Activity Based
Foundation Course
on Science,
Technology
and Society

Curriculum Book - 8

Health Matters

Bakhtaver S. Mahajan
Chitra Natarajan

Homi Bhabha Centre for Science Education
Tata Institute of Fundamental Research

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Series Editor: Chitra Natarajan
Cover layout: Anand Ghaisas, Leena Thakar
Illustrations: Leena Thakar
Computer graphics: Alka Dureja

January, 1999

The titles in this series published so far:

1. The Population Problem
2. Resources: Energy
3. Resources: Land and Air
4. Education
5. Global Climate Change
6. Ecological Balances
7. Conflicts
8. Health Matters

Printed by:
Good Impression
Om Raj Apartment
Ghanshyam Gupte Cross Road
Dombivli (West) 421 202.

Acknowledgements

The 'Activity Based Foundation Curriculum' has its genesis in the project for talent nurture among post-school students funded by the J.N. Tata Endowment Trust and conducted by Homi Bhabha Centre for Science Education (HBCSE) for three years since 1993. Besides providing adequate funds for the project intended for developing 'good citizenship qualities' among students of grades 11 and 12, the benevolence of the Late Mr. D.K. Malegamwala allowed the Centre both intellectual and economic freedom to select students and to experiment with innovative content and mode of interaction. The project continued to receive support from his successor, Dr. Suma Chitnis, Director of the J. N. Tata Endowment Trust.

The sensitivity to current issues and the concern about education of young people evinced by Mr. V.G. Kulkarni, Founder Director of HBCSE, guided the project from its inception. Discussions, in the initial stages, with Dr. Phondke and Mr. Kulkarni have enriched the content of the series. Besides deriving the benefit of his rich experiences in the areas covered by the project, we have been inspired by Dr. B. M. Udgaonkar's keen interest in this curriculum.

HBCSE Director, Dr. Arvind Kumar's commitment to enriching students' knowledge, and his participation and support in drawing up the content and format of the programme, contributed immensely to the success of the project. The series of books, of which this is one, is a direct outcome of the programme. Dr.Arvind Kumar has been actively involved in planning the overall content of the books. His encouragement and gentle nudges have been useful in bringing them out in print over a reasonable time span.

Drs. Arvind Kumar, Sugra Chunawala, G.C. Pal and Ms. Sandhya Karande conducted several sessions during the programme. Besides encouraging the project, Dr. H. C. Pradhan, through the programmes he has coordinated, has provided opportunities to test some of the activities included in this book on selected students of secondary and higher secondary levels.

The participants of the programme in Mumbai were students from arts, commerce and science faculties of two junior colleges in the vicinity of the Centre. The programme was also conducted at the D. B. F. Dayanand

College of Arts and Science, Solapur, by Dr. N. S. Dhayagude and his team, where it was received well by the local participants. The participants of the Mumbai and Solapur programmes performed many of the activities included in the books, and enriched this endeavour by their enthusiasm and feedback. These young people's quest for meaningful activities is the *raison d'etre* for this activity based curriculum.

Yogita Parab assisted in every way in bringing out the first five books in this series and co-authored the sixth. It has been a pleasure working with her on all the books. We were helped by Ms. Alka Dureja in the variety of tasks involved in bringing out this book, especially in the computer illustrations, photocopying, and proof-reading. Drs. G. Nagarjuna, and K. Subramaniam provided the needed human interface in our computer interactions. Everyone at the Centre contributed to providing a problem-free working atmosphere.

Chitra Natarajan, Bakhtaver S. Mahajan

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The foundation curriculum

1.1 The need

The complex web of interactions between all spheres of human activity demand that prospective decision makers possess a repertoire of skills complemented by a reasonable capability to communicate their strengths, in oral and written form. Many of these skills are dependent on the domains of specialization: the study of biology may hone observational skills and the ability to classify and categorise; mathematics calls for logical skills, and the pursuit of sociological sciences calls for critical thinking and the ability to make complex linkages.

Both teachers and the taught readily acknowledge that science, technology and society are intimately linked. However, these linkages are complex. Hence, there is a need to adopt different methods in classrooms to encourage students to form such links. These pose problems for the teacher.

A factor that makes teaching issues at the interface of science, technology and society even more difficult is the proliferation of information. The information boom also comes in the wake of crumbling national barriers for trade and information exchange and a global notion of neighbourhoods. Societies and individuals are reacting more rapidly to global changes than they ever did before. Changing environmental perspectives in Europe have led to migration of polluting industries into the developing countries. Ten-

sion in the Middle East or West Asia becomes an immediate cause for concern in Kerala. War, destruction, concern, recovery, rebuilding, and war again - cycles that used to take hundreds of years in previous centuries, now have a periodicity of less than ten years. Contemporary issues not only affect all citizens to some extent, but also call for a systems approach to its understanding and resolution, considering among other things, the technological, economic and socio-cultural linkages. This approach requires a certain attitude to problem solving.

Appropriate training can enable students to acquire problem solving abilities. However, increasing content specialization after grade ten, and lack of an integrated approach to learning before that, are hurdles to such a training. This situation can be partially remedied through intervention training programmes, be they at the level of higher education, or during professional on-the-job training.

1.2 A programme for post-school students

Such a training formed the principal objective of the programme funded by the J.N.Tata Endowment Trust, and implemented by HBCSE over three years at Mumbai and also for two years at Solapur. Developing a sensitivity to, and an understanding of, the complex linkages between science, technology and society, was the basis for the programme that aimed at promoting 'good citizenship' qualities among post-school students. The other vital input was strengthening the comprehension and communication skills of the students.

1.3 The curriculum

1.3.1 Genesis

The success of the programme, measured in qualitative terms — heightened sensitivity of the participating students, and their sustained interest — has inspired this Foundation Curriculum. The curriculum has been embodied in a series of books. The objectives of the curriculum preclude these books from being textbooks. Instead, these books outline a series of

activities that lead from simple issues and ideas to complex ones, requiring the students to make the necessary linkages. The activities are also designed to develop the skills necessary for a practical understanding of issues at the interface of science, technology and society.

Most activities suggested in the books have been tried with post-school students during the programme. These could be used by any interested person — a teacher or leader of a forum — to develop comprehension and communication skills among members of a group of young people. They will be working on a broad canvas of issues at the interface of science, technology and society. Outlined below are the objectives of the curriculum, guidelines for interaction, and the topics, chosen for convenience, under which various issues will be discussed.

1.3.2 Objectives

The objectives of the curriculum can be summarised as follows.

- Offer guidance to students in improving their English comprehension, communication and analytical skills, besides quantitative reasoning. English has been chosen in the light of its being the language of global information flow.
- Integrate students' curricular knowledge with environmental and developmental issues of concern, thus giving a broad exposure to several disciplines.

1.3.3 Guidelines

Setting guidelines for interaction between the group of students and the teacher will go a long way in achieving the objectives stated above. A possible set of guidelines are listed below.

a. Sessions should be conducted in a participatory and interactive mode.

b. Sessions should involve thinking across disciplines, stretching the ability of participants to think beyond the obvious connections.

c. Relevance of the issues to daily life should be stressed, and participants should be guided in making decisions.

d. Weaknesses and lacunae should be assessed at intervals, through appropriate questionnaires.

e. Skills should be developed through suitably designed activities. These could include the following.

   - writing persuasive essays, poems, letters to local newspapers,
   - writing and staging street plays,
   - organised formal debates,
   - analysis of tabulated information,
   - comparison and quantification,
   - drawing charts and graphs,
   - designing games,
   - conducting interviews and surveys, and
   - visits to industries, research institutes.

1.3.4 Content

Activities designed to meet the objectives of skill development are grouped under issues of current concern. The issues are all interlinked and need to be treated that way. For convenience of presentation, these are discussed under the following topics.

- Survival of Humankind: Curricular Philosophy, and The Population Problem
- Education
- Health — Diseases, Drugs, and New Challenges
- Resources: Land and Air
- Resources: Food and Water
- Resources: Energy

- The Environment — Balance in Nature
- The Environment — Degradation, Science and Technology
- Information Revolution and the Media
- Social Conflicts, Gender Issues and World Peace

The present chapter, an introduction to the curriculum, is a part of each book, with a variation only in Section 1.4. It would be useful to revisit the discussion on *Survival of humankind* given in the book on "The Population Problem", whenever in doubt about the goals of the session.

1.3.5 Duration and target group

The activity books are designed to be adequate in content for a 2-year course in Science, Technology and Society at the Higher Secondary level. The activities in the curriculum can be completed over a span of 200 contact hours. Some of the activities require the participants to collect data by library search or survey outside contact hours. However, many activities, mentioned in Section 1.4 of the respective books are essential for giving students a flavour of the issues. These may be covered over a span of 100 contact hours, about 10 hours per book. The large number of activities given in each book allow ample scope for a flexible and innovative approach to teaching.

The activities outlined in the books can, however, be used with any group of individuals with a minimum schooling of standard X (grade 10). It has been found to be harder to work with groups exceeding 30 members. This problem can be overcome by dividing the group into subgroups of smaller size. It would certainly help to have a common language of communication within the group. Since it is most likely that the books will be used in a classroom situation (say, higher secondary class), the participants are referred to as *students* in all the books.

1.3.6 The group leader

The objectives will be patently met if the group consists of a leader or coordinator, who has more than a cursory interest in the developmental

issues of concern today, and enjoys making linkages. The students should be guided not only in making the obvious links, but also to go beyond them.

A coordinator with a formal training in cross-disciplinary thinking has a clear advantage, but a person with an open mind to the ideas of others, and one who feels that students cannot be all wrong, would do just fine. It would be useful for the group leader to be proficient in English, so as to be able to read and comprehend the proliferating information and communicate this to the group. It is most likely that the leader will be the teacher, and hence *teacher* in the books will mean the leader or coordinator of the group.

The leader plays a special role in all the activities outlined. The cardinal principles that govern the interaction of the leader with the group include the following.

i. Understand and value individual and group perceptions.

ii. Encourage listening by setting an example.

iii. While moderating discussions, support the apparently indefensible viewpoint.

iv. Attempt to raise the discussion from the level of free-standing personal statements —'I feel', 'I think', etc., with no accompanying justification — to coherent and logical arguments, with quantification wherever possible.

v. Allow for changing and evolving views during discussions and show a willingness to learn from the students.

vi. Encourage following firm rules during a debate.

vii. Facilitate and liven up discussions by introducing a new angle whenever possible.

viii. Use the 'let us find out' mode as often as is appropriate.

The role of the leader is far from a passive one. Encouraging the diffident student, guiding the overly confident one, finding loop holes in the arguments of a member without lowering self-esteem and being in control of

the situation in a class full of thinking individuals is a challenging task. Yet, if viewed as an opportunity to improve one's skills of critical thinking, at the same time creating a generation of thinking individuals, the joy of such interactions can be infectious.

1.3.7 What this is, and what it is not

As already explained in Section 1.3, these books are not substitutes for textbooks, nor are they comprehensive. They are meant to give students a feel for 'real world' problems, without introducing the intractable complexities all at once.

There are very few problems of concern today that have either globally applicable, or locally unique, answers. As in any reasonable developmental approach, the answers to many questions must be sought within a local framework of society, politics and economics. In fact, increasing students' sensitivity to local needs and problems and putting these in the context of global concerns, constraints and opportunities, with examples of solutions arrived at in different contexts, is a tacit aim of the Foundation Curriculum.

Hence, it is an advantage for leaders and group members to have access to information, both local and global. The bibliography is indicative rather than exhaustive. Definitions and concepts can be sought and found in any relevant textbook available in a junior or senior college. Newspapers and locally available magazines could be additional and sometimes valuable sources of issues of debates. Many newsgroups and voluntary agencies provide information and clippings files free of cost or at a nominal charge. The group must, in the course of the interaction, generate and catalogue its own set of clippings files on issues of concern to the group.

The important, but rather difficult, questions of evaluation have not been addressed here. In this curriculum, more than in any other, evaluation of any form is a measure not only of participant's comprehension, but also of the effectiveness of the leader. Test questionnaires have been provided in some of the books as guidelines to assess effectiveness of interaction in the course and to help take corrective measures.

1.4 This book

The importance of *health* for our survival is undebatable. Several historical instances bring out the relationships between the disappearance of entire populations and the spread of epidemics. Today, many of these communicable diseases have been wiped out or are under control. Yet, the health scenario in India is far from satisfactory. Importantly, Indian economy is also greatly affected by our poor health status.

You will see in this book that India has a high incidence of communicable as well as non-communicable diseases. In addition, several other *new* health challenges and hazards stare at us — the diseases associated with increasing ageing populace, multiple drug resistance and new *avatars* of several microbes. Experts predict that the next century will see us struggling with the AIDS epidemic. The effects of AIDS threaten to be disastrous at personal, social as well as economic levels. Funding in the health sector, especially in public health, needs to be further enhanced. India has a long way to go before it is in the *pink of health*. Or, achieves the WHO objective of **Health for all** even by 2020 AD. India's disease burden **can**, however, be reduced by effective preventive programmes of cleanliness, nutrition and vaccination.

The totality of health issues are too diverse and complex to be covered in a book of this kind. Health issues not addressed here include environmental and occupational hazards, cancers and other diseases and issues related to addictions, sports, yoga, sex education and reproductive health.

Five major themes — communicable diseases, vaccination, nutrition, new challenges and funding — are covered in this book through a variety of activities. The exercises include analysis of graphs and tables, collages, surveys and essays. About 20 hours will be needed to complete all the sections in the book. For a shorter course of about 10 hours, activities in Sections 2.5, 3.2, 4.1, 4.2, 4.3, 5.1, 5.5 and 6.2 may be attempted first. These sections should give a flavour of the linkages involved in addressing health issues.

Chapter 2

Health and communicable diseases

Health is a concept that can be used in several contexts. However, generally this term (healthy or health) is used while referring to *health* of individuals. This is the aspect which will be largely discussed in this book. Obviously, health is a matter of concern for all of us. Maintaining a whole nation of people healthy and productive requires the combined efforts and participation of all people as well as the Government.

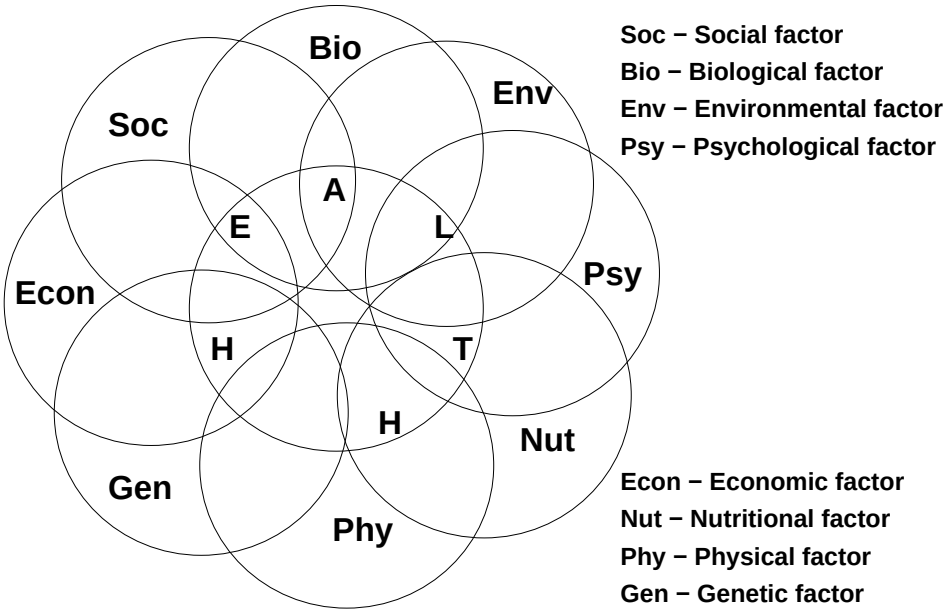
2.1 Definition of health

You will examine here the various dimensions and complexities of the idea of health.

1. What ideas come to your mind when you think about health? Include ideas not related to humans, such as, "a diseased tree" or "a crumbling and sick democracy". Elaborate in a few sentences some of these ideas.

2. Figure 2.1 conveys several ideas about health. [17] Elaborate each aspect shown. Give some subdivisions under each category.

Figure 2.1: Web of causation of diseases.



3. List some aspects other than those shown in the figure. Is one particular aspect more important than the other? Justify your stand. Discuss everyone's ideas in the class. Was there a consensus on which aspect is more important than the others? Do you think there should be a consensus at all? What does it show when everyone does not agree on a particular aspect?

4. Now, define health. Arrive at a consensus in your class. Your definition should encompass ability to work, a feeling of well-being and being free of diseases.

5. Do you need to refine any of the aspects shown in Figure 2.1 when referring to the health of the elderly?

6. Carry out a literature search to know how the ideas of health have evolved over time. Talk to relevant people and refer to encyclopaedia.

7. Suggest another appropriate title for the motive in Figure 2.1. Compare your titles in class.

To maintain good health, it is important to have a good understanding of each of the aspects which affect our health. You have realised through

the discussion here that the health of a country or an individual needs to be addressed from many angles, that is, in a holistic manner. The overall model of development, economics, environment, social and political systems of a country, together determine the health of a population.

2.1.1 Universality of the health concept

Health is a universally applicable concept. It relates to several contexts and situations, not solely human. If you read a newspaper or a magazine critically you would be able to gauge the healthy or not-so healthy situations in different set-ups.

1. Read the two situations given below. What can you say about the health of the institutions in the two situations?

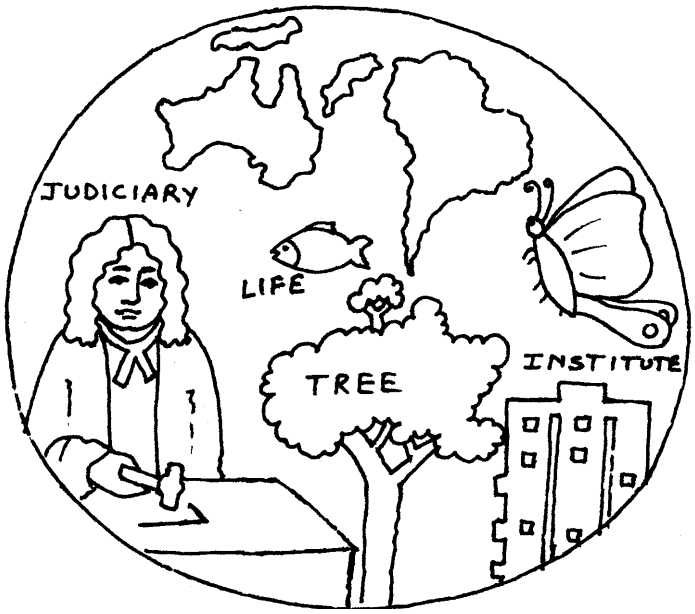
   - *Students are busy at work. While those in the library are reading attentively, often closing their eyes and thinking, others are working in their laboratories or on their computers. This was observed for several months, night after night. When they meet in corridors or in canteens, they analyse and debate about the political turmoil in their city or the major administrative changes being made in their university.*
   - *It is 11.30 am and the university canteen is choc-o-full. Some students are gossiping about personal lives of film and television personalities over cups of tea. Others are leaning against canteen walls puffing away at cigarettes. These students are arguing about the power struggle in the student bodies.*

   Argue that one of the institutions is *healthier* than the other.

2. The collage in Figure 2.2 shows many "systems". List them. What role does the idea of health play in their survival? Is mere survival enough? How does health contribute to the vitality of a system?

3. Society enacts laws and lays down guidelines to be followed in all walks of life. Argue that this is essential not only for the survival of society, but would help its growth and prosperity. Argue, through an example or two, that laws of a society cannot be fixed for all times. The laws need to be responsive to its emerging needs.

Figure 2.2: Universality of health as a concept.



4. Apply your arguments about the survival needs of a society to the other systems shown in Figure 2.2.

5. Survival has two important aspects:

   - Survival of the whole versus the survival of a unit (a part), and
   - Short term versus long-term survival.

   These issues are addressed in the following examples. Read them and write a paragraph on what options you would suggest in each case. Support your suggestions with ideas about survival of a whole, a part, short term and long term.

   (a) A small family (of two children) is advocated by the Indian government. (In China, the law favours couples with one-child.) Certain groups, such as Parsis or Muslims in India feel that their very survival is threatened by the small family norm. Increased population, on the other hand, puts pressure on all resources: food, energy, shelter, land, etc.

   (b) A dancer has an accident and her leg is afflicted with *gangrene* (local loss of soft tissues due to loss of blood supply). She op-

poses her doctor's idea of amputation of her leg as her whole life revolves around dancing.

(c) A farmer finds that the only way to increase the productivity of his small farm is by the use of large amounts of a new chemical fertiliser. His friends warn him that this could lead to a long term degradation of his soil as well as the water bodies. However, he needs the extra food and the money it could bring for his immediate family commitments.

(d) A family advocates yoga and avoidance of processed and preserved foods. In the bargain, it ends up spending a larger share of the monthly budget on "healthy" foods. As the children grow up, their needs change and there is friction in the family.

6. In India, *Panchayati Raj* has been introduced for long term survival of democracy in the country. What could be the short-term problems here?

7. Make up a situation, say from politics or other social situations which bring out the dilemmas of survival on a short-term and long-term as well as of a whole or a part.

8. The Chinese government promulgated "the Chinese Maternal and Infant Health Care Law" in 1994. This law advocated the abortion of foetuses that were diagnosed to have genetic defects.

   There were international concerns about this Law. There was a national survey in 1996-97 among 402 geneticists in China, funded in part by the Ethical, Legal and Social Implications Branch of the US National Centre for Human Genome Research. The gist of the results of the survey are given below.

