heat stress. Some of the effects of heat on human body are heat stroke or high fever caused by heat, heat exhaustion, heat cramps. On the other hand severe exposure to cold results in trench foot or frost bite. Rapid cooling of the body, i.e. chilling reduces the body's resistance to disease organisms. That is why people catch cold through sitting in draught.

Excessive noise not only causes annoyance and mental stress but can also result in auditory defects like deafness, interference with speech and adverse physiological changes.

SAQ 8

i) List the diseases which are spread due to poor housing.

.....

ii) How does cholera spread by defecation in an open field?

.....

iii) Write about some effects of radiation on our health.

22.7 HEALTH CARE IN INDIA

Health status of the people is determined to a large extent by the social, political and economic forces existing in the country. Let us briefly discuss the health system in India from the ancient times to the present.

In Indus Valley period, the standards of environmental sanitation were very high. The city of Mohenjo-daro of 5,000 years ago had public health facilities. Almost all households had bathrooms, latrines, water closets and carefully built wells. Although, it is difficult to imagine the nature of health problems they faced, the evidence surely indicates their great concern and emphasis on preventive and promotive aspects of health care.

As you have learnt in Unit 3, during the Vedic period, medicine took a momentous step from "magico-religious" approach to a rational way of dealing with the subject. People in those times understood that interaction between body and environment matter determines diseased or a healthy body.

This is exactly what we understand about disease in the present time i.e. disease results from a complicated interactions between man and his environment. Therefore, we observe that there was more emphasis on environment. This tradition of preventive aspect of health continued during the golden age of India.

During the period of decline of Indian science, the growth of our indigenous medical system also almost ceased. During the colonial period, there was complete disruption in the way of life. Health practices, which we had developed over centuries, were adversely affected. Now medicine was left in the hands of incompetent people. So, the very scientific basis of our ancient medical system was totally eroded. Besides, colonial exploitation increased poverty and created environmental conditions detrimental to health. As a result, the incidence of diseases increased. The western system of medicine, which had evolved only a few centuries earlier, was denied to our people because it catered to the needs of a small number who had money and lived in cities. The effort of western drug manufacturers to sell their goods exclusively in the Indian market created an atmosphere of distrust among educated people of the Indian systems of medicine.

At the time of independence, a number of communicable diseases viz. smallpox, malaria, cholera etc. and malnutrition were prevalent throughout the country. Therefore, the government framed various policies, National Health Programmes and the timetable for achieving certain targets for improving the health status of the people. The Planning Commission was established in 1950 and from then on started the phase of health planning. There was rapid expansion of health infrastructure. Primary health centres were established throughout the country. The focus was on free medical services to all. Since then efforts have been made to tackle several areas related to health such as Population Control, Family Welfare, Maternal and Child Health, Rural Health, Health Education, Health Man Power, Control of Communicable and Non-Communicable diseases, Nutrition and Community Health. The 1997 update on the health scenario of the country is given in tables 22.4 and 22.5. Some of the programmes have been partially successful but are no where near the targets.

Table 22.4: Statistics Showing Status of Population, Birth Rate, Death Rate, Growth Rate and Life Expectancy in India since Independence. (Source: Prof. Harcharan Singh, 1997: Paper presented at Silver Jubilee Conference of Indian Association of Preventive and Social Medicine held at Gandhi Medical College, Bhopal)

Year	Population (million)	Birth Rate (per 1000)	Death Rate (per 1000)	Growth Rate (Percent)	Life Expectancy (in years)
1947	340.5	40.0	27.0	1.3	2.7
1971	548.2	41.2	19.0	2.22	50
1997	960.0	28.3	09.0	1.73	62

The vital role of science in India is to fight ignorance, poverty and disease, and function as a powerful instrument to bring about a social transformation, so that millions could live longer and happy life.