   - 95% of Chinese geneticists agreed that people at high risk for serious disorders should not have children unless they use prenatal diagnosis and selective abortion.
   - 90% agreed with the statement that "*an important goal of genetic counselling is to reduce the number of deleterious genes in the population.*"
   - 90% called for ethical guidelines for the practice of genetics and research in China.
   - 89% supported the Chinese law on abortion for genetic abnormalities and non-medical indications.

Based on the survey response given above, initiate a debate on the short and long term consequences and whole or part benefits accruing to the Chinese society. Address the issues given below in your debate.

(a) The positive and negative points about prenatal diagnosis and situations that demand prenatal diagnosis of a pregnant woman.

(b) Prevalence of inherited (genetic) diseases, especially those common in India, (find out about these), and the best methods of dealing with these diseases.

(c) The financial burden to the family and to the society while caring for those afflicted by genetic diseases.

(d) Issues raised in terms of infringement of human rights.

9. Should India, too, think about a law similar to the one passed in China? Justify your stand with examples and arguements.

10. Write a skit to enact a scenario where a family is burdened with a child having a genetic abnormality, such as Duchenne muscular dystrophy, thalassaemia or Down syndrome. You may send a copy of the skit to the editor of this book.

Evolution of a system is essential for its survival and its vitality. To take just one example, this is evident in the changing nature of the three constitutional arms of the Indian democracy: the executive, judiciary and the legislature. In this process, however, the country may have to forego some of its short-term interests in favour of its healthy long-term survival and vibrancy.

2.2 Different interpretations of health

Health means varied things to different people. Historically, all civilisations and societies have valued good health and have evolved their own ways to maintain it. Cleanliness has been one common value among all civilizations. For warding off diseases, several practices were followed, some based on magic, superstition, and quackery, too. Alternatively, several cultures, including the Indian civilisation, based these practices on

herbal, ayurvedic, yogic, unani and such other approaches. In all these, there was an emphasis on exercise, nutritious food and clean environment. Hence, ideas like clean body, clean house, clean water, nutritious food and treatment of different ailments existed, at one level or the other, even in ancient times.

1. Recall as many customs as you can that relate in one way or the other to health. Discuss with your grandmother or an older member of your family about kitchen rules. Was everyone allowed to enter the kitchen? There is a rule about removing foot wear before entering a house or kitchen. Trace the relevance of such practices to health.

2. How is drinking water stored in homes in small towns or villages? Discuss with your mother and grandmother about water storage 20, 30 or 50 years ago. Relate the shapes of water containers and their material to practical aspects of convenience and health. Discuss how the drinking water was taken out of these containers.

3. Why should our food be preferably cooked? What special purpose other than mere taste did items like *papads*, *wafers* and *pickles* serve?

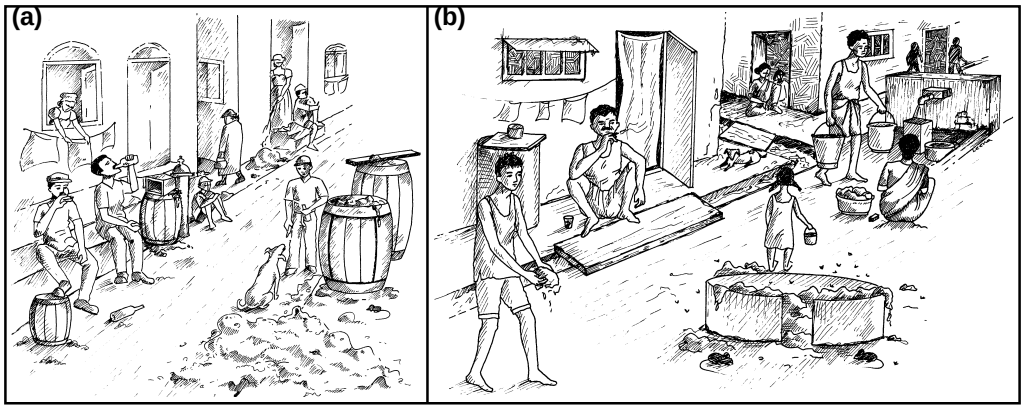
4. Why do several households have different foot wear for toilet? Why are all containers used in the toilet kept scrupulously separate? Suggest some scientific reasons to justify these practices.

5. Next time you see any Indian film, especially if made a few years ago, observe the different actions of film stars. Note down which of these relate to the principles of hygiene.

The magnificent sanitation system of the Mohenjadaro and Harappa (3000 BC) bear a silent testimony to the strict public hygienic norms prevalent in ancient times. Several of these norms continue today, most marked in the case of personal hygiene. Sadly, though, several of these practices are slowly getting disrupted.

There is an urgent need to document those Indian practices which ward off diseases, both in the realm of public and personal hygiene. They will also have to be explained scientifically. You could contribute to reviving this rich tradition.

Figure 2.3: Health situation (a) in the West (some time in 1800's) and (b) in India (1998).



2.3 Your surroundings: the current scene

In the last section you have discussed some practices for warding off diseases, especially communicable diseases. The situation has deteriorated in the last few decades. There has been a near-breakdown of public hygiene, leading to a high incidence of all communicable diseases in the country. You will examine this situation in more detail in this section.

1. Study the two illustrations given in Figure 2.3. Note the differences and similarities in the scenes. What factors led to cleaner surroundings in the West?

2. Edward Chadwick, a lawyer by profession and training, ushered in the Great Sanitation Revolution in the 1860's in the West. What does *sanitation* mean? How does it relate to health?

3. Name a few Indians who have succeeded to some extent in cleaning up their surroundings, leading automatically to reduction in the load of communicable diseases in the country?

4. Mahatama Gandhi, Ambedkar and more recently, Bindeshwar Pathak and S. R. Rao of the Surat fame deserve special honour for their contribution to public hygiene. Justify that they ushered a near social revolution in the country by introducing novel and indigenous methods of public hygiene.

5. In what ways can you, as a citizen, support the hygiene revolution?

6. Several towns and suburbs of Indian cities with millions of inhabitants do not yet have an underground sewage system ! Is the underground sewage system equally needed in all areas of country? Consider the different needs of densely and sparsely populated areas.

7. Observe the dates again in Figure 2.3. What is so significant about these dates?

You can see that something is going wrong with the public hygiene and health in the country. The introduction of clean drinking water and sanitation facilities in the West, in the 1840's, led to a dramatic reduction of communicable diseases. Bear in mind, antibiotics to cure these diseases were introduced only in the 1940's; vaccination programmes for prevention of these diseases came into vogue only in the 1950's.

2.4 Importance of Germ Theory

In this section, you will discuss the science behind the personal and public health measures. For this, you will have to recollect some aspects of your school biology.

The work of Antoni Leeuwenhoek, Louis Pasteur and Robert Koch are mentioned in your school texts. These three, besides several others, laid the foundations of the Germ Theory and gave a real fillip to microbial science.

1. Check out the two lists in the box given here, and match the items in them.

	List A		**List B**
1.	Vibrio cholerae	a.	Typhoid
2.	Streptococcus pyogenes	b.	Mumps
3.	Variola sps.	c.	Small pox
4.	Salmonella typhi	d.	Cholera
5.	Myxovirus	e.	Tonsilitis

2. What do you think is the Germ Theory? Find out the significance of this theory in the context of health and hygiene? Relate the Germ Theory to the benefit of the hygienic practices evolved in earlier times.
3. Enact the discovery of penicillin by Alexander Fleming in the class. Wear the period costumes. Name a few antibiotics.
4. Which approach do you follow in your daily life: A preventive approach — whereby you will not get diseases; or The curative one, whereby you pop a pill whenever you fall ill? Give as many instances as you can from your daily habits to support your choice.
5. Will antibiotics become redundant with the preventive approach? Initiate a discussion.

By the mid-19th century, it was firmly established that a variety of microorganisms — viruses, bacteria and fungi — cause communicable diseases. The science of microbiology grew exponentially. In the context of our health, the microbial reservoirs — the places where the microbes live and multiply — were identified. Hence air, water, soil, food and animals, birds, and humans, too, all microbial reservoirs, were viewed with a new perspective. It logically followed that to be free of communicable diseases, people will have to either remove the microbial reservoirs or keep some distance from them. Some understanding of microbes and their behaviour can help a lot in keeping you healthy.

2.5 Health status: a global comparison

A global perspective of any topic often brings out several points which are otherwise not apparent. The tables and graphs in this section give important health statistics and hence major insights regarding different health aspects in the major regions of the world.

Study Table 2.1 in detail. [9] Five major demographic regions of the world are represented here. **Child mortality rate** (**CMR**) is the probability of a child dying between birth and age 5, expressed per 1000 live births. A related factor, **infant mortality rate** (**IMR**) for any year is defined as the number of infants who die before one year of age, per 1,000 live births in that year. **Life expectancy at birth** is the number of years that a person

born in a given year could expect to live, given the age-specific mortality rates for that year.

1. In Table 2.1 observe the pattern of change in child mortality region-wise. In the column marked **% Redn**, fill in the percentage reduction from 1975-90 for each region. Find out in absolute numbers the levels of child mortality in India and China in 1990.

2. Similarly, observe the change in life expectancy for different regions. What could be the possible reasons for differing life expectancies in the regions? Fill out the next column in terms of percentage increase for the same period.

3. What do you think are the reasons for the different child mortality rates in the regions listed in Table 2.1? In what way do they indicate the varied health scenarios in different regions?

4. Using the data in Table 2.1, plot a graph of child mortality rates against income per capita. Analyse the relationship between the two quantities. What conclusions would you draw?

5. Now, plot for child mortality versus life expectancy. What sort of relationship do you observe? Write a paragraph on the correlation between child mortality, life expectancy and income per capita.

6. Besides the political system, what other factors must have helped China achieve the spectacular decline in child mortality?

7. Will there be major differences between life expectancy at birth and at age 20? Why? Discuss this issue in the class.

8. Observe the numbers under life expectancy at birth in Table 2.1. The former socialist countries (FSC) and the more developed countries (MDC) had already reached high life expectancy levels in the 1970's. What is the increase in life expectancy in China and India in the given 15 year period? From a book on the census or from a WHO or World Bank Report, find out the child mortality and life expectancy at birth for some countries that interest you.

9. In the graph that you have plotted in item 5 include the data for the countries that you have found in the above activity. Do they follow the same relationship? Some countries may seem to fall outside the linear relationship. Discuss the significance of this data.

Table 2.1: Population, economic indicators and progress in health of some major regions (1975-90).

Region	**Popn. 1990** millions	**Deaths 1990** millions	**Inc./capita USD 1990**	**Child mortality/1000**			**Life expectancy**		
				1975	**1990**	**% Redn**	**1975**	**1990**	**% Inc.**
Sub-Saharan Africa	510	7.9	510	212	175		48	52	
India	850	9.3	360	195	127		53	58	
China	1134	8.9	370	85	43		56	69	
F.S.C.	346	3.8	2,850	36	22		70	72	
M.D.C.	798	7.1	19,900	21	11		73	76	

Note: Sub-Saharan Africa = countries south of the Sahara, excluding Mauritius, Reunion and Seychelles.
F.S.C. = Former Socialist Countries.
M.D.C. = More Developed Countries.

In the span of 15 years from 1975 to 1990, you have seen that there has been an improvement in the health status in all regions of the world, albeit to varying extents. The progress achieved in China on the health parameters discussed here is significant. It is possible that an emphasis on health education and health delivery at all levels in that country has paid rich dividends.

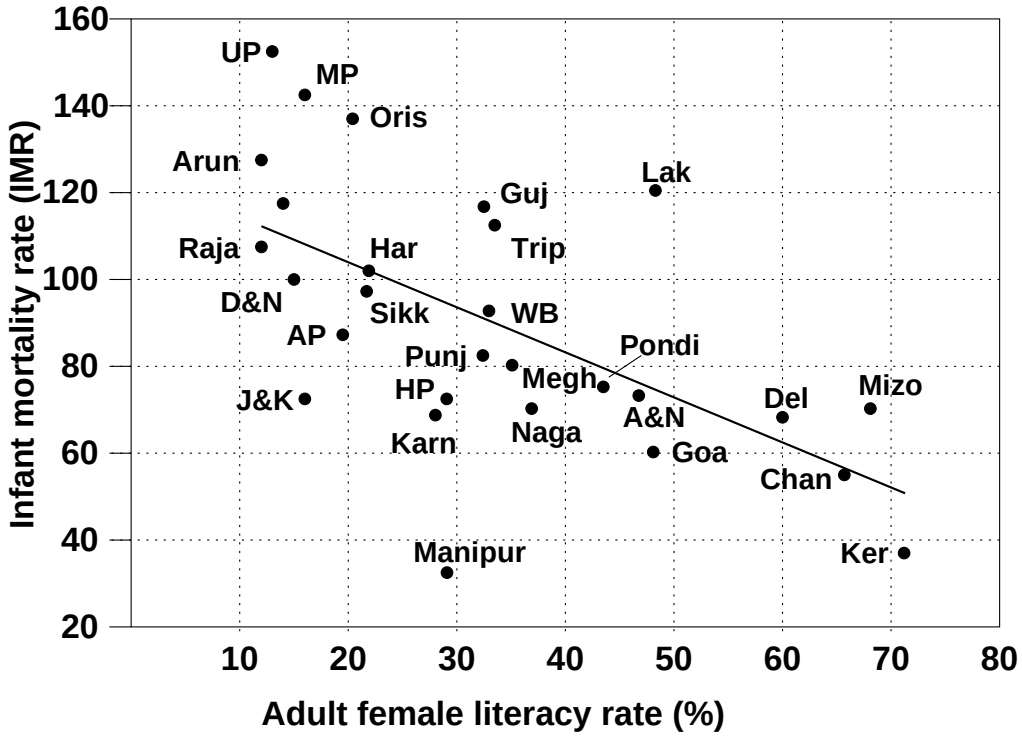
2.5.1 Female literacy and infant mortality

Another point which you must have discovered in the last section is that the improved health status of a region is not solely dependent on its per capita income or its rate of growth. Several aspects contribute to make a healthy population. You have possibly discussed in the two books in this series — *The Population Problem* and *Education* that the levels of infant and child mortality decrease with increase in women's education. This section will engage you in a discussion on this aspect.

Figure 2.4 shows a scatter plot of infant mortality rate and adult female literacy rate. [20] Infant mortality rate (**IMR**) refers to the number of children who die within the first year of their birth out of 1000 live births in that year. For instance, if 200 children die within one year of birth among the 2000 children born in a certain small town in a year, the IMR for that town in that year would be 100. Study the figure and discuss the issues raised below.

1. What is the slope of the line in Figure 2.4? What does the negative slope indicate? Explain.
2. In what ways does a literate woman reduce infant mortality?
3. Study the graph in Figure 2.4 for a certain range of female literacy, say between 25% and 35%. What are the maximum and minimum infant mortality rates in this range? Consider that the literacy rates in the States falling within this range are about the same. What do you think acounts for the large range in infant mortality rates? Take each State in this range and come up with possible explanations based on the situation there.
4. Choose a 10% range around another value of literacy rate. List the States that fall within this range, their infant mortality rates and

Figure 2.4: Relation between adult female literacy rates and infant mortality rates in the States and Union Territories of India, 1981.



explain the differences.

5. Carry out the following survey in your class. Each of you should list two families of your grandparents' generation. It could include for instance, your grandparents, their brothers and sisters. For each of the families listed find out the number of children born, whether they are surviving, if not, their age at death, and abortions if any. For each family, also note the educational level of the mother. Pool the information from the whole class. Discuss whether there is a relationship between educational level of the mother and number of children who died before the age of five years. Include abortions.

6. Do you think female literacy will always operate to reduce IMR? List other factors which are responsible for high IMR.

7. Do you think there might be a difference in IMR values between male and female infants? Find data to support your stand.

8. The average IMR for India stands at 72 in 1996, from a high of 129 in 1971. In 1981, the national average IMR was 110 while the average female literacy rate was 29.85. Plot the national average for 1981 as a point on the graph. List the States in Figure 2.4 that have a higher infant mortality than the national average. Comment on your findings. What do you think will be their situation in 2000?

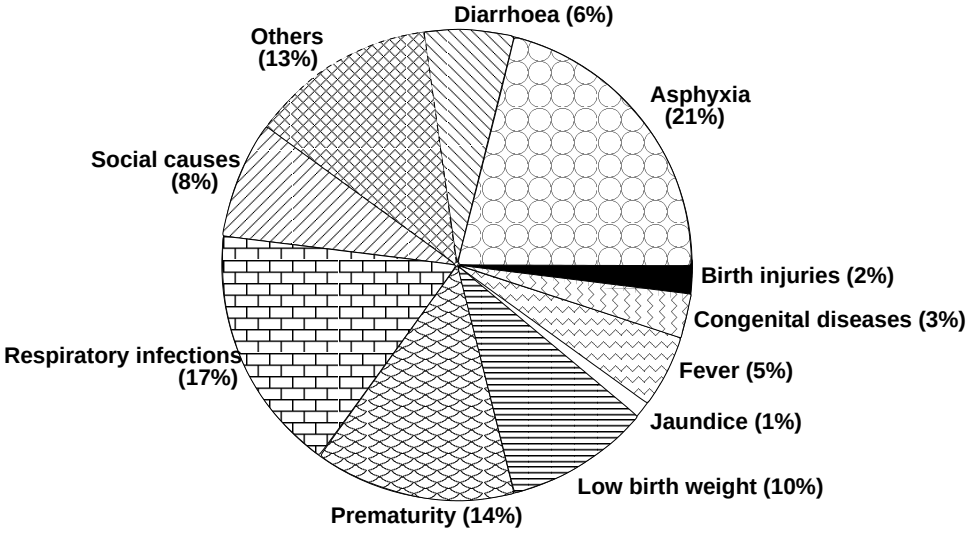
9. Find out the IMR and adult female literacy rates in recent years for different Indian States and Union Territories, especially for MP, Andaman and Nicobar, Orissa and Lakshadweep. Compare these values with the earlier ones. Discuss in class.

Several states in India, with Kerala leading, have made significant progress in reducing the infant mortality rate in the last 50 years. However, India's IMR at 72 in 1996 is still high when compared to that of other developing countries like Sri Lanka, Thailand and China. Detailed studies bring out that several other factors also play an important role in high IMR.

2.5.2 Causes of infant deaths

Figure 2.5 shows the contribution of different causes to infant deaths in the Tamil Nadu State of India in 1995. (Source: DPH Survey 1996) [1]

Figure 2.5: Cause of infant deaths in Tamil Nadu, 1995.



Infant deaths implies the death of a child within one year of birth. Study the figure and discuss its details through the activities given below.

1. Tamil Nadu had an IMR of 54 in 1995. List the different factors responsible for infant deaths.

2. Which of the causes listed would fall under the category of communicable diseases? What is the percentage of deaths due to these?

3. Deaths due to which of the diseases could be prevented by simple measures? Suggest some simple preventive measures. Talk to your grandmother and find out the measures she has used in her time to prevent dehydration. Discuss the pros and cons of the use of *oral rehydration therapy* (ORT) available over the counter and the existing local measures.

4. What could be the reasons for the high percentage of deaths due to prematurity? What do you think will be the weight of these premature babies? What facilities do premature babies need to survive?

5. Look up the meaning of *asphyxia* in a dictionary. Explain what it means to say that 21% infants died due to asphyxia.

6. Asphyxia, birth injuries, low birth weight and prematurity could cause deaths within the first few weeks of birth. What percentage of infant deaths occur within the first few weeks?

7. Discuss the *dai* system of health assistance in the country. In what ways do the delivery set-ups differ in rural and urban areas? Discuss the advantages and disadvantages of the set-ups involved. How can either be made safer?

8. How do social factors lead to infant deaths? Discuss the social attitudes to females that contribute to differences in infant deaths. Would these also contribute to increasing infant deaths in general? Elaborate.

The IMR is a sensitive indicator to monitor the health status of the society. Most causes of infant deaths can be attributed to low female literacy, especially in rural areas, absence of basic infrastructural facilities, including safe drinking water, sanitation and primary health care, combined with poor health status of mothers. It is a challenge to address the social and medical causes of high IMR, not only in TN, but throughout India.

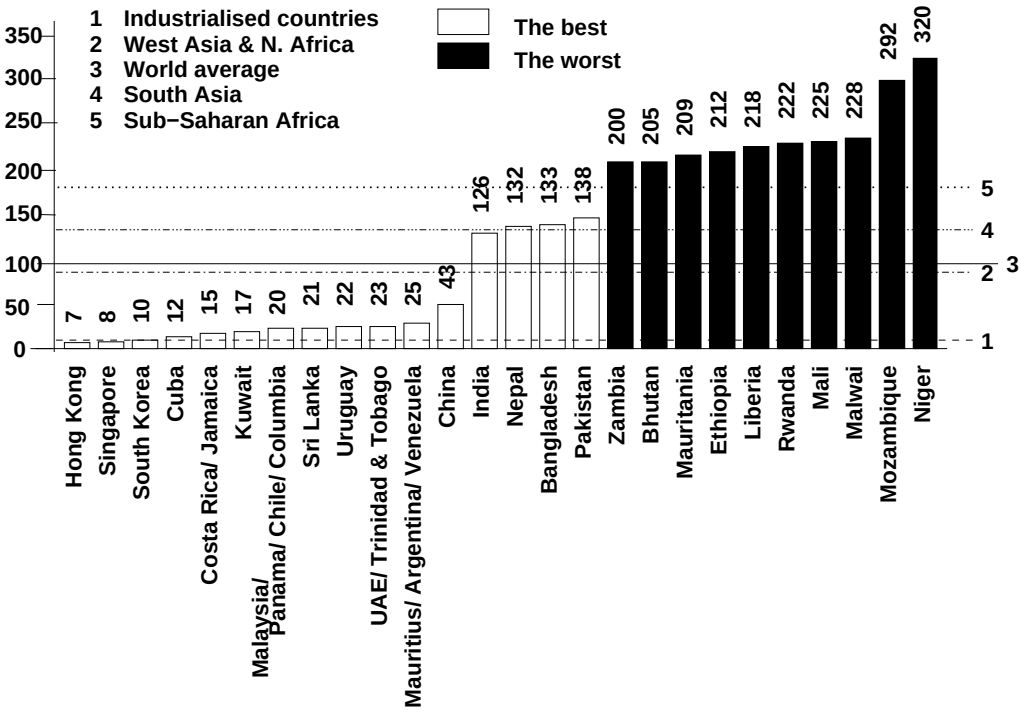
2.5.3 Child mortality

On a global scale, where does India stand with respect to under-5 mortality rates? Figure 2.6 shows the survival league of under five mortality rates in many countries of the world. (Source: Progress of Nations) [5] The y-axis indicates the number of children who are likely to die before they reach the age of 5 years out of 1000 live births in that country.

The average values of the survival league of under five mortality rates have also been shown by horizontal lines. These are for the following regions: ‘

- Industrialised countries — line **1**
- West Asia and North Africa — line **2**
- The whole world — line **3**
- South Asia — line **4**

Figure 2.6: The survival league of under-5 mortality rates for many countries of the World.



- Sub-Saharan Africa — line **5**

1. Study the horizontal lines for the five regions of the world. They are numbered on the right. Using an Atlas locate the countries that fall in the four major regions (other than the world on line 3) mentioned here. On a copy of the world map, mark each country by a colour corresponding to one of the 4 regions it belongs to. Choose different colours for the regions so as to indicate each region's collective average. Make a poster showing the world scenario of under-5 child deaths.

2. According to the graph in Figure 2.6, which countries are better than the world average in terms of preserving the lives of their children? Which countries among those given in the graph contribute to raising the world average?

3. Using the political, economic and geographical situations of the coun-

tries given in the graph, list the possible reasons for the high under-5 child deaths among certain countries. You may have to read up in a *Year Book* or *Encyclopedia* about the economic and political situations in these countries.

4. The total number of live births in India and China in 1990 was 25.8 and 25.1 million respectively. Calculate the absolute number of children who are most likely to have died before they reached the age of five years. What is the ratio of the infant deaths in China to that in India for 1990?

Literacy, especially of the females, economic development and infrastructural development, especially in the areas of public health development, will go a long way in reducing IMR.

2.5.4 Burden of diseases

Life expectancy and child mortality at birth are indicators of the health status of a population or society. You have realised through the activities so far that neither of these gives the whole picture. Conditions like fever, paralysis, headache, diarrhoea, and cough and cold may not kill you. But they all contribute greatly to reducing your well-being. They could make you less productive too. This is referred to as **morbidity**. Contrast this with *mortality* meaning the probability of death.

In order to measure the true health status of a society more accurately, a derived quantity called **the global burden of diseases** (GBD) is used. GBD combines losses from premature deaths and loss of healthy life due to a disability or a disease. That is, it combines the mortality and morbidity effects. GBD is measured by a new unit called **disability adjusted life years** or **DALY**. Table 2.2 gives the DALY loss in some relevant regions of the world. It also gives the contribution of communicable and non-communicable diseases to this loss. [13]

1. Compare the total DALY loss, or disease burden, in the different regions of the world.
2. India has a total DALY loss of 292 million. Relate the DALY loss to the population. Explain, in about a paragraph, what the DALY loss

Table 2.2: Distribution of DALY loss due to different factors in some regions of the world, 1990 (in %).

Factors	**Sub.S**	**India**	**China**	**F.S.C.**	**M.D.C.**
Population (m)	510	850	1134	346	798
Total DALY loss (m)	293	292	201	58	94
Communicable diseases	71.3	50.5	25.3	8.6	9.7
TB	4.7	3.7	2.9	0.6	0.2
STD/HIV	8.8	2.7	1.7	1.2	3.4
Diarrhoea	10.4	9.6	2.1	0.4	0.3
Vaccine-prevented childhood infection	9.6	6.7	0.9	0.1	0.1
Malaria	10.8	0.3	0.05	—	—
Worm infection	1.8	0.9	3.4	—	—
Respiratory infection	10.8	10.9	6.4	2.6	2.6
Maternal diseases	2.7	2.7	1.2	0.8	0.6
Perinatal diseases	7.1	9.1	5.2	2.4	2.2
Other	4.6	4.0	1.4	0.6	0.5
Non-communicable diseases	19.4	40.4	58.0	74.8	78.4
Injuries	9.3	9.1	16.7	16.6	11.9

Note: Sub-S. = Sub-Saharan Africa; See Table 2.1 for other abbreviations.

means in terms of the productivity and health of Indians.

3. Using the total DALY loss in millions and the percentages given in the table, calculate the DALY loss corresponding to each causal factor (like communicable diseases, TB, worm infection, and injuries).

4. Compare the DALY loss of all the regions in the table under each factor. Under which factors do you find the maximum variation in DALY loss?

5. Under which factors do you think DALY losses can be reduced with some interventions.

6. Make bar graphs or pie charts of DALY loss for communicable diseases of different countries.

7. Consider the DALY losses due to communicable diseases under different disease heads. Reclassify these diseases, where possible as either respiratory or air-borne diseases or gastro-intestinal ones. How do the regions in the table compare on these two categories of diseases? List the possible reasons for the high burden of these diseases in certain regions.

8. Collect newspaper stories over 3 months, which bring out the outbreak of one or the other communicable disease. Classify these stories under different heads of diseases: air borne and gastro-intestinal. Are any of them specific to certain months of the year? Do you find any common threads in these stories? Write a paragraph on the common kinds of diseases in our country, and especially in your town or city.

9. What pattern do you find in the distribution of DALY loss due to non-communicable diseases in the different regions? What diseases contribute to this category? What is needed to reduce the incidence of such diseases?

Life expectancy and child mortality continue to be simple but crude indicators of health. However, it is the DALY loss that you must use when you want a more complete picture about health. DALY loss gives you an idea about the loss of healthy life years due to a variety of symptoms.

You have also seen in this section that most of the DALY loss in developing regions like India arise due to communicable diseases, such as TB,

malaria, leprosy, diarrhoaes, cough and cold, and other respiratory diseases. When you see the global scene, it becomes obvious that this disease burden can be reduced. For instance, China has done remarkably well in reducing the DALY loss due to these diseases. Do you wonder how they managed it?

2.5.5 India's double burden of diseases

A recent report of the World Health Organisation (1995) while commenting on the world health situation states that the non-communicable diseases are registering a rapid rise in India. These include different types of cancers, cardio-vascular diseases, nutrient deficiencies and a host of psychiatric problems. All these diseases are intimately connected with your everyday habits and life-styles. You will discuss some of the connections in this section along with a few details of the more common communicable diseases.

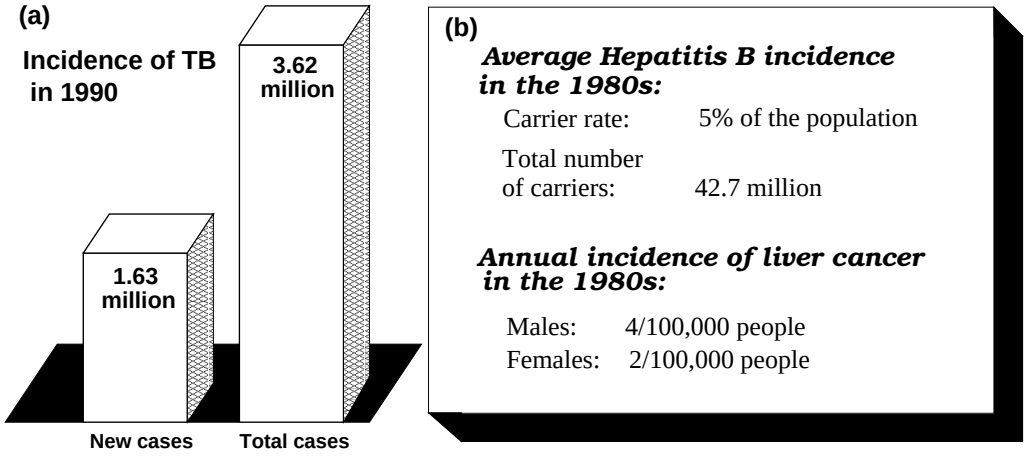
1. How is malaria caused? Why are people in certain areas more susceptible to this disease? Establish linkages between the overall deteriorating environment and the incidence of malaria. Suggest some effective ways of eradicating malaria?

2. Survey your surroundings for the places where mosquitoes can possibly breed. Contact local doctors and find out in which season they have maximum number of patients diagnosed as suffering from malaria.

3. In 1998, Gro Harlem Brundtland, the Director General of the WHO launched the **Roll Back Malaria** Campaign in several affected regions of the world. Formulate such a campaign for your locality. Involve as many people as possible in this campaign. Make posters to advertise it and organise meetings to create awareness. Write to the editor of this book about the outcome of your campaign.

4. In 1990, about 2% of people in India were affected by malaria. Do you think this is a worrisome figure? Would the incidence of malaria be uniform all over the country? What differences will you find? Why do such differences in incidence of malaria arise?

Figure 2.7: Incidence of (a) TB, and (b) Hepatitis B and liver cancer in India in the 1980s.



5. Assume, for simplicity of calculation, that the disease is distributed uniformly (2%) over the country. How many people live in your building society, village or colony? How many of these are likely to be affected by malaria in this year? Do you think this ought to worry you?

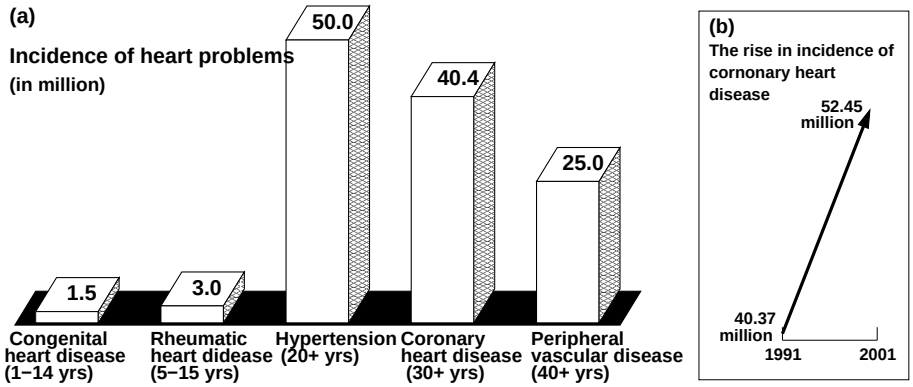
6. How do people in rural and isolated areas get malaria? You have discussed the threat of ecological disasters posed by canals and dams in the book on *Ecological Balances*. Discuss the effects these projects could have on incidence of malaria. List all the possible ways in which malaria is acquired in India.

7. It is estimated that every fourth person in India carries the bacteria which causes TB. Figure 2.7 (a) shows the incidence of tuberculosis in India in 1990. [6] What fraction of the total TB cases in 1990 were new cases? What does this say about the Indian scene on TB? From your discussions in the last section on DALY loss due to various diseases, what can you say about the correlation between incomes and a disease like TB?

8. The sudden spurt in infectious TB in the country as seen in Figure 2.7 (a) is ascribed to two important reasons. Find out these major reasons.

9. In 1998, an aggressive programme to reduce the incidence of TB, called **Directly Observed Treatment, Short course** (**DOTS**) has

Figure 2.8: (a) Incidence of different types of heart problems, 1991; and (b) Estimated rise in coronary heart disease, 1991-2001.



been launched in some of the major metros of the country. Why do you think a *directly observed* course of treatment is needed? Find out more about the DOTS programme.

10. What kind of approach would you advocate for fighting TB: the preventive or curative? What should be the priority given to each approach? Explain. Discuss in the class.

11. Argue that unless a preventive approach to TB is undertaken with a missionary zeal in the country, the disease will cripple productivity and divert the precious economic resources.

12. Figure 2.7 (b) shows that 5% of the population in India were carriers of hepatitis B virus in the 1980's. Explain the role that the carriers play in spreading this virus. How could you be infected by the hepatitis B virus? List and explain all the possible ways. How would you know that you have been infected? Estimate, with supporting arguments, the carrier rates in the 1990s.

13. Figure 2.7 (b) indicates that more males than females were annually affected by liver cancer in the 1980's. Give possible reasons for this difference. Do you expect this trend to change in the future? Justify your stand. Include arguments related to life styles and socio-cultural changes.

14. Figure 2.8 shows some types of heart problems and the age groups they most affect. [6] Which is the commonest cause of heart dis-

ease? What proportion of total heart problems are constituted by hypertension and coronary heart diseases?

15. What trend do you observe in the incidence of heart problems? Do you expect this trend to continue well into the next century? Do you think this trend could be halted or reversed? Justify your answer.

A double burden of diseases — communicable and non communicable — weighs India down. And there are no signs of their declining in the near future in the country. However, there is hope. A few dedicated people in some towns and city suburbs have shown the way in reducing the load of at least some communicable diseases. A missionary zeal in cleaning up, and awareness creation about health matters can certainly save India from her declining health standards.

2.6 Sanitation and water services

Water is a basic need for all living beings. And waste is a necessary byproduct of living too. The earliest infrastructures built by human civilizations involve transport of water and disposal of waste through proper sanitation. The activities in this section will open your eyes to the inadequacy of these basic human needs in present day India. You will discuss where we should be going from here.

1. Where does the water you use in your home and institutions come from? What other sources of water do you know of? Include water sources for a city, a suburb, a village, a river town and so on.
2. List the ways in which a source of water could get contaminated. Do you store water in any form? For what purpose do you use the stored water? Are you at any time likely to be drinking contaminated water? Explain the circumstances.
3. Name some water borne diseases. Are these prevalent in your locality? Can you say the same about all towns and villages in your State?
4. Figure 2.9 shows the percentage of population who do not have access to water and sanitation in some regions of the world. [9] What

Figure 2.9: Percentage of population without services.

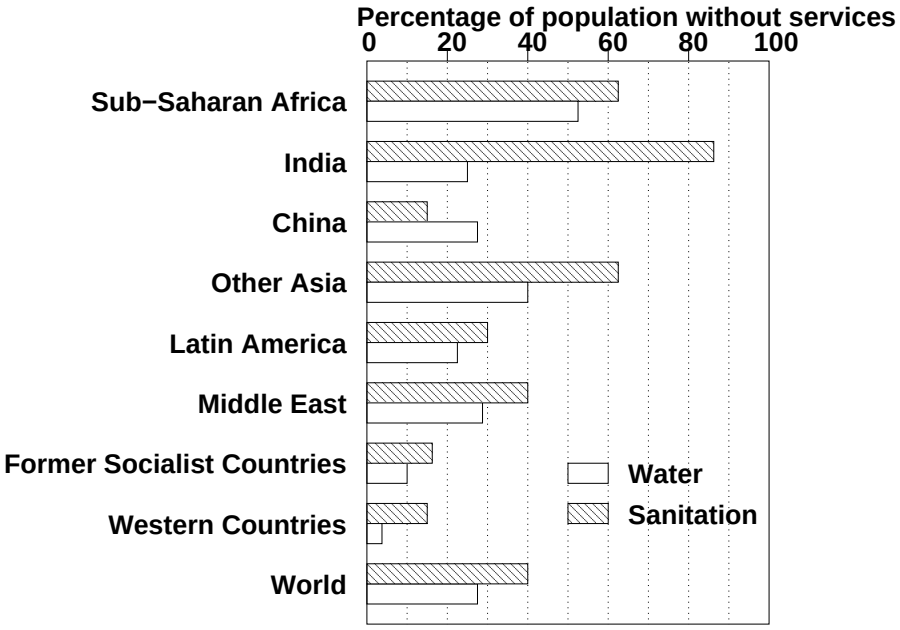


Table 2.3: Format for suggestions on ensuring access to water.

Suggestions	**Rank for characteristic**			**Overall**
	Cost	**Urgency**	**Practicality**	**Rank**

do you think this means? Analyse India's position with regard to providing water to her people. Discuss this in the class.

5. Form groups of 4 or 5 members. Talk to people who have visited different places about the water availability in those places. If you can contact people from different States or countries, that would be even better. Document your findings in the form of a report. Discuss the reports made by different groups in the class.

6. List a set of recommendations to ensure that all people of India get access to water. You could tabulate your suggestions in the format given in Table 2.3.

7. Categorise your suggestions in terms of its cost, urgency and practicality. You could choose other criteria to characterise your suggestions. You could give some mark on a scale of 1 (say, most expensive) to 5 (say, least expensive) for each category. Add up the overall ranking of each suggestion.

8. Prioritise the suggestions, where the one with the lowest number would get the highest priority. Make a draft report of your discussions. Send a copy to the local newspaper and to the editor of this series.

9. Figure 2.9 also shows the percentages of people without sanitation facilities. Argue why it is important to provide sanitation facilities to people. Where does India stand with regard to provision of sanitation facilities? How does it compare with other regions given in the graph? Why do you think this is the case?

10. How can absence of sanitation contaminate soil and water sources? Have you heard about the *Sulabh* movement? Find out more about it. Suggest alternative public or open space toilet designs. Ensure that they are located at a safe distance from dwellings. Take account of minimising water use. In fact if you could use the waste for energy production, it would be even better.

11. For every object you use, or food item you consume, list what gets thrown away, and in what form. Consider rich, middle class and poor in the city, rural and urban locales, and densely and sparsely populated areas. Which places are likely to produce more waste than can be disposed off in the same locality? What would be the constituents of the waste in each case? How would they differ?

12. Establish linkages between different infectious diseases and waste disposal facilities.

You have just discussed that millions in the country have no access to clean drinking water and sanitation facilities. The most pronounced and crippling health problems arising from this are the many types of diarrhoea.

Table 2.4: Plan expenditures on health and sanitation (Rs. in crore).

Period	On health	On water supply and sanitation
First plan (1951-56)	65.3	11.0
Second plan (1956-61)	143.0	74.0
Third plan (1961-66)	250.8	105.7
Fourth plan (1969-74)	613.5	458.9
Fifth plan (1974-79)	1252.6	1091.6
Sixth plan (1980-85)	3412.2	3977.6

2.6.1 Spending on health and GI diseases

In this section you will analyse the correlation between the expense over time on health, water and sanitation, on the one hand, and incidence of diseases, especially gastro-intestinal (GI), on the other.

1. The 5-Year Plans were launched from 1951 and since then investments have been made in health sector and on water supply and sanitation. Table 2.4 gives the amounts spent on these sectors. [8]

   Plot a graph of Plan expenditure on health versus year of beginning of the Plan. On the same graph also plot the expenses for water supply and sanitation. Use different symbols, and different colours for the two expense heads. Describe the nature of expenditure over time. Explain in what ways inflation would affect real expenses.

2. What is the percentage increase in expenditure on health from the first plan to the sixth Plan? What is it for water supply and sanitation?

   Table 2.5: New cases per thousand beneficiaries per annum.

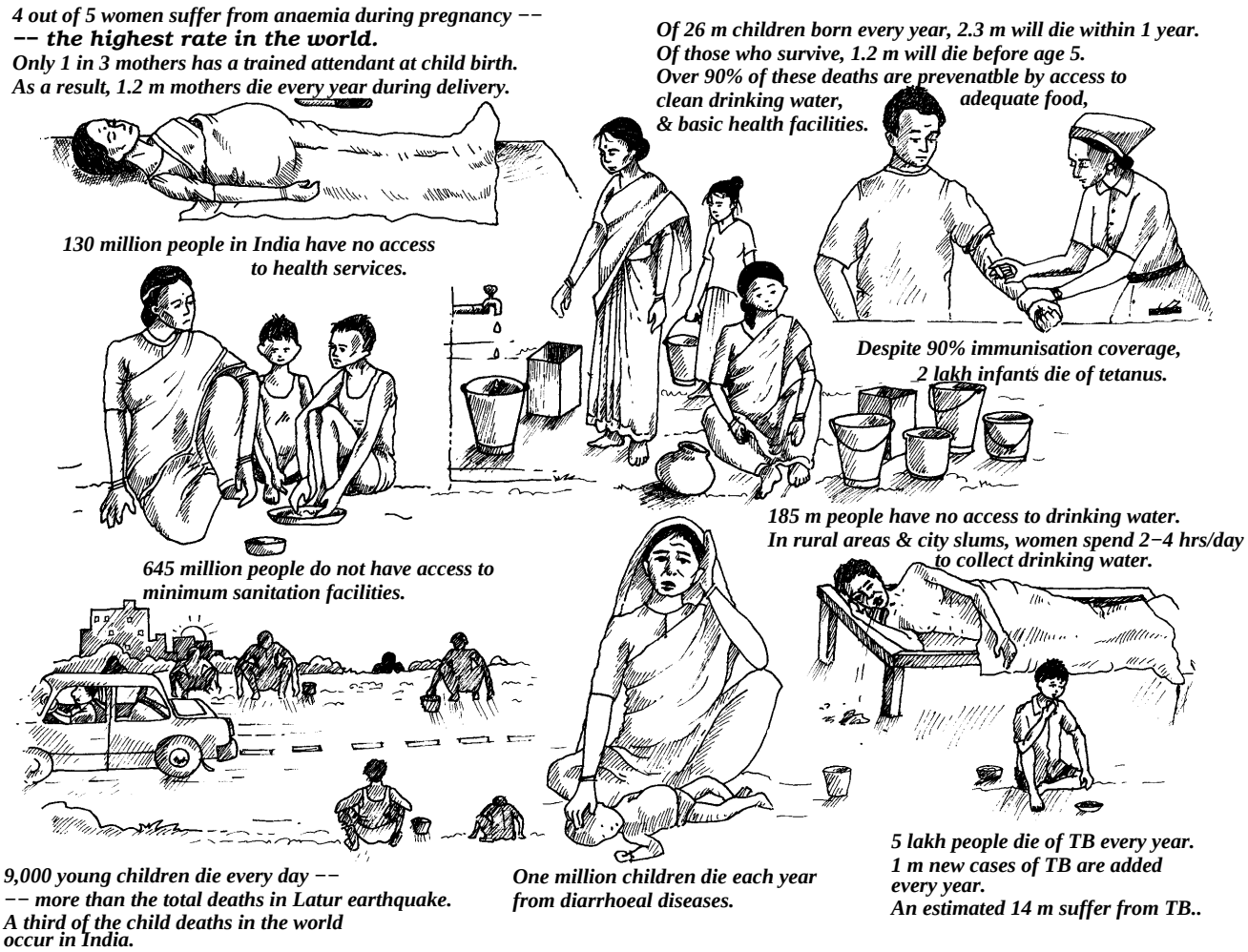
Period	Dysentery	Diarrhoea & enteritis	Cols. 2 + 3
1965-66	255	194	449
1969-70	234	198	432
1982-83	200	143	343
1983-84	244	193	407
1985-86	264	147	411
1987-88	244	139	383

3. Now study Table 2.5. [8] It shows data on the new cases of diarrhoea and enteritis, and dysentery detected annually. This data was obtained from the beneficiaries of the Employees State Insurance Scheme, mostly employed in the organised sector, living in urban and semi-urban settlements and benefiting from sanitation and medical benefits. Explain the prevalence of these GI diseases among a population which has access to water and sanitation facilities.