—Jawaharlal Nehru
1947 Science Congress

The population has doubled in just 32 years from 480 million in 1965 to 960 million in 1997. In comparison to death rate which has come down to 9.0 per thousand population, the present birth rate has come down to about 28.3 per thousand of the population. Therefore, the annual growth rate, which was 1.3% in 1947 has increased to 1.73% (Table 22.4). India's population is projected in 2001 a billion plus and it may become the most populated country, even more than China, in the world. It is so frightening. Unfortunately, most of the programmes launched for family planning did not make any headway at the grass root level.

In the area of Maternal and Child Health (MCH) services, the infant mortality has been reduced to 74 and maternal mortality to four per thousand live births respectively. This success rate is far behind when compared with western world. The Government of India has launched special health programme to improve the quality of MCH care.

The communicable diseases continue to be the major health problems in our country. Only a partial success has been achieved in their control since independence. We have witnessed resurgence of malaria in mid seventies and again in 1994. In addition just in a period of a decade, the HIV infection has spread in all parts of the country. Almost the whole world is gripped by AIDS and the disease is spreading rapidly. This disease may dilute or even erase most of the efforts made to improve social and biological health of various communities particularly in developing countries.

Table 22.5 : Status of Infectious Diseases Since Independence. (Source: Prof. Harcharan Singh, 1997: Paper presented at Silver Jubilee Conference of Indian Association of Preventive and Social Medicine held at Gandhi Medical College, Bhopal)

Year	Malaria (million)	TB Prevalence (%)	Leprosy Per 10,000	Cholera	Small Pox	Diarrhoeal Death (%)	HIV
1947	100	NA	NA	NA	NA	NA	NIL
1951	75	2	NA	1,76,307	1,57,487 (1950)	NA	NIL
1961	2(1958) 0.1 (1965)	2	NA	14,167	1,68,216 (1958)	NA	NIL
1971	5(1975) 6.4 (1976)	2	58.4	17,140	1,436 (1958)	NA	NIL
1981	1.7 (1986)	2	38.6 (1984)	8,717	NIL	12.3 (1985)	NIL
1991	1.81	2	19.5 9.74	7,088	NIL	9.9 (1993)	5,588
1997	2.8	1.3	(1994) 5	20,800	NIL	8.0	6,600

It must be realised that spread of communicable diseases is closely linked with environmental sanitation. More than 70% of the population lives in villages. Even the safe drinking water is not available in rural and in many urban areas.

The National Health programmes could not reach the desirable targets because more attention was paid to the cure of diseases than to their prevention. In other words, a "curative approach" based on western models was adopted to solve our health problems. Most of our health institutions remain predominantly curative in character and there has been neglect in preventive and promotive aspects of health care. These have proved to be inappropriate for the needs of our rural people. The established hospitals, well equipped with sophisticated equipment, have served largely to the upper crust of society residing in urban areas. We can see from health manpower statistics that there has been a significant increase in the number of medical and para-medical staff. In 1997, there were 4,89,189 doctors, 19,525 dentists and 5,59,896 nurses registered in the country.

According to 1991 census, our total population was 846 million, out of which 218 million (25.6%) lived in urban areas and 629 million (74.4%) lived in rural areas. However, the number of hospitals, dispensaries and their bed capacity in urban and rural India is far from satisfactory (Table 22.6). From these data we can calculate that 79% of the hospitals and 86% of the beds are in the urban areas.

At the time of independence the doctor population and nurse population ratio was 1:7,165 and 1:2,4340 respectively. In spite of such a large increase in population the doctor population and nurse population ratio in 1997 was 1:1,962 and 1:1,714 respectively.

Table 22.6 : Medical Care Statistics in Rural and Urban sector (Source : Ninth Plan document , mimieo).

	Total	Urban	Rural
Hospitals	13692	9382	4310
Dispensaries	27.403	16.323	11.080
Beds in Hospitals (per lakh population)	70.4	217.9	19.4
Beds in Dispensaries (per lakh population)	3.0	5.6	2.1

In spite of great increase in number, doctors are largely urban based, and poor rural people who stand most in need, are deprived of them. Most villages do not have potable drinking water supply or basic sanitation.