4. Recall the manner in which the GI diseases are transmitted. Make a poster indicating the multiple routes of transmission of these diseases. Put this up in a prominent place in your institution.

Apparently, the all pervading microorganisms have several ways of maintaining the oral-faecal chain for infecting us. Education can play an important role in your fight against infectious diseases. Your enlisting the community's support can go a long way in controlling the spread of infectious diseases at the local levels. Some of the factors identified to fight these diseases are: oral and public hygiene, the use of antibiotics, vaccination programs, education and female literacy, and of course, improvement in the overall economic status of the society.

India's Balance Sheet of Health



From an article titled "Health" by Mira Shiva.

Find the nine diseases hidden in the square below. Each disease name may be vertically, horizontally or diagonally arranged, forward or backward. The letters of each disease name are, however, continuous.
(Answers on page 47.)

P	R	E	V	E	U	G	N	E	D	X	O	P
I	A	Z	M	A	L	A	R	I	A	M	E	N
M	E	A	S	L	E	S	P	L	U	A	U	A
A	E	D	F	E	V	H	U	M	U	M	P	S
L	A	N	E	G	T	P	I	U	C	E	S	M
E	M	I	T	H	X	O	P	L	L	A	M	S
S	P	H	E	N	I	X	H	A	R	I	E	C
M	B	R	C	H	I	C	K	E	N	P	O	X
S	I	T	I	G	N	I	N	E	M	R	A	D
A	J	C	G	L	O	R	U	D	F	Y	P	I
J	K	E	N	X	S	D	H	Z	O	L	V	F
E	H	Q	W	P	B	I	S	Y	M	T	O	B
G	E	R	M	A	N	M	E	A	S	L	E	S

by Parvati Nataraja

Chapter 3

Vaccination

Vaccination has played an important role in protecting children from several infectious diseases. By the 1990's, nearly 80% of world's children were routinely immunised in early childhood against six diseases: polio, diphtheria, tetanus, whooping cough (pertussis), measles and tuberculosis. It is estimated that roughly 2-3 million children are saved from these diseases every year by vaccination. But millions die from these and other diseases for which there are still no vaccines.

3.1 Prevention of diseases

Health planners are moving towards fostering a greater social commitment towards vaccination. Recall the 1997-98 mass polio vaccination programmes in the country. Such programmes need to be intensified for other diseases as well. You will convince yourself of the need for such campaigns as well as research on newer vaccines in this chapter.

1. Have you ever been *vaccinated*? For which diseases? Ask your parents for this information. Have you seen anyone around you — in your home or school — being vaccinated? Where did this happen? What did you see? Which disease were they vaccinated against? After discussing in the class about your experiences with vaccination, list as many diseases as you can against which vaccinations

Table 3.1: Vaccines for some viral and some bacterial infections.

Viral infections		
Killed virus	**Living / inactivated virus**	**Living, crippled virus**
Influenza	Common cold Small pox	Mumps Measles Rubella Polio Yellow fever
Bacterial infections		
Toxoid	**Living, crippled bacteria**	**Killed bacteria**
Diphtheria Tetanus	Tuberculosis	Whooping cough Typhus Cholera Typhoid

are commonly administered.

2. What are vaccines? How are they administered? Are all vaccines given by injection?

3. Virus and bacteria that may cause diseases are known as *pathogens*. You need to know about these pathogens before you can discuss the role of vaccination in immunisation. Discuss how vaccination works — how it helps the body in guarding against diseases.

4. Table 3.1 lists the different types of vaccines used for prevention of infectious diseases. On the basis of the table, and using what you may have learnt in school biology, write a paragraph on what constitutes a vaccine.

5. Can vaccines be made of certain components from the pathogen? Which components are these?

6. As early as the 18th century, India already had a rich tradition in medicine, including ideas about vaccination. Read about some of these in books dealing with History of Science in India.

   Find out the following information about vaccines. You could read about them or ask a person from an institution that makes or markets vaccines.

(a) Who laid the scientific foundations of immunisation? When was this?

(b) How are vaccines made?

(c) What are the different stages in vaccine research?

(d) How difficult or easy is the process of making vaccines?

(e) How long does it take for a vaccine to reach the market place after it has been conceived in a laboratory?

7. Are the effects of the vaccination long lasting or do they vary for individual vaccines? Do living and attenuated vaccines have advantage over other vaccines?

8. What is the significance of a *booster* dose of a vaccine? Which vaccines need boosters? Visit a paediatric clinic and find out about these. Discuss your findings in class.

9. Discuss the risks involved in using vaccines made of live virus or live bacteria. What do you think is meant by attenuated, inactivated or crippled virus or bacteria?

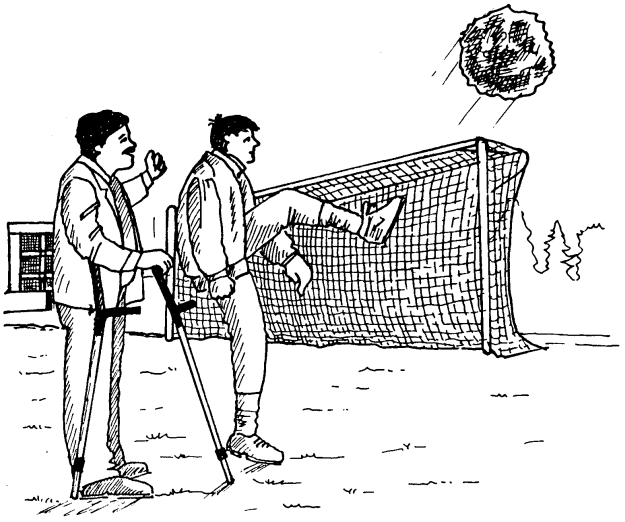
10. List all words that start with the syllable *tox*. Find their meanings. List all words that end in the syllable *oid*. What might a *toxoid* be? Why are toxoids used in making certain vaccines?

At the global level, a **Children's Vaccine Initiative** (**CVI**) was established in 1991 to attempt to save millions of children dying due to infectious diseases. It is co-sponsored by the United Nation's Children Fund (UNICEF), the United Nation's Development Programme (UNDP), the World Bank, the World Health Organisation (WHO) and the Rockefeller Foundation. The CVI is a coalition of international agencies, national governments, and NGOs. It aims to promote, co-ordinate and accelerate the development and introduction of new vaccines. The objective is to enhance the protection of the world's children against infectious diseases.

3.1.1 Kick polio campaign

India has embarked on an ambitious target of eradicating polio by 2000 AD. An equivalent of this campaign launched in Sub-Saharan Africa is

Figure 3.1: The **Kick Polio** campaign.



known as **Kick Polio**. Figure 3.1 is an adaptation of the campaign advertisement in Africa. You may recall several campaigns like this in your local communities.

1. List all the ideas you have about polio, the associated pathogen, and the effects of the disease on persons, their families and the society.
2. Describe what the *ball* means in Figure 3.1. Could the ball have something to do with the shape of the polio virus? Find out which viruses are round in shape.
3. How is polio transmitted? Ask your neighbourhood doctor to talk to you about polio.
4. One of the key factors in the success of any vaccination programme is the easy availability of the vaccine. What are the other key factors in the success of any vaccination programme?
5. Like any other public health programme, vaccination programmes are also beset with problems. And one of the challenges, especially in India and other developing countries, is to maintain the viability/effectiveness of vaccines when they are administered. This necessitates keeping them at low temperatures, often called as “maintaining the vaccine cold chain”.

Explain the principle behind the cold chain. Why is it necessary to keep vaccine stocks at reasonable distances from places where they are to be used? Suggest how a cold chain can be broken? This activity could be an exercise in lateral thinking. This is how you might go about it.

(a) List individually all possible ways in which vaccines, preserved in cold condition, can be made available to all parts of the country, including the remotest villages. Do not judge your methods either in terms of its cost or its applicability. Be as innovative as you can.

(b) Pool all the suggestions made in the class. Make the list as long as possible by combining ideas. Do not make judgements even at this stage.

(c) Discuss each idea in terms of its practicability and cost. Give credit for those methods that are energy efficient, those which use renewable sources and serve the needs of the remotest villages or places in difficult terrain.

(d) Form groups of 5 to 6 members. Each group should make a poster, write a report or make a model illustrating the best possible way to reach vaccines to all parts of India.

6. What is the role of bureaucracy and community in sustaining an immunisation programme. Talk to a local doctor about the immunisation programme in your area. Interview her about the obstacles to immunisation programme. Be a volunteer during the next immunisation programme in your locality. Write an essay describing your experiences.

7. Do you think the African name of the campaign is appropriate? Each of you should coin an inspiring title for a similar campaign in India.

The first two rounds of the 'Polio Eradication Programme ' in India conducted in 1998 were largely successful. This should make it possible to eradicate the disease by 2000 AD in India. Yet, there are questions that remain about the access to polio vaccines, its effectiveness and shelf life.

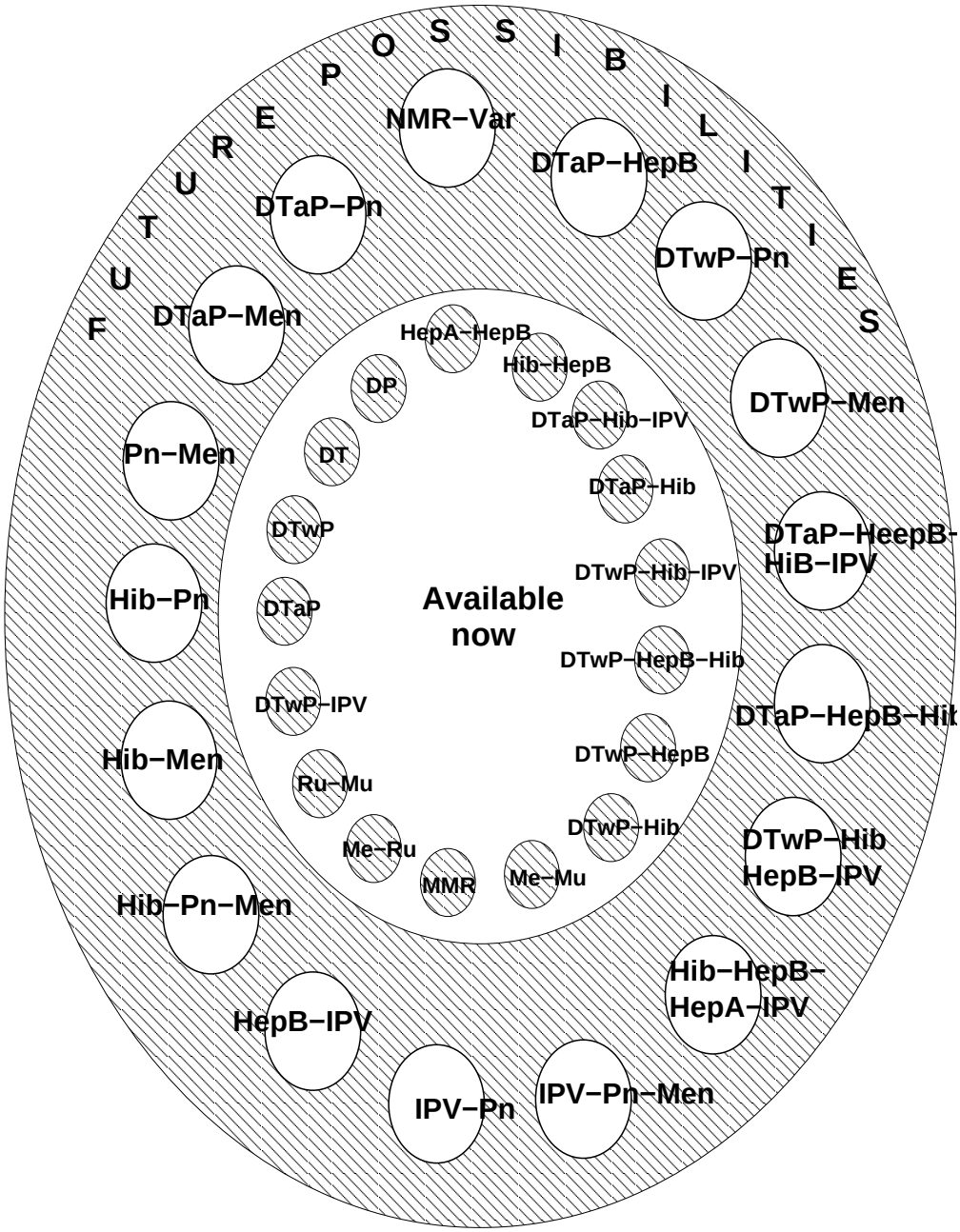
3.2 Combination vaccines

Immunologists have come a long way in the production of a variety of vaccines. From the first smallpox vaccine, nearly 200 years ago, we now have 27 vaccines in 1998. And, over 200 more are either in the research stage or in some stage of development. Nor are all these 200 single shot vaccines; they are combination vaccines. That is, each of these vaccines may carry antigens for several diseases. Thus, with one single dose (either in the form of an injection or an oral dose), they can provide immunity for several diseases.

Figure 3.2 shows the vaccines which are available in the global market at present (inner ring) and gives an indication of the vaccines of the future (outer ring). [14] In this section you will revisit all the diseases and their vaccines that you have discussed so far in this chapter and relate them to the wide variety of combination vaccines that are either available or are a future possibility.

1. List all the acronyms used in Figure 3.2, and write down their full form. You may have to refer some microbiology textbook or ask a teacher.
2. Vaccines in Figure 3.2 are for a combination of diseases. What will be the status of different antigens, say of differing microbial origins, in a combination? Will they be immunologically compatible and work in recipients as safely, consistently and effectively as in stand-alone vaccines? Discuss the pros and cons of using combination vaccines.
3. Which combination vaccines are used in India, for children's immunisation programme? Which of these have you heard of in your town? In a standard immunisation schedule in your town or area, roughly, how many vaccines are given?
4. How do you think the use of different vaccines is decided in a community or in a country?
5. Side-effects due to a vaccine sometimes becomes a reason for discontinuing it. List all the possible reasons for which a vaccination programme may be discontinued. Is the small pox vaccine still given in India? Carry out some literature search on the history of small pox.

Figure 3.2: Combination vaccines: those available now and some future possibilities.



6. The abbreviations in the figure contain small case letters *a* and *w*. These refer to *acellular* and *whole cell*. What do you think these terms mean? In what way do they describe the vaccine?

There are obvious advantages in the use of combination vaccines. But there are several unanswered questions too, in their manufacture and use. In this multi-billion rupee transactions, involving basic research, on one hand, and strong market forces, on the other hand, more work is yet to be done for perfect harmonization. But one direction in which combinations are moving is towards so-called Syndromic Vaccines against groups of **related** diseases. This is specially relevant for several diarrhoeal diseases which plague millions of people all over the world.

Though the overall cost of vaccination programmes may appear to be high, the benefits far exceed the cost in the long term. Humanity has turned around its fortunes in its fight against several diseases, specially infectious diseases, with vaccination playing an important role. Vaccination programmes are getting increased public support due to new emerging diseases and the rise of antibiotic resistance.

3.2.1 Indian vaccination initiatives

India has sufficient facilities in the country and the required trained personnel to carry out vaccine research. How does the country fare today with respect to producing enough vaccines for her people's needs? You will discuss the issues involved in this section.

1. What is the role of basic science in vaccine development? Where does India stand regarding research in the fields of micro-biology, immunology, molecular biology, areas which highly impinge on vaccine research and production?
2. Do you know of any vaccine manufacturing units in India? Are there any institutes devoted to vaccine research in India? Find out more about these units. How many vaccines are developed or manufactured in India?
3. Table 3.2 gives the names of different institutions in the country working on different vaccines. [11] It also gives the current state

of vaccine research in these places. Are all the diseases that afflict Indians covered in the research programmes of the institutes given in the list? Do you think they should? Which factors determine the inclusion of a disease in research programmes?

4. Study the locations of the different institutions and mark them on a map of India. Find out more about these institutions: when they were started, for what purpose, and so on.

5. There is an institution called the Haffkine Institute at Parel, in central Mumbai. How do you think the Institute gets its name and when was it established? Which vaccines are produced at Haffkine today? Find out more about this Institute and discuss the evolution of its activities in your class.

6. You have discussed that vaccine research involves several stages. Some of these stages are mentioned in the table. Which of the vaccines are closer to actual use.

7. You have realised by now that not all vaccines are developed in the country. Thus the country may be needed to import vaccines. What should be the criteria for importing vaccines?

Molecular biology and the science of immunology have provided incredible amount of information about diseases in the last 10 years. There is a good understanding about the molecular structure of several infecting pathogens and the host cells. The genes of many pathogens and other micro-organisms are being rapidly sequenced even as you turn this page. All this knowledge is being used for the manufacture of newer generations of vaccines, which would be more efficient, and possibly safer, than the current ones in providing protection against infectious diseases.[1]

[1]Dengue, Malaria, Measles, Mumps, Smallpox, Chickenpox, Meningitis, German measles and Diphtheria.

Table 3.2: Current status of research and development of vaccines in India

Vaccine	**Institute**	**Current Status**
β hcg-TT	National Institute of Immunology (NII), New Delhi	Phase II clinical trials
Leprosy M.W.	NII, New Delhi	Phase III clinical trials
Leprosy ICRC bacillus	Foundation for Medical Research, Mumbai	Completed animal studies
O-FSH based male contraceptive	I.I.Sc., Bangalore	Phase I clinical trials
Hepatitis B	NII, New Delhi	R&D
Hepatitis C	NII and AIIMS, New Delhi; IISc, Bangalore; CDRI, Lucknow	R&D
Tuberculosis	Delhi Univ. and NII, New Delhi; IISc, Bangalore; CDRI, Lucknow	R&D
Typhoid	CMC, Vellore	R&D
ETEC	NICED, Calcutta	R&D
Polio	CMC, Vellore	R&D
Rota virus (diarrhoea)	AIIMS, New Delhi; IISc, Bangalore	R&D
Malaria	CDRI, Lucknow	R&D
Rabies	PI, Coonoor; CRI, Kasauli	R&D to develop vero cell culture technology

Chapter 4

Nutrition

In the last chapter, you realised that there was a high incidence of different infectious and non-infectious diseases in the country. The infectious diseases were preventable, many by vaccination. They worsen both in incidence and intensity, especially among children and women, when proper nutrition is not available. The non-availability of nutrition may be due to a variety of factors. This and related topics are the issue for discussion in this chapter.
It is also important for each of you to connect the food you eat with your health status. You should be able to detect symptoms of deficiency and take corrective measures or consult a physician, dietician or nutritionist, when necessary.

4.1 Food for an active life

Energy is needed for the body to function and be active. The body derives energy from carbohydrates, fat, protein, and alcohol in the diet. Experiments show that exactly the same amount of energy is released from, say wheat when it is eaten by humans as when it is used for fuel in a railway engine. In this section you will calculate the energy provided by the different constituents in your daily diet. [15]

4.1.1 Metabolic rates and energy needs

A certain amount of energy is required for breathing, the heartbeat, the maintenance of body temperature, and other involuntary activities includ-

Table 4.1: Equations for calculating BMR for the two sexes and different age groups.

Sex	**Age group**	**BMR, kcals/day** $W = body\ weight\ in\ kg$
Females	Infants	$56W$
	10 - 17 years	$BMR = 13.4W + 692$
	18 - 29 years	$BMR = 14.8W + 487$
	30 - 59 years	$BMR = 8.3W + 846$
	Over 60 years	$BMR = 9.1W + 659$
Males	Infants	$56W$
	10 - 17 years	$BMR = 17.7W + 657$
	18 - 29 years	$BMR = 15.1W + 692$
	30 - 59 years	$BMR = 11.5W + 873$
	Over 60 years	$BMR = 11.7W + 588$

ing brain functions. This is known as the **basal metabolic rate** or **BMR**. The BMR varies with age, sex and body weight. Climate differences do not affect BMR as much as individual differences do. Average values of BMR for the two sexes in different age groups can be estimated in kilocalories (Food Calories) in terms of the body weight in kilograms, using the equations given in Table 4.1.

1. Using the equations in Table 4.1 calculate the BMR for every member of your family. You will need to know the weight of each person.

2. What other factors do you need to consider while estimating the food needs of each person?

3. The degree of physical activity of a person is difficult to assess. The energy consumed in an activity varies with sex, body weight and age. One way to simplify the calculations is to associate a *physical activity ratio* or **PAR** with each activity. The PAR is defined as,

$$PAR = \frac{the\ energy\ cost\ of\ activity\ per\ minute}{BMR\ per\ minute}$$

   For instance, if the PAR for resting and watching TV is 1.2, watching TV for 2 hours would cost a 20 year old male weighing 60 kg, that is, $1.2 \times 1598(BMR\ for\ 24\ hours) \times 2/24 = 159.8 \approx 160\ kcals$.

Table 4.2: Physical activity ratios for some daily activities.

Activity	**PAR**
Sleep	1.0
Sitting, reading, watching TV	1.2
Sitting and working (in the office, class, etc.)	1.4
Commuting (without too much exertion)	1.7
Standing, slow walking	1.8
Light domestic chores	2.2
Moderate work	2.3
Washing (manual), mopping	2.5
Light gardening	3.5
Heavy work	4.0
A game of tennis (or squash) or equivalent	7.5

Table 4.2 gives the PAR of some of the common daily activities. [15] Estimate your total energy requirements for an average day. Carry out this exercise for other members of your family.

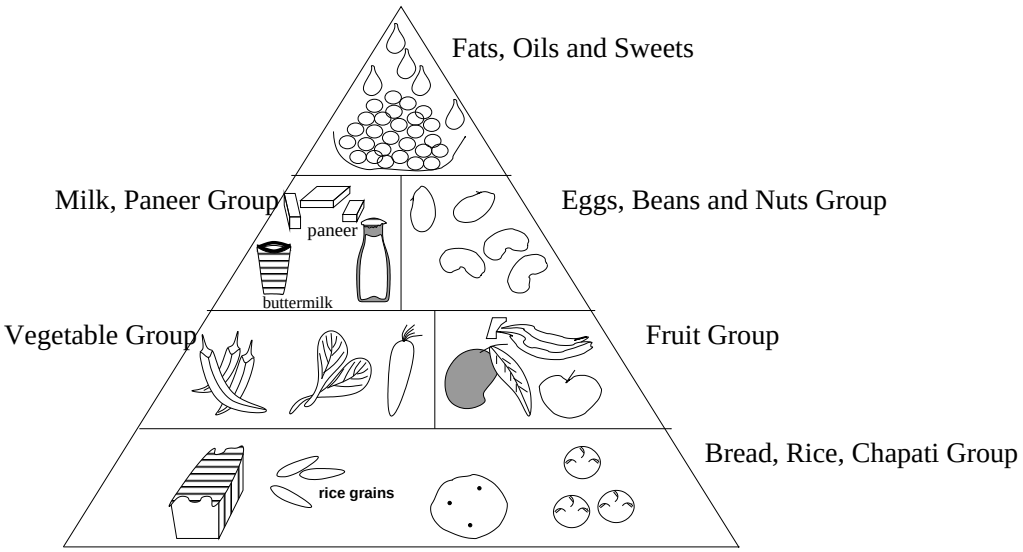
4. How should your estimated energy requirements reflect in the amount and type of food consumed by you?

4.2 Know your food

The type of food consumed by your family depends on several factors. Besides your economic capacity to buy food and awareness about the right mix of food for a balanced diet, you are also greatly influenced by several social and personal factors. Among such factors are life-style, exposure and adaptability to different food varieties, conventions and traditions and personal tastes. Here you will analyse the food you consume for its constituents.

Figure 4.1 shows a pyramid in which the major food nutrients have been indicated in horizontal slabs. [22] This pyramid, though connected with food, is very different indeed from the energy, food and trophic level pyramids involving different organisms that you discussed in the book in this series titled *Ecological Balances*.

Figure 4.1: The food guide pyramid.



1. Why do you think the nutrients are ordered in a specific way in Figure 4.1, with a base of carbohydrates, and sugars at the apex?

2. Each of you draw a pyramid and fill up the slabs at different levels with food items consumed by you. Preferably, you could draw the food items (or an icon for it).

3. Discuss the pyramids drawn by all members in your class. After a discussion, select a list of food items to be represented in each slab.

4. Does your list represent the variety of food items in each category available or used in the different regions of India, and for rural and urban areas? Does it include food items from other parts of the world? Choose a representative country, say one each from the developed and developing economies, preferably from different biomes of the world. Draw food pyramids for each of these countries.

5. Repeat the exercise for different States in India. Choose the States so as to include the different food items characteristic of the geographical and climatic regions. Form groups of five members each. Each group should draw two pyramids for a State or region, indicating urban and rural food items. How did your pyramids differ?

Table 4.3: Approximate amounts of carbohydrates, fat, protein and iron in 100 gm edible portions of some foods.

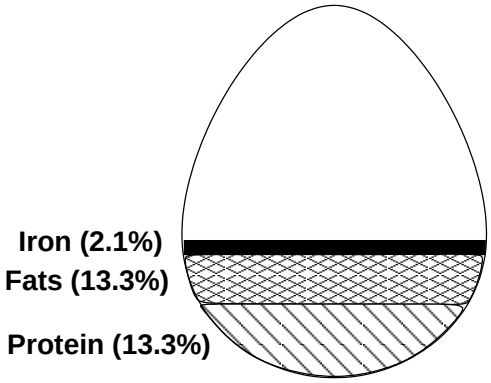
Food item	**Carbo.** gms.	**Fats** gms.	**Prot.** gms.	**Iron** mg.
Rice (raw, milled)	78.2	0.5	6.8	0.7
Rice (parboiled, hand pounded)	77.4	0.6	8.5	2.8
Wheat (flour, whole)	69.4	1.7	12.1	4.9
Wheat (flour, maida)	73.9	0.9	11	2.7
Bread (white)	51.9	0.7	7.8	1.1
Bread (whole wheat)	49	1.4	8.8	2.2
Black gram (udad)	59.6	1.4	24.0	3.8
Rajmah	60.6	1.3	22.9	5.1
Red gram (tuver)	57.6	1.7	22.3	2.7
Milk (buffalo)	5.0	6.5	4.3	0.2
Milk (cow)	4.4	4.1	3.2	0.2
Milk (skimmed)	4.6	0.1	2.5	0.2
Paneer	7.9	23	13.4	0
Khoa (buffalo, whole)	20.5	31.2	14.6	5.8
Butter	0	81	0	0
Ghee, cooking oils	0	100	0	0
Egg (hen)	0	13.3	13.3	2.1
Meat (goat)	0	3.6	21.4	0
Meat (mutton)	0	13.3	18.5	2.5
Fowl	0	0.6	25.9	0
Fish (hilsa)	2.9	19.4	21.8	2.1
Fish (pomfret)	1.8	1.3	17	0.9

6. Will the pyramid be different for you, your parents, your grandparents and your baby siblings and cousins? In what ways?

7. Proteins are made of smaller units called amino acids. Your body needs 20 kinds of amino acids. No single food item, even the protein-rich ones, contains all of these 20 amino acids. In what ways will you ensure that your body receives all the amino acids?

8. Table 4.3 gives the approximate amounts of carbohydrates, fat, protein and iron in 100 gm edible portions of some food items. [7] In this section you will use this table to analyse your daily intake of nutrients and energy. You may then compare this to your daily requirements calculated in the earlier section.

Figure 4.2: The proportions, in % by weight of carbohydrates, fat, protein and iron in the edible portion of a hen egg.



The nutrition content of egg (given in Table 4.3 is represented in Figure 4.2. Represent the nutrition content of paneer, chapatti, milk and cooking oil in the form of similar pictures.

9. List the name and quantity of each food item consumed by you on a typical day. It may be an average one, or one that you most remember. Estimate the calories, proteins, fats and iron in your diet on that day. Compare your values with the daily requirement of energy that you have calculated in the last section. Also compare and discuss your findings with other members in the class. You may want to form small groups where you can discuss easily.

10. Who needs more paneer: adults or young children? Obesity is less of a problem in India than in many industrial countries. Would you say that obesity is a problem among children in a school in your area? Suggest the possible causes of obesity among school-going children. Which foods must be avoided by obese children?

11. Does your school serve any food items? Do you know of any school, either in your town or elsewhere, where food is served? Which foods given in the food pyramid or in Table 4.3 are included in such school menus? Suggest some measures that schools can take up to improve the nutritional standards of its students. Discuss your suggestions in the class.

12. Do you know of any State which provides a full meal to its school-going children? Plan a menu for that State to follow. Include criteria

Table 4.4: Average intake of nutrients per consumer unit per day (1988-89) and recommended daily allowances in India.

Nutrient	RDA	AVE
Protein (g)	55.0	64.3
Calories (kcal)	2400	2419
Calcium (mg)	450	555
Iron (mg)	24.0	30.0
Vitamin A (μg)	750	352
Thiamin (mg)	1.20	1.53
Riboflavin (mg)	1.40	0.96
Niacin (mg)	16.0	16.2
Vitamin C (mg)	40	42

like nutrition value, suitability for growing children, variety and the low cost. Will the programme run better if there is a kitchen attached to the school?

4.2.1 Major and minor nutrients

Table 4.4 shows the average daily consumption of different types of food and average daily nutrient intake (**AVE**). It also shows the *Recommended Daily Allowance* (**RDA**) for a balanced diet by the National Nutrition Monitoring Bureau. [4]

1. Suppose you carried out a survey of consumption patterns of nutrients in an area comprising the very rich as well as the very poor. Would your average values of consumption depict the actual situation in the area? Discuss this in the context of the table.

2. In groups of 3 to 4 members, preferably belonging to the same cultural and socio-economic background, draw up a daily menu containing all nutrients that your mother could use. Keep in mind the cost factor too. You may use the following information that has been presented to you so far. Use it more as a rough guide and not as exact prescriptions.

(a) Table 4.3 for information about nutrient content in different types of food items.

(b) The pyramid in Figure 4.1 for the approximate amount of the food item to include.

(c) The second column on recommended daily allowance (**RDA**) of each nutrient given in Table 4.4 to guide you about what quantity of each nutrient to include in your menu.

3. Discuss the similarities and differences between the menus made by different groups in the class.

In Table 4.4, besides the major nutrients such as proteins, you must have noticed the inclusion of vitamin A, thiamin, riboflavin, niacin, and vitamin C. These are the micro-nutrients. As the name suggests, they are needed in small amounts in the body to carry out vital functions. Nutrition, like several other health aspects, is highly complex and multi-dimensional. Cultural factors can greatly affect the nutritional status of people.

4.3 Malnutrition

Malnutrition arises when either of the following conditions occur over prolonged periods: **Under-nutrition** when a person is deficient in one or more nutrients or energy-providing foods; and **Over-nutrition**, when an individual receives excess of one or more nutrients or energy-providing foods.

4.3.1 The Asian and African scenarios

Table 4.5 shows the percentage of children under 5 years of age who are malnourished in different countries in the continents of Africa and Asia. [2] Study the table and discuss the issues raised below.

1. Locate the countries mentioned in Table 4.5 on a copy of the world map. Mark in the map the location of the Sahara, the Thar and the Gobi deserts. Discuss your ideas, explaining the possible relations between the location of deserts and malnutrition among children.

Table 4.5: The percentage of malnourished children under 5 years age in Asia and Africa.

Country	**% mal--nourished**	**GNP PC, USD 1995**	**Females in Prim.Ed.**
Africa			
S. Africa	9	3160	—
Kenya	23	280	95
Zambia	25	400	91
Tanzania	29	120	98
Nigeria	36	260	76
Ethiopia	48	100	64
Asia			
Mongolia	12	310	—
China	16	620	86
Sri Lanka	38	700	93
Pakistan	40	460	52
India	53	340	71
Bangladesh	67	240	81

Note: GNP PC, USD — Per capita GNP in US dollars;
Females in Prim.Ed. — Females in primary education per 100 males.

2. Study the per capita GNP for the countries in the table. Do you think poverty is a major reason for malnutrition? Discuss.

3. In which of the listed countries is malnourishment among children most serious? Give possible reasons for this. Use arguments relating to geography, history and world politics. Support your arguments as far as you can with published information and numbers. Does the educational status of the mother affect birth weight?

4. In the light of your discussion so far comparing the nutritional status of children in Asia and Africa, discuss India's situation.

5. Mahtab Bamji, an eminent Indian nutritionist says, "*Malnutrition begins in the womb and ends in the tomb, and throughout the long distance between the womb and the tomb, nutrition is the key component.*" [2] Organise an elocution competition on the topic: **Malnutrition begins in the womb and ends in the tomb**.

Table 4.6: Direct and indirect contributions of malnutrition to the global burden of disease in millions of DALY lost in 1990.

Type of mal--nutrition	**S.Saharan Africa**	**India**	**China**	**FSC**	**MDC**	**World**
Direct effects						
Protein-energy malnutrition	2.2	5.6	1.7	0.2	0.2	12.7
Vitamin A deficiency	2.2	4.1	1.0	0.0	0.0	11.8
Iodine deficiency	1.7	1.4	1.0	0.0	0.0	7.2
Anaemia	1.0	4.5	2.7	0.4	0.6	14
Total direct	7.0	15.5	6.3	0.6	0.9	45.7
Indirect effects minimum estimates						
Mortality from other diseases attributed to mild or moderate under-weight	23.6	14.9	3.3	0.0	0.0	60.4
Mortality from other diseases attributed to Vitamin A deficiency	13.4	14.0	1.0	0.0	0.0	39.1

4.3.2 Micro-nutrients and DALY loss

What would happen if your food intake were deficient in one or more of the micro-nutrients? You will discuss this in this section in terms of DALY loss. Recollect the definition of DALY given in Chapter 2, Section 2.5.4.

1. List some micronutrients and the diseases due to their deficiency in your diet. How would you recognise if your diet was deficient in vitamin A, iodine or iron? What are the signs, symptoms and clinical effects of these deficiencies?

2. Table 4.6 gives a global comparison of disease burden due to malnutrition. [9] The disease burden is expressed in terms of millions of DALY loss. Direct and indirect effects of different types of malnutrition have been considered.

   Globally, how many million DALYs are lost due to the four types of

malnutrition listed in Table 4.6? Compare this to the DALY loss that you have studied earlier (Chapter 2, Section 2.5.4) for communicable diseases.

3. What is India's share in global DALY loss due to deficiency of micro-nutrients? Express this in terms of percentage of the world. In what way will this affect the productivity of the country? Do a similar analysis for China. How does India compare with China?

4. The Central Government had planned to introduce a law that all salt sold in the country should be iodised. However, several groups of people opposed such a law. What is the necessity for introduction of iodised salt in the country? What problems would it address?

5. Why are people in certain regions of the country more prone to iodine deficiency? In that case should all the people in the entire country be forced to buy only iodised salt? Justify your stand with medical and social arguments.

6. Vitamin A deficiency is a major reason for blindness in India. Find out the food items rich in vitamin A. Read the labels of some edible oils available in your shops. List those edible oil brands that claim to include Vitamin A? Discuss in your class the cost-effectiveness of this measure.

7. Table 4.6 is not exhaustive: it does not include the health damage from deficiencies of other micro-nutrients, such as calcium. What would happen if your diet were deficient in calcium? At what stages in your life do you require calcium?

8. Find out more about the following: periodontal diseases, bad teeth, brittle bones and osteoporosis. Why do these problems arise? Is one sex more prone to these problems than the other? If so, which one, and why?

Both malnutrition and communicable diseases go hand-in-hand and are often termed as the **malnutrition-infection complex**. In fact, you can also trace several non-communicable diseases to wrong food habits or malnutrition. But here the correlation is not as easy to make out.

4.3.3 Micro-nutrient deficiency among children

Effects of malnutrition in childhood persist into adulthood. For instance, malnutrition affects motor development (manipulating objects) as well as learning and understanding abilities of children.

Several studies, especially in developing countries, have begun to reveal how malnutrition in early childhood and in pregnant women can lead to iron deficiency and overall slowdown of growth of the child, which, in turn, can affect learning. [3] In the long run, this implies decreased job opportunities for the affected and resultant economic slowdown of a society.

The three graphs (arranged vertically) in Figure 4.3 indicate the effects of malnourishment on cognition and classroom attention. The activities below will help you assimilate the information given in the figures. Using this information and gathering some of your own, you should be able to discuss in greater detail the effects of nutritional status on the health of children and adults.

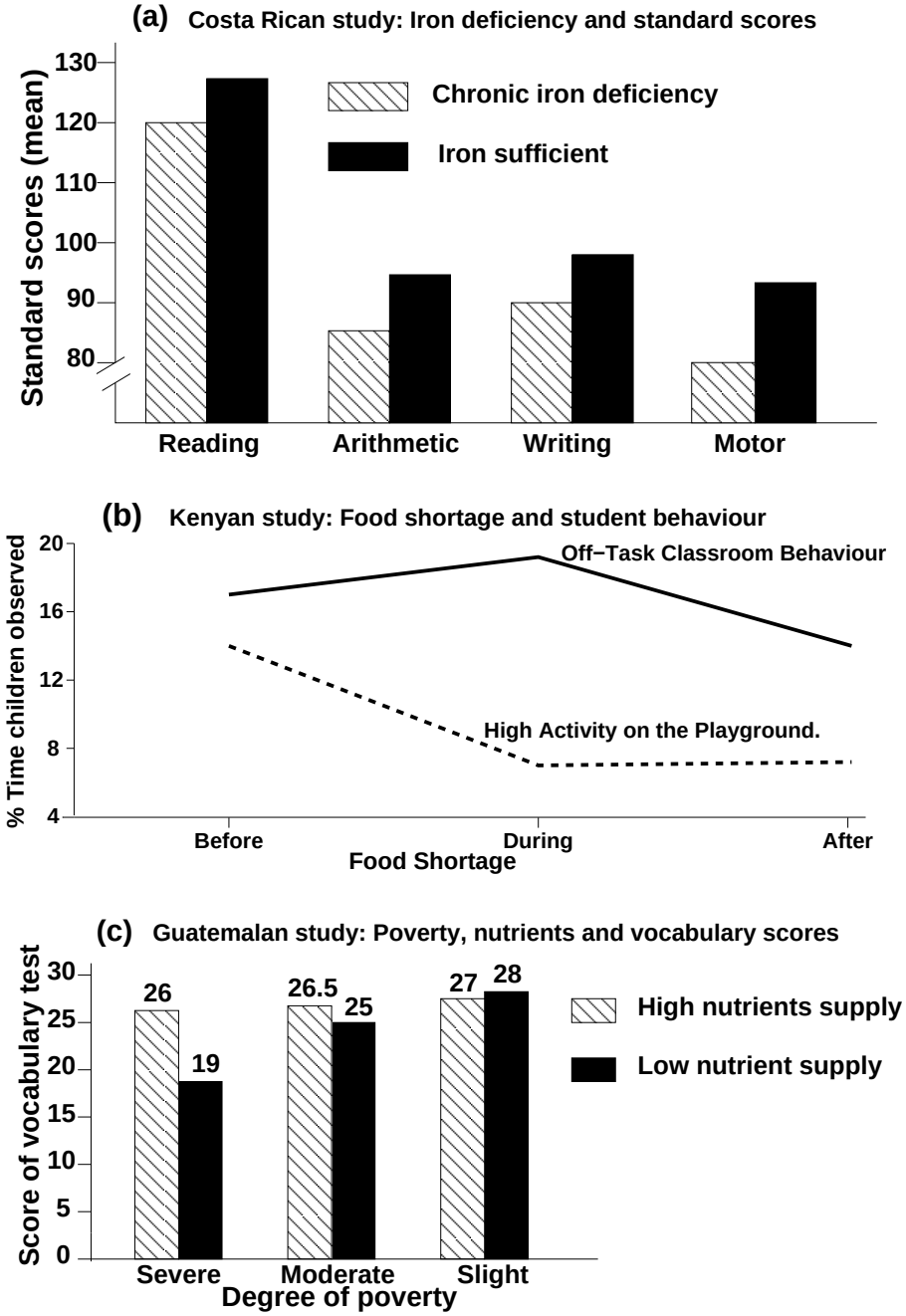
1. Study the graph in Figure 4.3 (a). In this figure, the cognitive abilities are measured among adolescents in Costa Rica through standard tests [1] under four different heads. Infants and young children were studied over a long period (15-17 years) in the 1980's to determine how providing nutrition at a younger age affects the information processing at adolescence. Where is this country located in the world?

   According to the figure, to what extent are the different learning abilities at adolescence affected by chronic iron deficiency in infanthood? Find the percentage increases in the different abilities when iron inputs are sufficient. Describe the ability in which there is a marked change with adequate iron inputs. What does this graph suggest about the development of different abilities at different times?

2. You have learnt in school that iron is important for synthesis of haemoglobin in your blood. However, iron also plays an important role in the synthesis of myelin, the covering of a nerve fibre. This, in turn, affects nerve conduction. What role do you think iron will

[1] Reading and arithmetic are tested by the Wide Range Achievement Tests; Writing test is the Wechsler Individual achievement Test; and motor test is the Bruininks-Oseretsky Test of motor proficiency.

Figure 4.3: Three studies on effects of malnourishment on cognition and classroom attention.



have in the development of different cognitive (learning) abilities in children?

3. In a study in Kenya, in 1984, the behaviour of children was observed in their class room and on the playground. A high off-task classroom behaviour indicated that the students were distracted from the task in the class. Figure 4.3 (b) shows how food shortage affected school children's classroom behaviour and activity.

   How are the classroom behaviours different before, during and after food shortage? Recollect your school days. How often were you distracted? Did your distraction have anything to do with hunger? Do you think a good breakfast would help you concentrate better on the tasks you take up.

4. Before the food shortage, children showed a high level of activity (over 12%) on the playground. What happened during the food shortage? Why do you think the activity level remained low even after the food shortage was over?

5. Form groups of 4 to 5 members. Each group should monitor students on a playground in a school in your vicinity. Note down the time spent on the playground by, say, a particular class of students in a week. Collect this data for a few months. Discuss the data obtained by different groups in the class. Were there differences? Could the differences be related to the socioeconomic background of the students? Could there have been other factors that affected the time spent by students in activity on the playground?