The integrated rural health services developed after Independence through Primary Health Centres (PHCs), form the institutional core of the national health services. The role of PHCs is to deliver comprehensive health care to population. By 1997, there were 21,889 PHCs and 1,33,498 sub-centres run by doctors along with accessory para-medical staff such as nurses, multi- purpose workers, health assistants, dais, etc. It was envisaged that such a large network of PHCs spread throughout the country would be essential to achieve "Health for All" as targeted after Alma Ata Declaration.

Table 22.7 shows health status of urban and rural India based on mortality indicators. These results reflect inadequacy in the functioning of the health service.

Fig. 22.7: Statistics Showing Status of Health in Rural and Urban India (values per thousand of population). (Source: Ninth Plan document mimieo).

Parameter	Total	Urban	Rural
Birth rate	28.3	22.7	30.0
Death rate	9.0	6.6	9.8
Infant Mortality rate	8.0	48	74

In most states, there is virtual collapse of health infrastructure. Health services are not free as they were aimed to be. Most people are forcefully drawn toward private medical care, which turns out to be very expensive for them.

The various health programmes have largely failed to obtain the participation by individuals and the families, which is necessary for establishing a self-reliant community in rural area. Instead, they have tended to enhance the dependency on "curative centres", i.e., hospitals and dispensaries. The working of our institutions for education, training and research, and established hospitals is such that we are heavily dependent on western countries for books, equipment, medicines, and even ideas.

It is very unfortunate that all along this period our indigenous medical systems were totally ignored. Had these been encouraged along with modern systems of medicine the health status of our nation would have improved. In March 1995, the Government of India created a new Dept. of Indian systems of Medicine and Homeopathy (ISM and H).

In order to involve the community to solve its own health problems, a "multi-disciplinary" approach was also adopted. This required a joint effort of biomedical and social scientists. However, many of the social scientists also presume that western practices are "modern, good, and desirable", and they should be adopted.

In fact, a more comprehensive social sciences approach to health services in rural areas is required. It is necessary to know how exactly people perceive their health problems. What do these problems mean to them socially and culturally? The programmes and delivery of health services should be such that they blend with the existing culture of the community. The western, the ayurvedic, unani, and homeopathic practitioners should all be knitted into teams serving the medical needs of all citizens whether they live in cities or villages. Thus, we have to work and evolve our own models for health services, especially for rural India. The model should be such that it should promote self-reliance in health in the community. Priority should be given to water supply, sanitation and proper nutrition within the means of the people.

The term Indian Systems of Medicine covers both the systems, which originated in India and outside but were adopted in India in course of time. These systems are Ayurveda, Siddha, Unani, Homeopathy, Yoga and Naturopathy. These systems have become a part of the culture and traditions of our country.

SAQ 9

- a) Which of the following statements are true/false? Indicate by putting letter **T** for true and **F** for false in the given boxes.
- i) The level of sanitation and health consciousness among people existing in India today are in contrast to what it was during Indus Valley period. ☐
 - ii) The health condition of Indians improved during colonial period due to availability of modern drugs. ☐
 - iii) "Curative based centres" have proved inappropriate for the health needs of our rural people. ☐
 - iv) It is necessary to give away old traditional systems of medicine, such as ayurveda, unani and homeopathy in order to improve health of our rural people. ☐
 - v) The success of primary health centres depends upon the participation of rural community in the health programmes. ☐

22.8 AIDS

You have learnt about infectious diseases. For centuries, death from infectious diseases was common and whole populations were often affected. One of the remarkable achievements of modern civilisation has been prevention and control of the infectious diseases of the past. However, we still seem defenceless against the rapid spread of AIDS, a deadly infectious disease of the century. AIDS stands for Acquired Immune Deficiency Syndrome. It is caused by **Human Immunodeficiency Virus (HIV)**. Currently there is no cure or preventive vaccine for it.