6. In the 1980s, a group of Guatemalan mothers, infants and young children were taken up for an interesting long term study. Scientists wanted to determine how the information processing during adolescence might differ when different levels of nutrition was provided at a younger age. The study subjects were divided into two subgroups. One subgroup was given a high nutrition food supplement, while the other was given a low nutrition food supplement. They were not told of the difference. When the infants and young children reached their teens, they were given several tests related to vocabulary and information processing. Figure 4.3 (c) shows how the two factors — the degree of poverty and supplementation of diet in childhood — affected the vocabulary scores of adolescents. Locate Guatemala in a world map. Read about the common history of Costa Rica and Guatemala.

7. Note the variations in the vocabulary scores for students who have been given a high nutrient supply. Does it vary with the degree of poverty? How does the score vary with poverty levels when infants have been given low nutrient supplements? What does this suggest in terms of the effect of nutrient supplements given during infancy? Comment on how this relates to the issue of providing meals to school students?

8. Is the effect of nutrient supply on vocabulary scores equally pronounced in all degrees of poverty? Give possible reasons for the different effects.

9. According to you, what are the implications of the three studies that you have discussed here for the majority of children in our country?

Malnutrition and micro-nutrient deficiency have several effects, often not easily noticeable, on young children. And these have serious repercussions in adulthood.

4.4 Malnutrition in Indian States

Table 4.7 shows the percentage of infants between 6 and 9 months in a few States of India who have been fed on food other than mother's milk alone. This parameter, known as *complimentary feeding* (**CF**), may be used as a rough measure of nutrition for infants. **CMR** in the table refers to the number of deaths among children under five years of age for 1000 live births. The table also gives total adult literacy rates (% adults who are literate). [2] The different states shown in Table 4.7 were selected because of the availability of data through the surveys carried out by the National Nutrition Monitoring Bureau of the Indian Council of Medical Research.

1. Make a scatter plot of complimentary feeding (CF) against child mortality rates (CMR). Is there a relation between the two?

2. Look at the numbers in the column on complimentary feeding (CF). Here babies are fed extra top food, such as rice, dal, vegetables, in addition to breast feeding by the mother. In what way do you think this influences child mortality?

Table 4.7: Complimentary feeding, total literacy rates and child mortality for a few States in India.

State	CF % fed	Literacy, %	CMR per 1000
Kerala	69	90.6	32
Tamil Nadu	57	63.7	87
Maharashtra	25	63	70
A.P.	60.7	45.1	91
Karnataka	38	55.9	87
Gujarat	23	60.9	104
M.P.	28	43.4	130
Orissa	30	48.5	131

3. How would you explain the values of complimentary feeding and infant mortality for Maharashtra? What other factors may affect the relation between the two?

4. Make a scatter plot of complimentary feeding (CF) against literacy rates. Is there a relation between the two? Analyse the relations between CF, CMR and literacy.

5. Discuss the States that you think fare the best with regard to CMR. What factors must have contributed to their low CMR? On similar lines discuss the States faring the worst in the list given.

This discussion should make it clear that complimentary feeding can have a dramatic effect on survival of children under 5 years. However, it also seems to depend on other factors.

4.5 Symptoms of malnutrition

How healthy you are greatly depends on your nutrition intake. Good health demands an adequate intake of all major nutrients — macro and micro nutrients. You already have a fair idea of what constitutes a balanced diet from your school biology and from your activities in Section 4.2.

Table 4.8 gives two nutritional parameters recorded in six countries: [9]

Table 4.8: The prevalence of stunting among children between 2 and 5 years and anaemia among pregnant women in some regions of the World.

Region or country	**Stunting**	**Anaemia**
Sub-Saharan Africa	39	41
India	65	88
Pakistan	50	57
Bangladesh	65	51
China	41	25
Vietnam	49	—
Latin America / Caribbean	26	35
USA	2	17

Stunting Stunting is defined as low height for age. The data given are for children observed between ages of 2 and 5 years. This is given in terms of percentage of children in that age group who are stunted.

Anaemia Prevalence of anaemia among pregnant women. This is given as the percentage of pregnant women who have been tested to be anaemic. Women are said to be anaemic when the blood haemoglobin is below the WHO norm of 110 gms per litre.

The countries listed in the table are chosen from among India's neighbours, and those which have either made great efforts in the recent past (Vietnam, Latin America) or those which have a long way to go in many economic and other health aspects (Sub-Saharan Africa).

1. Is stunting among children the only visible sign of malnutrition? Suggest other possible symptoms of a malnourished child. How would you proceed to determine whether a population of children is stunted or not? To what extent do your genetic make-up and your food intake determine your height? Discuss this based on information collected from your library on this issue.

2. From among the regions and countries given in Table 4.8, which country records the highest prevalence of both stunting among infants and anaemia in pregnant women? Why do you think this is so? Link your analysis with women's status. Use other parameters that may give a relative measure of women's status.

3. Stunted children are often also under weight, that is, have lower weight than what is considered normal for their age. This is referred to as *wasting*. List the possible exception to this rule.

4. List all the possible reasons for stunted growth among children. Include food, social and economic reasons. Compare the different countries listed.

5. According to the information in Table 4.8, is there a correlation between anaemia among pregnant women and stunted growth in young infants? Argue that such a correlation need not always mean that one causes another (a causal relation). Under what conditions would anaemia among pregnant women lead to stunted growth among children? Note the values for stunting and anaemia in Sub-Saharan Africa. Discuss why they are lower than many other countries listed here.

6. Do you believe that children in India have a poorer growth than children of developed countries? What data would you refer and quote in support of your stand? On the basis of your discussions so far, list the possible reasons for the poor growth of children in India.

7. What are the reasons for high prevalence of anaemia recorded among pregnant women in India? Include food, social and economic reasons. Compare the different countries listed. If you were to test all categories of women, say above the age of 15 years, would you find the same result as for pregnant women?

These activities highlight the importance of proper nutrition for health, in terms of quality and quantity. Not realised by many, the effects of malnutrition can be quite severe, affecting different cognitive abilities too. Besides, these disabilities cannot be rectified later in life. In turn, this affects growing adults, affecting their chances of a healthy life and survival, and the productivity of a nation.

Chapter 5

New challenges

What is the health scene going to be like in the 21st century? This question has been debated in several national and international fora. It elicits different responses: some bright and some bleak. While the communicable diseases may recede everywhere in the world to varying extents, several new health challenges lie ahead. You will examine some of these new challenges in greater detail in this chapter. How these health challenges will affect you will depend on trends and interactions in four main areas: population growth, urbanisation, environmental degradation and poverty.

1. What new health problems does the collage in Figure 5.1 suggest? Discuss the ideas in your class. Are the different challenges suggested by the figure related in any way?

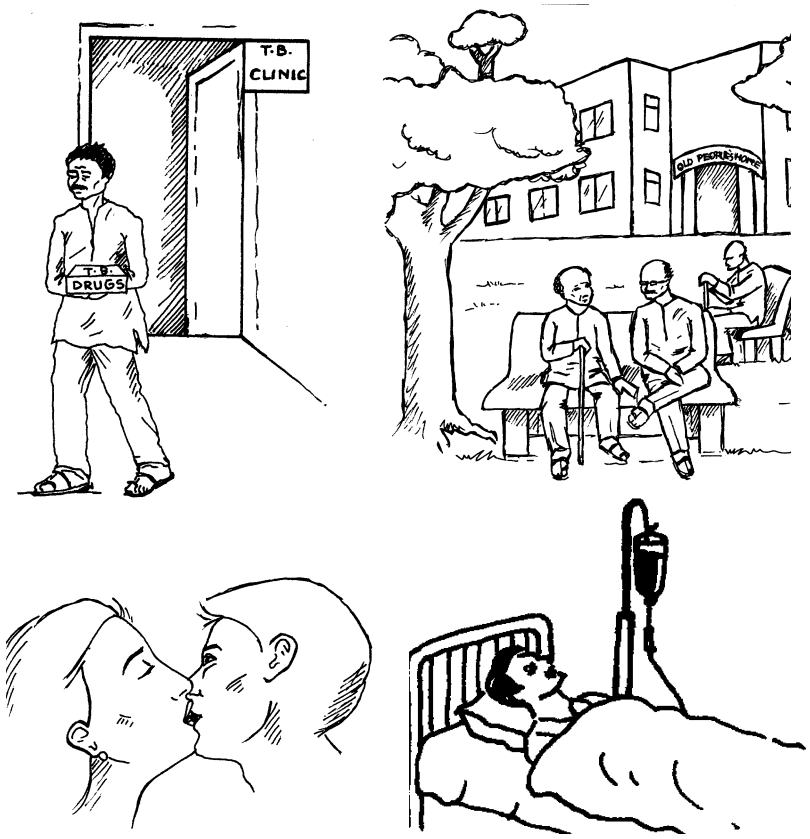
2. How does an increase in the ageing population contribute to new health challenges?

3. Figure 5.1 shows a TB patient walking out of a clinic with a heap of antibiotics in hand. Why should the patient be carrying several antibiotics?

4. Are there any other new health problems involving TB patients?

5. Consider the case of the kissing young couple. Assume that they are educated but unmarried. What advice would each of you offer them? Do the opinions of all members of the class converge to a similar code of conduct? If yes, then list out the code of conduct that your class

Figure 5.1: New health challenges.



would advocate. List also your reasons for advocating it. If you do not all agree, organise a debate to highlight the issues on both sides. Support your stand through hard facts, numbers or quotes.

6. Figure 5.1 shows an operation theatre in a hospital. What are your chances of getting a new disease from a hospital if you were admitted to one? Include the hazards of blood transfusion, especially when the donor's blood has not been tested for different diseases.

7. What are the health risks linked to the fast paced life styles that most of you are compelled to live? What diseases might global climatic changes (discussed in the book titled *Global Climate Change*) — global warming, ozone hole and acid rain — cause? What harm could come from increased exposure to violent behaviour? List the associated health hazards as well as their causes. Did you include

health aspects related to the body as well as the mind?

India, and some other developing countries, will be confronted with several new health problems. Some of these will involve the increasing number of aged people. They may be beset with a range of non-communicable diseases and problems for which there are no easy or fast cures. The HIV virus causing AIDS is fast spreading in the general population. Several pathogens are showing drug-resistant behaviour. Perhaps there are other health hazards lurking among the population. You may be able to recount some.

5.1 Ageing populations

As life expectancy continues to increase all over the world, the number of the elderly will register an alarming rise. This is specially true for a populous developing country like India. In this section you will discuss a few issues that concern the increasing number of the elderly.

Table 5.1: Percentage increase in the elderly population in India from 1961 to 2025.

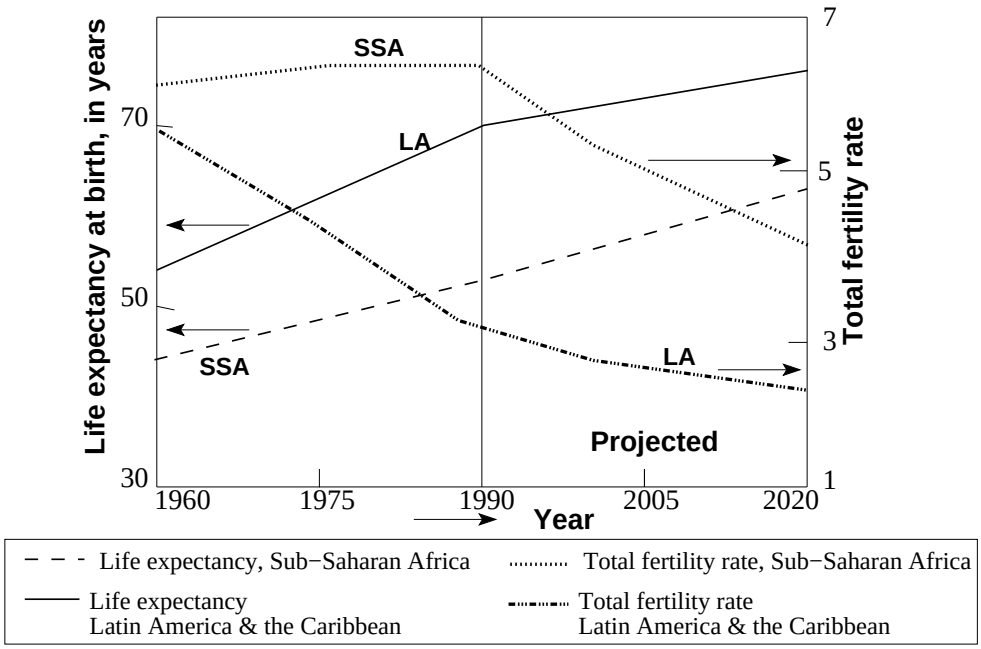
Year	**% People $>$ 60 yrs**
1961	5.67
1971	6.21
1981	7.70
1991	14.5
2025	27

1. Recall your activities based on Table 2.1 in Section 2.5. What will be the direct outcome of an increased life expectancy?

2. Table 5.1 shows the proportion of the elderly in India, in terms of percentage, over the period 1961 to 2025. The last value is an estimate. What trends do you observe?

3. Each of you plot the first four values as a graph of percentage of ageing people versus year. Draw a trend line and extend your graph to future years. Do not consider the given point for 2025. What value do you obtain for the year 2025? Does your extrapolated value for the year 2025 match with that obtained by others in their plots? Discuss the differences and similarities in your estimates.

Figure 5.2: Trends in life expectancy and fertility in Sub-Saharan Africa and Latin America during 1960 to 2020.

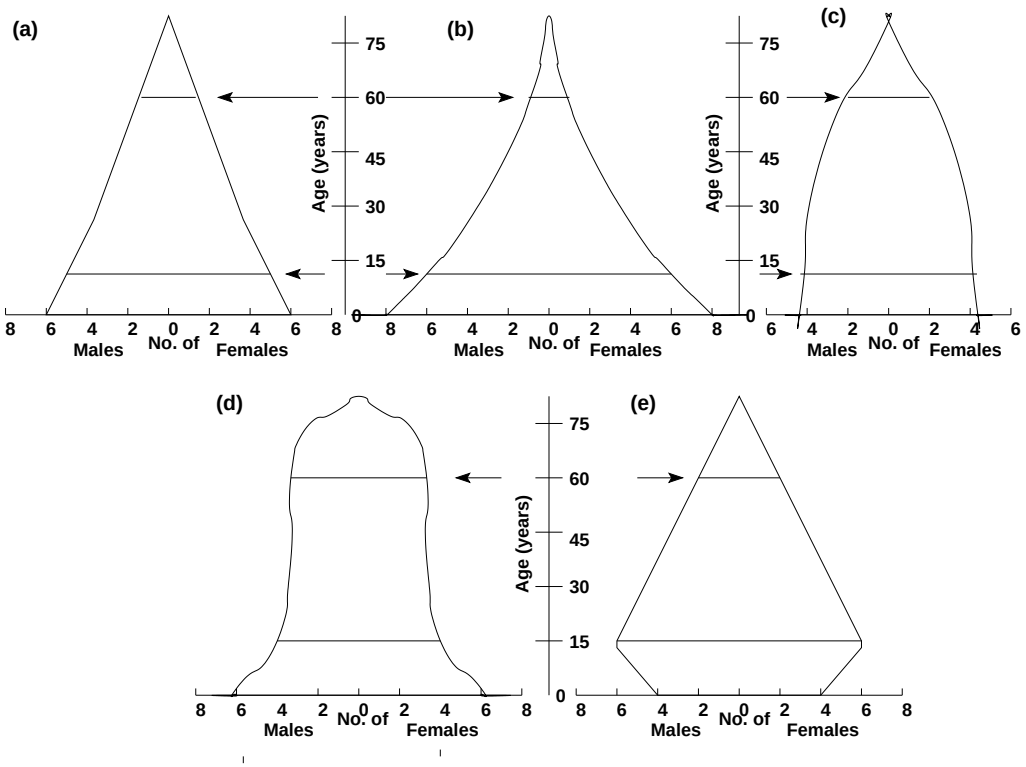


4. Can the proportion of ageing population keep increasing indefinitely? Argue that, for a stable population, only a certain proportion of population above 60 years can be maintained. Estimate the range of values (proportion to total population) that this proportion can possibly have. For instance, what will happen to a country that has over 50% of people above 60 years of age?

5. Figure 5.2 shows trends over the period 1960 to 2020 in life expectancy and fertility in two major regions of the world. The regions depicted are Sub-Saharan Africa and Latin America. [9] What does the y-axis scale on the left indicate? Describe the trends in life expectancy for Sub-Saharan Africa and Latin America. How do the trends differ for the two regions? The values beyond 1990 are projected. Why do you think the rate of increase in life expectancy decreases for Latin America beyond 1990? Give possible reasons.

6. Observe the y-axis scale on the right. What quantity does it indicate? Explain how this quantity is related to population increase.

Figure 5.3: Some national population structures: age-sex pyramids.



7. How does the trend in fertility rates differ for the two regions shown?

8. Sub-Saharan shows a certain trend in life-expectancy and fertility rate. Using the variation of these quantities over time, describe the composition of the population in 1960s, 1990's and in 2020.

9. Carry out a similar analysis for Latin America. What differences did you find? Discuss in class.

The demographic changes observed by you can be expected to have dramatic effects on the age distributions and disease patterns in developing countries. The age-sex pyramids for different countries of the world given in the next section should highlight this better.

5.1.1 Age-sex pyramids

Study the pyramids shown in Figure 5.3. The numbers on the vertical axis indicate the age ranges within the population. The numbers on either side

of the vertical axis (zero on the base) indicate the percentage of male and female populations.

1. What do the different shapes signify? Consider broad bases versus narrow ones. Discuss what they mean, especially in terms of fertility rates and birth rates.

2. Observe the shapes of pyramids at age 15. While in Figure 5.3 (e) the pyramid base is seen to be swelled up at age 15, in the others it maintains a nearly constant slope. What do the slopes at age 15 signify, especially in terms of fertility of the population? Discuss in your class.

3. Gradually move your eye towards the tip of the pyramids. What is happening to the populations as they approach age 60? Divide the class in five groups with one pyramid allotted to each group. The different scenarios represented by individual pyramid should be presented to the class by each group.

4. Now you may focus your attention on the tips of the pyramids. What do you think is the meaning of the different shapes of the tips, with shrunken bases, say at age 60, or with broad bands at 60 (in Figure 5.3 (c)) ?

5. Estimate the pyramid shapes in 2000 AD for some countries that interest you. You will need to know or guess the fertility rates in these countries and their changing trends. Do the pyramids you have estimated resemble any of the shapes given in the figure?

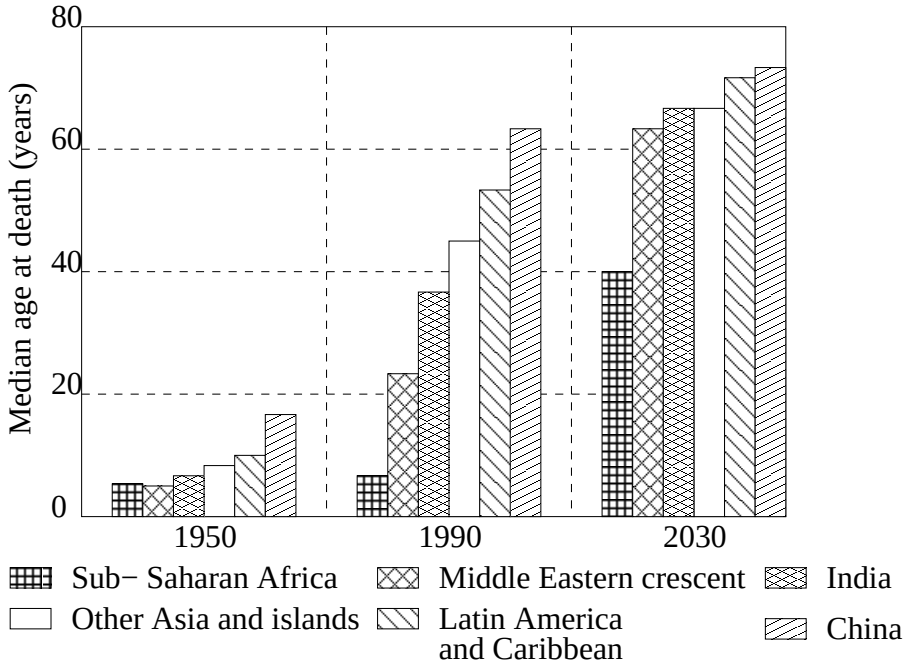
6. Make projections of the age-sex pyramid for India in 2000 AD, under different conditions. Consider situations such as, AIDS striking India in an epidemic form, or fertility rates not decreasing substantially, and so on.

The different shapes of pyramids give a vivid idea about several demographic features of a country, including birth rates, fertility, mortality and life expectancy and the evolution of these over time. Interestingly, these shapes can vary for individual countries over a period of time with changing trends in several factors.
Age-sex pyramids also give an indication about another important health parameter, the *median age at death*, which you will discuss in the next section.

5.1.2 Median age at death

Median age at death stands for the age below which half of all deaths in a year occur. Figure 5.4 shows the *median age at death* for 6 regions of the world. This information is given for three periods: 1950, 1990 and (estimated) 2030. [9]

Figure 5.4: Median age at death in some populous regions of the world, 1950, 1990 and 2030.



1. Six regions, including India, are grouped under three time-periods. At first glance, what do the three blocks reveal about the median age? What do you think were the types of diseases responsible for the low median age at death in the first block (of 1950)?

2. In 1990, what was the median age in China, Latin America, India and Sub-Saharan Africa? What factors will you ascribe for the observed variation? Discuss all the reasons, including social factors like literacy and women's status.

3. The bar graph also suggests the patterns of diseases afflicting the people of these regions. Discuss the disease patterns for different

regions. Weave in the information you have obtained from Figure 5.3 on pyramids and Figure 5.4.