The first case of AIDS was reported in the USA in 1981. However, it has now become a truly global epidemic with an estimated 22.6 million infected people. AIDS is reported from most of the regions of the world. It is prevalent in South America, Sub-Saharan Africa, Caribbean, Southeast Asia, Central Asia and parts of Europe. In India just in a period of decade, the HIV infection has spread in all parts of the country. It is prevalent in all states with exception of Arunachal Pradesh. About 3,161 cases of AIDS were reported in India by the end of 1996. The epidemiological data indicate that the prevalence of infection continues to increase from urban to rural area.

AIDS is fatal because the virus specifically affects our immune system and disables it. In section 22.4.4 you have learnt that our immune system is the defence force of the body and if it is damaged the body would lose the ability to protect itself from infection caused by bacteria, fungi, protozoa and viruses.

AIDS virus severely damages the immune system and therefore the infected person is vulnerable to other infections. Usually these secondary infections (termed as opportunistic infections) cause death in AIDS patient. For example, AIDS patients generally suffer from tuberculosis, which is now most prevalent infection associated with HIV.

A key to controlling HIV infection is to understand the routes of its spread.

The following are the modes of HIV transmission

1. **Sexual contact** - Intimate unprotected sexual contact between man and woman (heterosexual) or between man and man (homosexual), when one of the partners is HIV infected.
2. **Blood** - Transmission from an HIV infected source to the bloodstream of uninfected person (transfusion of blood or blood products contaminated with HIV, use of needles and syringes stained with HIV infected blood).
3. **Vertical transmission** - Transmission from infected mother to fetus during pregnancy (perinatal period), during birth or during breast-feeding.

In India by the end of 1996, a total of 2.93 million individuals practicing risk behaviors who were screened for HIV, 4,99,527 were found to be sero-positive.

Viruses are among the simplest life forms that survive as obligate intracellular parasites. This means that viruses cannot replicate and make more of themselves once outside the host cells. A virus particle consists of a molecule either of RNA or DNA that store genetic information, enveloped by a protein coat. In some viruses, including HIV there is an additional envelop of membrane outside the protein coat.

In AIDS virus the information is coded in RNA. You may know that in most organisms the genetic material is stored in DNA. Viruses, which contain RNA instead of DNA for storing genetic information, are called retroviruses.

AIDS is not a contagious disease, but due to ignorance, several prejudices about the disease are created. AIDS victims are being isolated and are discriminated by individual and society. You must remember that AIDS does not spread like many other air-borne or water-borne infections. It is important that we understand certain facts about HIV.

HIV is quite fragile in the external environment and the virus dies quickly when exposed to room temperature or light. It is quickly inactivated by contact with soap and water. It is important to understand that it cannot be transmitted through air, water or vector or casual contact like shaking hands, hugging, dry kissing, sharing eating utensils, sharing towels, using same gadgets or toilet seat etc. Therefore living with victims of AIDS i.e., breathing the same air or eating from same plate does not spread infection.

In an infected individual HIV is present in certain cells of the blood (macrophages) which are probably the long term reservoirs of HIV since they are not killed by the virus. They circulate in the blood and remain in the mucosal lining of the internal urogenital surface of the vagina and penis, the lining of the anus, lungs and throat. Therefore, for the test, HIV can be isolated relatively easily from blood, semen and vaginal, cervical secretions (including menstrual fluid). It passes through fluid containing HIV of infected person to the susceptible cell (usually via blood stream) of the receiver. Blood and semen are the most infectious fluids i.e. why injection drug user and unprotected sexual behavior are greatest risk of HIV transmission. You must note that saliva, tears, perspiration, urine and feces are completely or nearly completely free of live cells.

Other targets for HIV infection are oral cavity and the throat since these also have mucosal lining. However, the efficiency or transmission through oral cavity is low.

Symptoms

The HIV infection cannot be detected in early stages because the infected person does not show any sign of illness right away and appears a healthy normal individual. The infection remains latent for 5 to 10 years. The set of symptoms of AIDS appear later. Nevertheless, such a person is carrier of infection and can transmit it to other person.

You have learnt that exposure to the virus occurs by sexual contact, blood or birth. Even if exposure occurs by any of the above routes, this does not always result in transmission of the virus. Only a fraction of exposed people is infected by HIV virus. However, most infected people ultimately develop some disease symptoms. These are the indirect result of damage to the immune system by HIV. As mentioned earlier that most people infected with HIV never show symptoms at the time of initial infection. This period is called **asymptomatic period**. Some people may develop relatively mild disease symptoms such as swollen lymph glands, sore throat, fever, headache and skin rash. However, these are not specific to HIV infection only and appear in many other viral infections. Therefore, HIV infection cannot be diagnosed by such symptoms. Instead, HIV antibody test is performed to detect the virus. However, this test is not foolproof.

Initial Symptoms

- i) persistent swelling of the lymph gland (Lymphadenopathy syndrome)
- ii) loss of body weight (Wasting syndrome)
- iii) neurological disorders – damage to brain cells, loss of mental functions (Dementias), damage of spinal cord, peripheral nerve damage

Early Immune Failure

- i) Shingles (Varicella) – painful rash condition that often occurs on the torso.
- ii) Candida – The fungus forms white plaques in the mouth and harms other mucosal surfaces.
- iii) Hairy leukoplakia – White plaques appear due to the abnormal growth of papillae cells of the tongue.

Opportunistic Infections

- i) TB
- ii) Pneumonia
- iii) Fungal Infections
- iv) Protozoan infection (gastroenteritis)

- v) Viral Infection
- vi) Bacterial Infection (TB like)
- vii) Cancer
- viii) Tumors of the blood vessels (Kaposi's Sarcoma)
- ix) Lymphomas
- x) Cervical cancer

Initially AIDS was restricted to only a certain group of people termed as high risk groups such as commercial sex workers, truck drivers and injecting drug users, which routinely indulge in activities that could be termed as high risk behaviors. But it has now spread to other strata of society infecting people not associated with high risk behavior, particularly women who are in a faithful monogamous relationship. Although a decade ago women and children seemed to be at the periphery of the epidemic, they are now the centre of concern. The age group between 15-49 years is most affected. About 89% of all cases are from this age group and these are productive and reproductive segments of the society. They are the supporters for younger and older generation. It is likely that the children of AIDS victims would become street children. No other disease affects marital harmony, human rights, employment security and family economy of those affected as does AIDS.

Although the disease is not contagious but due to ignorance about mode of transmission the AIDS victims are discriminated. The disease has social and economic implications also. In order to control the rapid spread of the disease it is necessary that we educate ourselves and also raise public awareness about HIV infection.

A New York based orphan project estimated that nearly 1 million children under 14 years of age have been orphaned by AIDS in Kenya, Rwanda, Uganda and Zambia which may rise to 2 million by the year 2000.

Scientists are trying to find ways to cure AIDS. So far, there is no vaccine against it. A combination regimen of three drugs – Zidovudine (AZT), 3TC and protease inhibitors (Norvir, Saquinavir, Indinavir) has been tried that bring down the viral load in the system. These drugs are extremely costly, and thus are not really a viable option for most people in developing countries. Besides, it is not certain whether low levels of virus will be maintained when the drugs treatment is withdrawn. Gene therapy and other special chemicals are being investigated to combat the virus.

CLINICAL CASE DEFINITION FOR AIDS IN ADULTS IN INDIA (NACO)

AIDS in an adult is defined as who has:

- a. Tested positively for HIV antibody detected by two separate tests using two different antigens,

and

Any one of the following criterion:

- 1 (a) Weight loss of > 10% body weight or cachexia.
- (b) Chronic diarrhoea of > one month duration, chronic cough for one month > 1 month duration.
2. Disseminated, miliary or extra-pulmonary tuberculosis.
3. Neurological impairment restricting daily activities.
4. Candidiasis of the oesophagus diagnosable.
- Dysphagia (odynophagia) along with oral candidiasis.
5. Kaposi's sarcoma.