4. What would you expect when a region makes a transition in its health status? Do the different regions in Figure 5.4 show signs of health transitions? During which periods do they show such signs?

5. Bulging of the tips of the pyramid and increase in median age at death, both suggest an increase in the number of people over 80 years. Collect as many newspaper clippings as you can to support this suggestion.

Soon in the next section you will find that increasing age brings with it an entirely different set of diseases and disabilities. And communicable diseases will not leave the elderly that easily, especially in the developing countries. The message from these demographic projections are clear: the number of the elderly throughout the world are increasing. And this aging population will be one of the most profound forces affecting health and social services in the world.

5.1.3 The diseases of the elderly

With large numbers of the aged, the situation will be difficult in India and other developing countries. In terms of disease burden, the incidence of noncommunicable diseases, especially of the elderly, will rise sharply.

1. Gather the following data about all your family members above the age of 60 years and tabulate the information:

   - For those who are living at present, their present age, and ailments, if any, that they complain of;
   - For those relatives who are no more, record their age at the time of their demise and the ailments they had while they lived.

   Include, if possible, members of extended family like your grandaunts, granduncles and your grandparents' cousins too.

2. How many of the ailments listed could be classified as communicable diseases? How many were non-communicable diseases? Which of the diseases do you largely note among the elderly?

3. Form groups of 4-5 members. Organise an elocution competition among the groups on the topic: **Healthy and happy senior citizens**

is a sign of a healthy society. Argue on the basis of what you have found out about the ailments of the aged. Keep in mind the important role senior citizens play in any society, especially ours where society, and not the government is responsible for the social security of its citizens.

4. On October 29, 1998, 77-year old John Glenn blasted into space aboard space shuttle *Discovery*. He was on an official mission for scientists doing research on ageing. What do you think was the significance of including John Glenn in the space shuttle crew?

5. Read and discuss the information given in Figure 5.5. [19] Are the Americans living healthier, or just longer? Would the disease pattern among the elderly be different in different regions, say, in the West and in India?

6. Compare and contrast the condition of the aged — social, and economic — in the USA, in China and in India. You may have to find out about the Government's role in social welfare in the three countries, and read up about the cultural differences.

7. What factors are responsible for the increase in the life span in the developed countries? Is affluence the only factor responsible for healthy aging? What role do diet and level of physical activity play? Do you expect to find a difference between situations for the male and female elderly? Give reasons for your answers.

8. Find the meaning of the word *gerontology*. Consider the slogan: "Preventive gerontology is the name of the game in the West."

   What do you think are the aims of preventive gerontology? What would it emphasise: slowing down the diseases associated with the aged, or addressing the decline in the functionality of the aged? What sort of a lifestyle would this suggest?

9. One association of the elderly in Mumbai is known as *Dignitarians*. Started by Dr. Sheilu Srinivasan, its members organise community development work, and have done much to improve the cleanliness in several localities in Mumbai. They keep in touch with other elderly people through a newsletter. Survey the activities of the elderly people in your residential locality. Comment on the relation between the elderly, the younger adults and the children.

R.K.Laxman in
The Times of India

Future perfect: More & healthier elderly?

- **According to the World Health Organisation's projections, the proportion of the population in age 65 years and above will increase from 4% in 1990 to 9% in 2030.**
- **Already in the USA, with better health facilities and quality of life, the percentage of those over 65 years has climbed to 13%. It was 4% at the turn of the century.**
- **Life expectancy at birth has increased from 47 years in 1990 to over 76 years today and is expected to touch 83 by 2050!**
- **In the USA, 89% of those above 85 years are fully functional; those residing in nursing homes have declined from 63% in 1982 to 50.2% in 1997.**
- **There is mounting evidence that the elderly have less of several chronic diseases, including arthritis, dementia, hypertension and stroke.**
- **More than one fourth of China's population (> 400 million) will be over 60 years of age by 2050.**

Figure 5.5: Projections of ageing populations.

10. Draw up a plan of lifestyle for the elderly in your area with sufficient attention to the following: physical and cognitive functions so that the elderly have a feeling of full engagement in life, including productive activities and interpersonal relations.

11. Who do you think should look after the elderly — the family or the society? For how long should the elderly be looked after? What if the elderly father or the mother is sick and needs attention, especially when all the younger family members are working? What could be done to look after them? How would their medical treatments and care be paid for? Discuss the pros and cons of the joint and nuclear families.

12. Discuss the issue of euthanasia in the context of the aged.

13. Draw up some plans for the elderly in India. Would your plan have different recommendations for rural and urban areas? Justify.

It is about time that India formulated a national health policy which would take the aged into consideration. Perhaps India should also consider a strategy of preventive gerontology, which can save crore of rupees in the long run. Treatment of diseases of the aged, including arthritis, cancers, several types of cardiac and mental problems and eye problems, in addition to reduced mobility, puts an additional strain on the scarce health funding in countries.

5.2 Drug resistance

Another health challenge fast spreading in the global population is 'Microbial drug resistance'. This phenomenon is observed in the treatment of several infectious diseases. The seriousness of this major public health hazard is still not realised by many clinicians and public alike.

1. Read the following passage

> *Sharad is apparently a healthy young man. He is employed with a private company as a plumber and earns nearly Rs. 5,000/- per month. He is married and has two, young school going children. He lives in a small room in central Mumbai.*
> *He has been recently diagnosed as having TB. He is under treatment, and the doctor has assured him that he will get*

well if he is regular with his treatment and continues as long as asked to do so.

However, Sharad is perturbed by the loads of medicines the doctor gives him every fortnight. Soon after starting the TB treatment, he also picked up the Dengue virus. Sharad has also been given several blood transfusions.

(a) What new health hazards does this situation suggest? The next time you read your newspaper, gather the new items which have reference to these hazards.

(b) What does the name antibiotic mean? Name some antibiotics. How do you think they manage to kill or paralyse the infecting microbes? Is there a single antibiotic that works against all pathogens? Comment on the specificity of antibiotics for certain pathogens.

(c) Find out about the different modes of action of antibiotics. Consider the different ways by which organisms, such as bacteria, can be prevented from multiplying or can be killed. You will have to find ways to destroy one or more of their vital structures or functions.

(d) What is meant by drug (or antibiotic) resistance?

(e) How do infecting microbes gain the ability to resist (not respond to) one antibiotic, say rifampycin for TB? What factors do you think are responsible for this phenomenon? What exactly is happening to microbes? How can the different target sites in the pathogens change? To understand this problem from the genetics perspective, invite a competent geneticist to give a general talk to educate you.

(f) What was the situation in say, the early 1980's? How do doctors recognise when a particular drug has ceased being effective in curing a disease?

(g) What is the doctor's role in the emergence of drug resistant strains of pathogens? The next time you visit your doctor, enquire about what she has prescribed for a mere cold and cough.

(h) In what ways may a patient contribute to the emergence of drug resistant strains of pathogens?

(i) Presume that your doctor diagnoses a bacterial infection and prescribes an appropriate antibiotic. You are advised to take

three tablets for four days accompanied by rest and good diet. However, you start feeling better after two days and stop the antibiotic. How can discontinuing the treatment possibly lead to a disastrous situation? Could there be any correlation between not completing a course of treatment and the emergence of drug resistant pathogens?

(j) Why do you think it is important to read the leaflet accompanying different medications, especially the instructions for use?

(k) Discuss, formulate and organise a public awareness campaign on how and when antibiotics should be given and taken. Involve the proprietors of *Medical shops* in your area in this campaign.

2. Some diseases and antibiotics are given in the table below. Match them appropriately. [13]

1.	Malaria	a.	Isoniazid
2.	Leprosy	b.	Chloroquine (Quilones)
3.	Tuberculosis	c.	Ampicillin
4.	Haemophilus influenzae	d.	Dapsone
5.	Syphillis	e.	Rifampycin
6.	Pneumonia	f	Tetracycline

3. How many drugs (antibiotics) are prescribed for treating a patient with TB at the present time? What are they? How many drugs were prescribed in the late 1970's for TB?

4. Name some other diseases for which more than one antibiotic (drug) is being prescribed.

5. Consult with your neighbourhood doctor or family physician regarding the correct matchings in item 2. For several of the above diseases, doctors now prescribe more than one set of antibiotic. Discuss whether we should write off antibiotics for fighting infectious diseases.

6. What does the term **Multiple Drug Resistance** (**MDR**) suggest? Besides in the context of infectious diseases, where else do you think MDR is applicable? In what manner do the drug resistant microbes pose challenges for researchers?

Drug resistance, especially multiple drug resistance, is an insidious and a silent epidemic. Widespread inappropriate use of different drugs, especially antibiotics, has led to the emergence of this problem. Fighting

this problem will require a multi-pronged strategy at the global level. This implies a strong involvement of policy makers, a responsible pharmaceutical industry, health officials, clinicians, researchers and members of the public.

5.3 Emerging diseases and newer parasites

The 20th century has introduced new diseases and health challenges for which we have no easy solutions or cures. While some of these new challenges are related to the fast changing lifestyles of people, others are due to deteriorating environment and the ecological imbalance.

1. For how many hours do you watch TV? How many hours do your younger friends and family members spend watching TV? Keep a record of the time spent by each and the nature of programmes watched.

2. Is violence on TV a health hazard? Justify your stand. Monitor the different TV channels and programmes for a week and keep a record of *violence* shown. Define what you might call violence: include physical and mental violence.

3. Which programmes, Indian or foreign in origins, have more violence? Which regional movies/channels show more violence?

4. What do you think is the effect of violence on the psyche and behaviour of children and young adults? How does violence affect women and men? Is there any difference between the effect on the two? Comment on the effect of violence on the language used.

5. Dengue, Ebola, Sabina, Lyme! What do these names suggest? When and where did you first read/hear about them?

6. To which regions of the world are these pathogens confined? Collect newspaper clippings on these and file them. Discuss the links between changing or deteriorating environment and the emergence of newer pathogens and diseases.

7. Classify the pathogens of newer diseases under the heads of virus, bacteria, protozoa, etc. Find out the different set of symptoms corresponding to each disease. Are these diseases confined to specific regions of the world or country? Do they preferentially affect or not affect certain groups of people?

It has been a century of contradictions. Biologists have achieved remarkable advances in their understanding of different diseases and pathogens. On the other hand, a large number of newer health challenges are confronting humans at the turn of century and millennium. One of the biggest health challenges is posed by AIDS, a comparatively newer disease, which reared its head only three decades ago.

5.4 AIDS: an alert or an alarm

The twentieth century has seen one major human tragedy in the form of a new disease, AIDS, posing a serious health challenge to countries like India. Unknown prior to 1981, all public health discussions and health programmes today have to take AIDS into consideration. The disease deserves special focus, as half-hearted measures would be far too expensive and the consequences could be irreversible.

1. AIDS is an acronym — a short form derived from the first letter of each word in a phrase with many words. What does AIDS stand for? What is the meaning of each word?

2. What does the immune system in your body do? How does it work?

3. What is a **syndrome**? Look up the word in the dictionary and describe how it might apply to AIDS? How is a syndrome different from a *symptom* or a *disease*?

4. Compare the different cells of your immune system to the different types of defence units, say in the army, such as the infantry, artillery,

cavalry and armoury. Explain the similarities between different units of the army and the different cells of the immune system.

5. Another acronym used in the context of AIDS is **HIV**. What is the full form of HIV? What do $HIV+$ (HIV positive) and $HIV-$ (HIV negative) stand for?

6. How is HIV connected with AIDS? If you are informed by your doctor that the blood tested of one of your near relatives shows HIV+, what does this mean? What symptoms is he or she likely to show? In what time scales?

7. Do the symptoms of the disease show up immediately, say after a shot of intravenous drug, using an infected syringe? Or, after indulging in careless sexual behaviour? Will the symptoms vary in different individuals? Being aware of the risks involved (in the exposure), but not having any symptoms, say for a year or two, do you think you should visit a doctor?

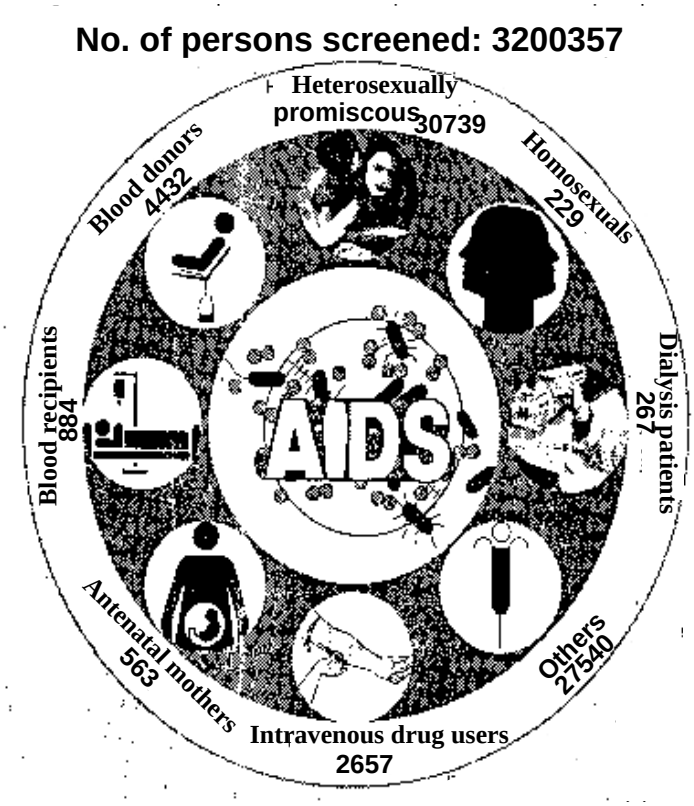
8. If in the intial stages the blood test is negative for the HIV virus, what does that mean? When is the virus likely to show up in the blood test?

AIDS and the HIV virus causing the disease need special attention and understanding. The virus, which essentially cripples the immune cells, is difficult to detect in the blood. Additionally, the disease caused by the virus has no straightforward symptoms. In fact, these very factors have led to the rapid spread of the disease.

5.5 The spread of AIDS

AIDS is spreading rapidly in our general population essentially because people are unaware of how the disease is transmitted from one person to another. AIDS education campaigns need to be carried out at all levels — in schools, colleges, at work places and even in different religious fora.
Figure 5.6, derived from a newspaper report, shows the situation of different people who tested postive for HIV from among a large group of people who were screened for HIV in their blood. The screening was done until October 31, 1997 and the report was published in the bulletin of the Indian Council for Medical Research, New Delhi. (Source: “Death by Blood”

Figure 5.6: Modes of HIV transmission: an Indian surveillance data.



by Meera Nair in *Indian Express*, Oct 23, 1998.) The figure and the discussion based on it should focus your attention on the spread of AIDS. It should fill you with an urgency to stop the spread.

1. How many people were screened (their blood was tested for the presence of HIV) for obtaining the data presented in Figure 5.6? Why do you think they must have been screened? How many people among the screened people tested postive for HIV? Calculate the percentage of the total number of screened people who tested HIV+.

2. Suppose you selected the same number of people from all over the country, completely at random and tested their blood for the presence of HIV, would you get the same percentage of HIV+ people? Give arguments supporting your stand (about a paragraph). Discuss the arguments given by different members in your class.

3. Using Figure 5.6, list the different ways (modes) by which the HIV finds entry into the blood stream. Calculate the percentage of people affected by each mode as found by the survey depicted in the figure. Draw a pie chart to show the contribution of each mode. Would you expect to find the same distribution at all times in all regions of the country? Explain your answer and discuss.

4. Are the routes (modes) that you have listed also effective for spreading other sexually transmitted diseases (STDs) or hepatitis B virus (HBV)? What body fluids may be involved in the spread of HIV? Saliva is one example. Suggest others.

5. Read the following letter by an eminent Indian virologist, Dr. K. Pavri, associated with AIDS virus reseach (Times of India, 1997). Discuss the issues raised at the end of the letter.

> *Anyone who unequivocally specifies the number of seconds in which the HIV is inactivated runs the risk of oversimplification. The time depends on a variety of variables such as the amount of the virus present, and also whether in liquid or dry conditions. In general, it is accepted that the virus gets destroyed at* 100^o *C (boiling water) within a minute. It is neither pragmatic nor desirable to state that the virus gets destroyed instantaneously, as suggested by "one second".*
>
> *When a high concentration of the virus is present in blood or other bodily fluids, it would take longer to inactivate it. In these circumstances, let us not quibble over whether it takes one second, seven seconds or 60 seconds, when our safety is assured by going for a slightly longer interval. However, for decontamination or sterilisation through boiling, the recommended time is 20 minutes after the water has come to a boil. The virus survives in dried or clotted blood for several days, while the hepatitis B virus can survive for several weeks. Chlorine-containing solutions like sodium hypochorite or ordinary laundry bleach (four teaspoons in two litres of water) are quite effective in decontaminating blood spills, or items contaminated with blood. Dettol is not effective against HIV but undiluted Savlon, containing cetrimide, is very effective.*

   (a) Does the HIV die in one second in boiling water? What is recommended by the virologist for decontamination or sterilisation?

Table 5.2: A questionnaire on the transmission of HIV.

S.No.	**Is HIV likely to be transmitted in this situation?**	**Y** or **N**
1.	Having protected sex (using condoms) with multiple sex partners.	
2.	Regular blood transfusions (without testing the blood for the presence of HIV) as needed in some genetic diseases.	
3.	Use of improperly sterilised needles and other equipment in a dental/ medical set-up.	
4.	Use of unsterilised razor in a barber's shop.	
5.	Mosquito bites.	
6.	Mouth-to-mouth kissing.	
7.	Hand shakes between people who have no open cuts or wounds in the hands.	
8.	Use of the same telephone receiver by many people.	
9.	Sharing a common drinking water glass or food like a sandwich.	
10.	Hand shakes between people who may have cuts or bruises in the hands.	

(b) Would you say that the virus dies in seven seconds in hot air?

(c) Does the virus survive in clotted or dried blood? What does this imply for doctors, nurses, people who work in hospitals or nursing home wards, barbers and their customers? Who else would be affected by the survival of the virus in clotted blood? Discuss this in the class.

(d) Does chlorine kill the HIV? What does this imply for you? Could the virus be present in swimming pool water?

(e) Does Dettol kill HIV? What should you use to disinfect your hands after, say, cleaning a wound?

6. Table 5.2 asks about the transmission of HIV in different situations. Test your knowledge about this by marking **Y** for *yes* or **N** for *no* in Table 5.2.

7. Some doctors, especially in slums or rural areas, are known to just dip the used syringes and other instruments in hot water, to be reused for the next patient. Form groups of 3 to 4 members and

survey the doctors in your residential area. Tabulate the following information for the area you have surveyed.

(a) Name of the locality.

(b) Total number of doctors surveyed.

(c) Number of doctors who had facilities for boiling/autoclaving medical instruments, including syringes, needles, etc.

(d) Number of doctors who used a fresh set of instruments, gloves, etc. for each patient.

(e) Time taken by each doctor to autoclave or boil the instruments. (*Autoclave* is an equipment owned by some doctors to sterilise their instruments. It works rather like a pressure cooker.)

After reading Table 5.2 you will find that answers to questions about the spread of AIDS are not straight forward or simple. To have a proper understanding about how the HIV (or even HBV and other viruses) spread, you will have to bear in mind the very minute size of these viruses — about 0.01 microns — and also how microbes, in general, are transmitted.

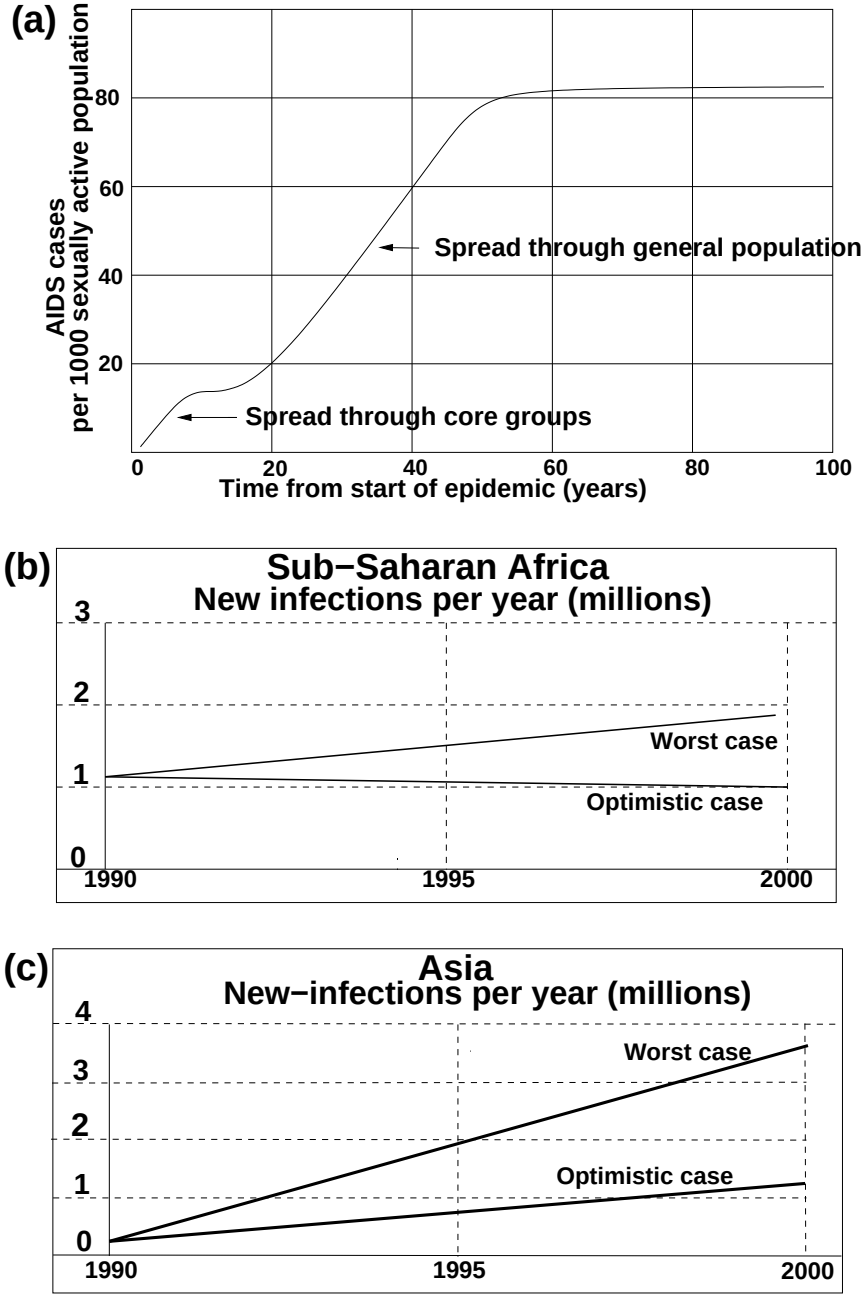
5.5.1 Patterns of spread

As you have already discussed, the HIV epidemic is worrying and is getting worse in India. As an increasing number of people get tested for the presence of HIV, you will be confronted with greater numbers testing HIV+. In 1990, globally about 9 million were estimated to be carrying the virus. Of these, more than 80% lived in developing countries. And this 80% is expected to increase to 95% by 2000, with India taking a big share of this percentage.