Clinical stage progression:

Stage I	HIV infection – asymptomatic
Stage II	HIV-related diseases – symptomatic
	Pulmonary tuberculosis
	Thrombocytopenia
Stage III	Advanced HIV/AIDS

(Source : Annual Report National AIDS Control Organisation, Ministry of Health and family welfare. Government of India, Dec., 1996)

Test for AIDS – HIV Antibody Test

To see if an individual has been exposed to HIV, his serum is tested for antibodies to HIV virus proteins.

The presence of HIV specific proteins indicates he is infected. There are potential problems with the HIV antibody test because about 0.1% individuals who are not HIV infected show the test antibody positive.

SAQ 10

- a) In the following statements choose the correct alternative word given in the parentheses.
- AIDS is caused by a (virus/bacteria).
 - It is transmitted via (sexual contact/blood/air droplets).
 - The virus specifically disables (nervous/immune) system.
 - HIV (can/cannot) survive outside the body.
- b) Indicate whether the following statements are true or false? Write T for true and F for false in the given boxes.
- AIDS victim should be isolated in order to prevent further infection. ☐
 - AIDS is a contagious disease, ☐
 - Death of AIDS patient occurs due to secondary infections. ☐
 - AIDS patients suffer from fungal and bacterial diseases. ☐

22.9 SUMMARY

In this unit we have tried to show you how technological developments led to the unfolding of mystery of disease and saved millions of lives. You have learnt that

- Infectious diseases are caused due to various types of microbes.
- Microbes present in the environment gain entry into the body via air, water and food. They multiply in the body and make the person sick. The sick person releases them in greater number in the environment thus infecting many people.
- Our body has a defence system which is capable of fighting against the germs. Modern drugs assist our defence system.
- Disease results from a disturbance in the balance between man and his environment. Improvement in the health status of our people requires clean drinking water, adequate living conditions and proper sanitation.
- Curative approach of health care in India could achieve limited objectives. The importance of Indian Systems of Medicine has been realised and these are being encouraged. A comprehensive approach involving social, economic, psychological, political and environmental aspects is required to organise health care system for the prevention of diseases in the rural areas.
- The world is now faced with new deadly infectious, viral disease AIDS which has become global epidemic. The virus disable the immune system in the body. As a consequence the body becomes vulnerable to other infections. It is transmitted through sexual contact, blood and from mother to foetus. The best way to escape the disease is to restrict from activities that are responsible for its transmission. So far no cure has been found for this disease.

22.10 TERMINAL QUESTIONS

- 1) Write the causative microbe for the following diseases.

Diseases	Causative Microbe
i) Cholera	
ii) Ring worm	
iii) AIDS	
iv) Chicken pox	
v) Malaria	
vi) Conjunctivitis	
vii) Guinea worm	

- 2) Make a survey in your locality and find out which of the infectious diseases were prevalent during last six months. Tell us if the environmental factors were contributing to the spread of these diseases.
-
-
- 3) Explain briefly how vaccination helps to resist diseases.
-
-

22.11. ANSWERS

Self Assessment Questions

- 1) i) properly, healthy ii) intellectual, emotional
- 2) a) i) F ii) T iii) F
b) Use Table 22.1 to check your answers.
- 3) i) F ii) F iii) T iv) F
- 4) a) i) F ii) T iii) F iv) T v) T vi) T
b) i) skin ii) healthy iii) food, water, germs carrying fingers.
- 5) i) engulfing, antibodies, toxins ii) defence system iii) guards, circulatory iv) defeated
v) killing vi) train, body, weakened.
- 6) i) air ii) water food house fly iii) air iv) air v) water vi) air vii) air viii) mosquitoes
- 7) i) a) Washing of hands before and after meals.
b) Entering into the kitchen only after bathing.
ii) During the Industrial Revolution the labourers were living in extremely filthy conditions. There was no sewerage system, piles of garbage collected in front of houses and the slaughter houses were full of flies.
iii) Some of the diseases are caused due to bacteria which breed on filth. Clearing away of filth removed the breeding grounds for bacteria and thus helped in control of diseases.
- 8) i) Lung infection, whooping cough, diphtheria, tuberculosis etc.
ii) Cholera bacteria are passed with the faeces of an infected person. When the patient defecates in an open field, the bacteria are carried by bare foot, rain water or by other means to the nearest source of water supply. People get infected by drinking this water.
iii) Radiation causes
a) Various forms of cancer like leukaemia and malignant tumors.
b) Injury to the body tissue.
- 9) a) i) T ii) F iii) T iv) F v) T
- 10) a) i) virus ii) sexual contact/blood iii) immune iv) cannot
b) i) false ii) false iii) true iv) true

Terminal Questions

- 1) i) Bacteria ii) Fungi iii) Virus iv) Virus v) Protozoa vi) Virus viii) Worm
- 2) Vaccination is a way of acquiring immunity against an infection. A sample of a weak or dead bacteria is introduced in the body to trigger defence system and produce special WBCs that would encounter the bacteria. Such WBC develop a memory, and are held in reserve as trained cells, to ward off the future attack of the particular invader.

GLOSSARY

- alpha and beta particles:** harmful radiations emitted by radio active substances,
- amino acid:** the building blocks of protein molecules,
- anaemia:** deficiency in the circulating haemoglobin or red blood cells,
- antibody:** a protein substance produced in an organism to counteract harmful organisms or substances,
- arid land:** regions not having enough rainfall to support vegetation,
- basal metabolism:** energy expenditure of the body at rest in the postabsorptive state,
- beriberi:** a deficiency disease caused by lack of vitamin B and characterised by extreme weakness, nervous disorders, edema, and cardiac failure,
- bubonic plague:** a highly fatal bacterial disease of the blood, spread by the fleas and respiratory secretions,
- calorie:** a unit of heat measurement; in nutrition, the kilocalorie is the amount of heat required to raise the temperature of 1 kg of water 1°C,
- congenital:** existing at or before birth with reference to certain physical or mental traits,
- critical irrigation:** the essential requirement of water by a crop at a particular stage of its growth,
- enzyme:** an organic compound of protein nature produced by living tissue to accelerate metabolic reactions,
- epidemic:** a rise in the number of cases of a disease in a population far above the level normally expected,
- essential amino acids:** an amino acid that must be supplied in the diet to provide the body's need for it,
- gastroenteritis:** inflammation of the digestive organs,
- germplasm:** the genetic material through which the hereditary materials are transmitted,
- goitre:** enlargement of the thyroid gland,
- haemoglobin:** the iron-protein pigment in the red blood cells; carries oxygen to the tissues,
- hormone:** substance produced by an organ to produce a specific effect in another organ,
- kwashiorkor:** deficiency disease related principally to protein lack and seen in severely malnourished children; characterised by growth failure, edema, pigment changes in the skin,
- limiting factor:** a chemical or physical factor that determines whether an organism can survive in a given ecosystem,
- lysosyme:** a kind of digestive enzyme found in special structure of the cell called lysosome,
- malignant:** occurring in severe form frequently fatal; in tumors refers to uncontrollable growth as in cancer,
- marasmus:** extreme protein-calorie malnutrition marked by emaciation, especially severe in young children who receive insufficient amounts of food,
- malnutrition:** general term for illnesses resulting from inadequate feeding. Usually due to lack of one or more essential components of the diet,
- nutrient:** chemical substance in foods which nourishes, e.g., amino acid, fat, calcium,
- nutrition:** the intake, digestion, absorption and effective use of food,
- obesity:** being overweight. Caused by accumulating fat to the point where health is likely to be affected,
- pellagra:** a deficiency disease of the skin, gastro-intestinal tract, and nervous system caused by lack of vitamins of B group,

protozoa: single-celled animals.

pulmonary oedema: presence of abnormal amount of fluid in the inter cellular spaces of the lungs,

rickets: a deficiency disease of the skeletal system caused by a lack of vitamin D or calcium or both, and often resulting in bone deformities,

shelter beds: rows of trees and shrubs planted alongside field to reduce wind velocity and to increase soil moisture.

FURTHER READINGS

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