1. Figure 5.7 (a) shows how the AIDS epidemic might occur as a function of time. [9] This is expected to be the scenario when no preventive measures are taken. Describe the nature of the graph in about a paragraph. Read out your descriptions and discuss the interpretaion of the graph.

2. In the initial stages of the epidemic, the disease has been observed to spread rapidly among a certain group of people. These people have the highest risk of acquiring and transmitting HIV infection. Who do you think will constitute this group? Justify your answer. This group of people is normally referred to as the **core** group.

Figure 5.7: Spread of AIDS: (a) Simulated AIDS epidemic in a Sub-Saharan African country; (b) Trends in new HIV infections 1990-2000 in Sub-Saharan Africa; (c) Trends in new HIV infections 1990-2000 in Asia.



3. Do you think the constitution of the core group will vary from one country to another? This could include sex workers, migrants, professional blood donors, members of the military, truck drivers, homosexuals, and drug users who share needles. Could their proportion in the population vary from one region of a country to another? In what ways? Illustrate with an example.

4. Assume that a locality, say the size of your ward or township, is now at stage corresponding to 20 years after start of AIDS epidemic. Using the graph in Figure 5.7 (a), calculate the number of people per 1000 who are likely to have AIDS 10 years from now. Make estimates about the number of sexually active people in a population of 1000 in that area. *Hint: You will have to add the number of people affected in each year for 10 years.*

5. Will this be valid for all regions in the country? How might this vary for those areas where the following actions were taken?

   - Where preventive measures are taken at the initial stages of the spread (disease prevalance in the core group), and
   - Where no preventive measures are taken.

   In which of these categories does the locality in which you live fall?

6. Draw a simulation of AIDS spread for India. According to you, is there adequate level of preventive measures in India? Presuming that AIDS was initially detected in India in 1980, when will you expect the disease to plateau off?

7. From the nature of the spread so far in India, it appears that the preventive measures taken so far have been inadequate. Assuming that this is true, what would be the prevalence of the disease in 2000 AD? Give this value in percentage.

8. Estimate the number of AIDS cases at its maximum in India. When will this maximum number be reached?

You will not be wrong in saying that AIDS is spreading in India in an epidemic form. And all of you are going to be affected, in one way or the other.

5.5.2 New infections per year

Figure 5.7 (b) shows how the number of new HIV infections per year could vary with time in Sub-Saharan Africa, one of the worst AIDS-affected regions of the world. [9] The number of new infections per year indicate the rate of transmission of HIV in the region.

1. Explain why the number of new infections indicates the rate of transmission.
2. Figure 5.7 (b) shows trends for new infections under two assumptions. What conditions might give rise to the optimistic case? Under what conditions would you get the worst case?
3. What is the number of new HIV infections in the region in 1990?
4. According to Figure 5.7 (b), how many people would have been detected to be HIV+ between 1990 and 2000 AD in Sub-Saharan Africa in the optimistic case? What would be the number for the worst case scenario?
5. Figure 5.7 (c) shows similar data for Asia. This includes China, India, other Asian countries. [9] List the ways in which this figure is different from Figure 5.7 (b).
6. In 1990, which of the two regions has a higher number of new HIV infections? Which region shows a higher number of new HIV infections per year in (i) 1995 and (ii) 2000? Does the rate of spread of HIV infection existing in a region at the beginning of a certain period of time, say 10 years, decide the rate of spread of the disease in that region at the end of the period? Argue your answer using Figure 5.7 (a) and (b).
7. Suggest all possible reasons that might have contributed to the higher number of new infections in Asia in the "Worst case" assumption.
8. Explain the role that education about AIDS and HIV could play in reducing the rate of spread. How would public awareness of the *do's* and *do not's* affect the spread?
9. Should sex education be made compulsory in India? Justify your stand in about a paragraph. Include in your arguments the age at which it should be provided, the context — within formal education in schools, outside schools, in medical centres, or other contexts —

and by whom (parents, medical personnel, teachers, others whom you specify). Discuss the issue in class. What is your class consensus? Write a letter to the newspaper.

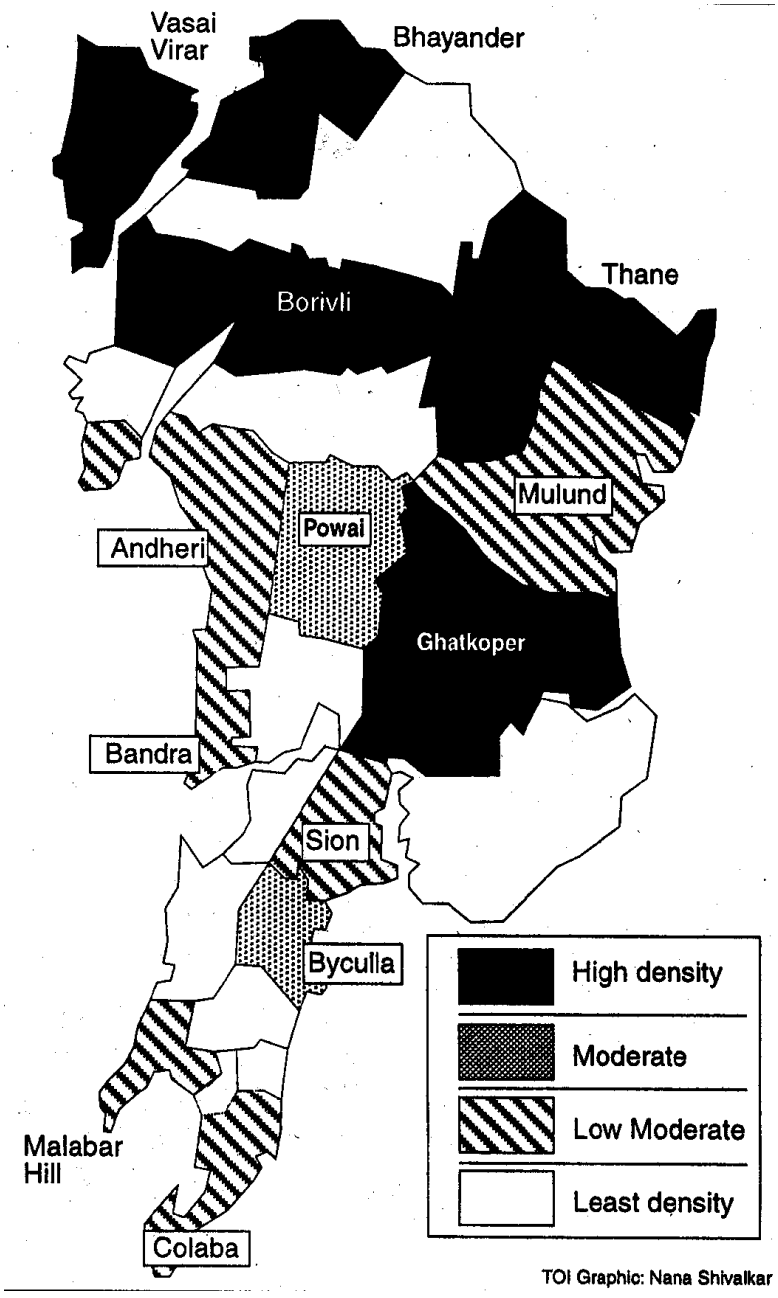
10. Ask an expert on this disease to talk about HIV and how it interacts with your body at the molecular level. In groups of six members, prepare two models:
    - a model of the virus, and
    - the manner in which it causes AIDS at the molecular level.
11. Suppose a close young friend shows symptoms of HIV infection. Estimate the finances that your friend would need to sustain the rest of his or her life. For what all purposes would the finances be needed?
12. You are very close to this friend who is infected with HIV. You are called upon to advise the family and your friend on their future course of action. Form groups of 4 members. Discuss the specific advice for the cases when your friend is a married or unmarried male or female.

The graphs depicting the rapid spread of the disease in Asia bring out the urgency of the situation. Perhaps one can take tips from programmes in other countries where specific preventive interventions have been undertaken. These interventions involved: providing correct information to all people, reducing blood-borne transmission, integrating AIDS prevention and STD services, testing and screening, enhanced survelillance and a national will to fight the disease.

5.5.3 AIDS in Mumbai

Figure 5.8 shows the ratio of HIV+ cases to the population living in an area, for different suburbs of Greater Mumbai in 1996 (Source: The Times of India, 26 Nov, 1996). This data on the density of HIV+ cases in different areas of the city are based on the analysis of 4,500 persons who were suspected of HIV+. They were referred to by physicians and hospitals to the AIDS Research and Control Centre (ARCON), in Mumbai between 1994-1996. Further follow up by ARCON counsellors revealed their residence, enabling the establishment of tentative HIV density ratio in the city. The vulnerable groups (most infected with HIV) were identified as: Young males — 15-19 years; Other males — 29-39 years; and Young females — 20-24 years. Study Figure 5.8 and discuss the issues raised below.

Figure 5.8: Density of HIV+ cases in Greater Mumbai in 1996



1. Write a page on the distribution of present and prospective AIDS patients in Greater Mumbai.

2. How many of you wrote that AIDS was higher in the so-called "red light" areas? Is this justified by Figure 5.8?

3. Looking at the map, can we now say that AIDS is primarily a problem of the 'red light' areas in the city? What is the spread- patttern for the disease now?

4. Look at the areas marked 'low' or 'moderate density.' Some of these areas are considered to be predominantly "middle-class localities" with several residential blocks (or *societies*). What implication does this have for the spread of the disease?

5. Which age groups do you think are most vulnerable to AIDS?

6. If you were an official of a government body in charge of controlling the spread of HIV in the city of Mumbai, what steps would you take? Form groups of 3-4 members and list as many steps as you can. Then rank them according to their priority. Justify each step. Explain how each task may be carried out — the people who will carry it out and the people who will be targetted.

7. How do you think the government and other health agencies should go about spreading AIDS prevention messages?

8. Discuss the properties of the material from which condoms are made. Latex, a porous material used in the manufacture of condoms, has a pore size of 0.5 micron. The human sperm is 0.3 microns, while the AIDS virus is 0.01 micron (Source: The Times of India, 8 Dec 1998). Which is more likely to pass through the condom? In the light of the above information, is condom use the real answer to fight AIDS? Justify your stand.

9. Read the information in Figure 5.9. The misunderstandings (myths) given in the figure were obtained from students during a research study. [12] The advertisement actually appeared in the matrimonial column of The Times of India, Mumbai edition. What level of understanding about AIDS do the materials given in Figure 5.9 show among the *educated*? What reasons would you give for this level of ignorance about the disease? Add some further myths that you might collect.

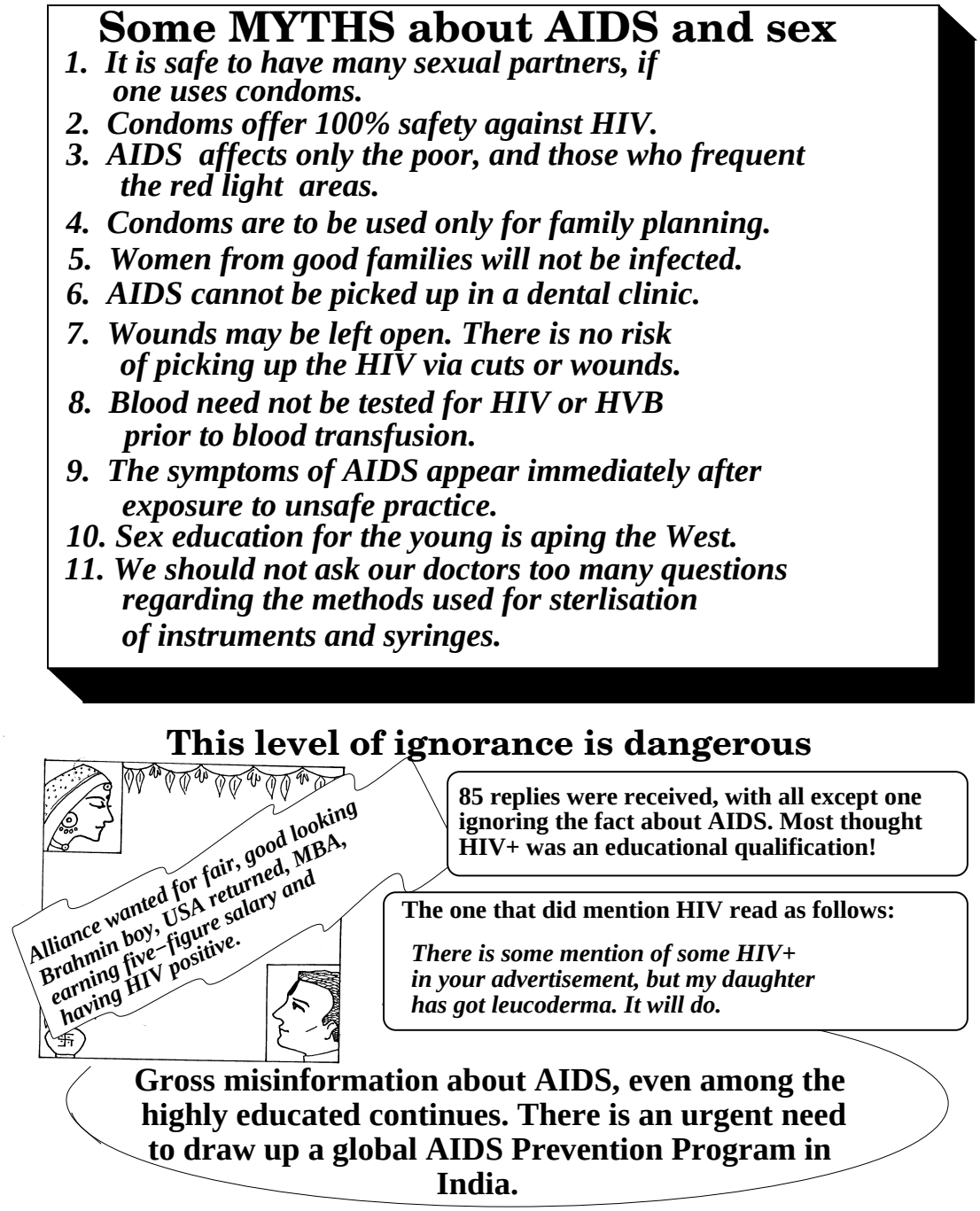
10. Specifically discuss the marriage advertisement and its response in class. Read matrimonial columns in the newspapers in your area. In the light of your awareness about AIDS, how would you approach matrimony?

11. Suppose two progressive individuals engaged to be married to each other decided to take a medical test for HIV. If one of them tested postive, what should they do next? Discuss the options, keeping in mind the social and psychological implications for both individuals.

12. Organise a debate in your class on: **Safe sex with one uninfected partner is one of the major preventive strategies for AIDS**.

In India, AIDS needs to be tackled on a war footing. Unfortunately, little attention is being paid to this burning problem. There is no second chance with AIDS.

Figure 5.9: Myths and advertisements.



Chapter 6

Funding health

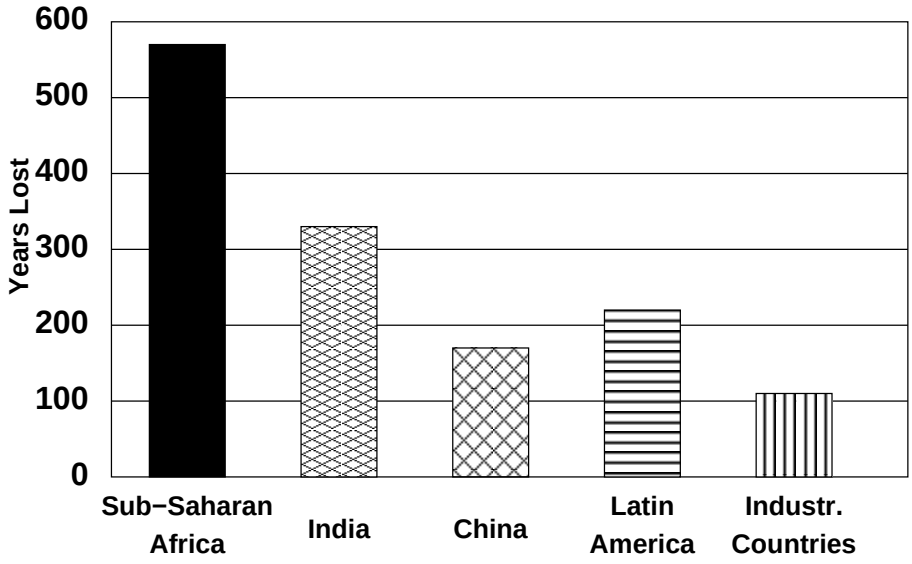
Nearly into the 21st century, there are high possibilities of drastically reducing the incidence of communicable diseases in the developing world. In India, child mortality (death of children under age 5) can be reduced to 50 per 1000 live births from 120 (approximately) at the present time. In fact, you could be living in a world where less than 7% of babies are born with low birth weights. Yours could be a world where micro-nutrient deficiencies in the population have been eliminated with a consequent fall in the malnutrition among children and women by 50%. The entire (100% of) population could have access to safe drinking water and sanitary facilities. Medical health facilities could be available to people within an hour of motor vehicle ride.
These are not *pipe-dreams* — targets which cannot be achieved — nor naive wishes for Utopia (a perfect world). These are achievable goals. They can be achieved only if enough resources are made available for the health sector and right policies are implemented. They can be achieved only if you care.

6.1 Health cost and status: global comparison

In this section you will engage in a global comparison of the economic implications of maintaining the health of a population.

1. Figure 6.1 compares the *disability adjusted life years* (**DALY**) lost per 1000 people in 5 major (and relevant) regions of the World. [18] Sub-Saharan Africa loses almost 600 disability adjusted life years per 1000 people in the region. Calculate the total DALY loss in millions. The total population in this region is about 600 million.

Figure 6.1: Disability adjusted life years (DALY) lost per 1000 population in different regions of the World.



Explain what this large DALY loss that you have calculated means in terms of the health status of the country. Include its impact on the economic productivity of its people and the steps and expenditure that may be needed to improve the situation.

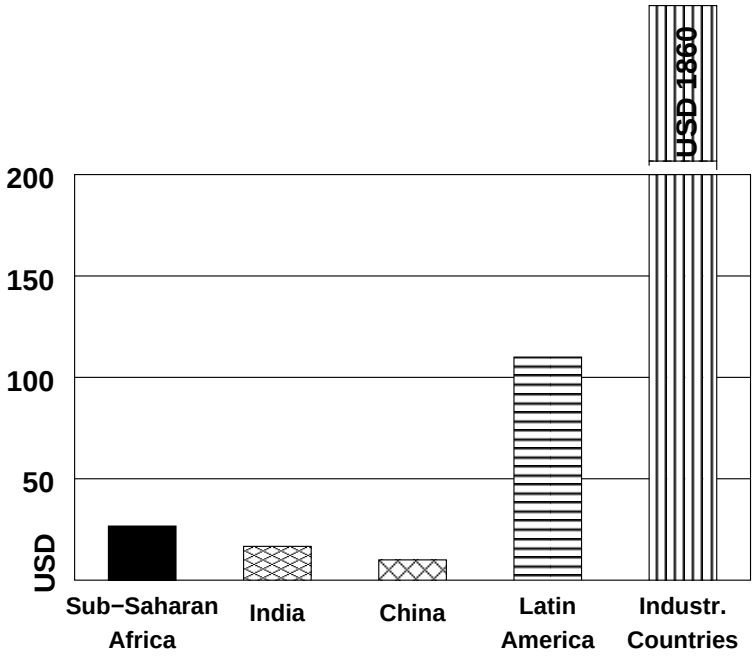
2. Carry out a similar exercise for India and China. You may use the population numbers from Table 2.2 in Section 2.5.4. Calculate the **disability adjusted life days** (**DALD**) for individual regions by using the formula:

$$DALD\ per\ person\ year = \frac{DALY}{total\ population} \times 365$$

Using this formula, find out the DALD loss for each of the above regions. What do you have to say about the DALD losses, especially for China? Compare this with losses in developed countries, and India. [13]

3. Form groups of 4-5 members. Each group selects a class of pupils in any school in their locality for a survey. Record the number of days in a month that each child in the class reports *sick*. Include even minor ailments, like a headache, coughs and colds. Tabulate the following information:

Figure 6.2: Per capita health expenditure in US Dollars at official exchange rate in 1990.



(a) How many students fell sick in a month?

(b) How many days are lost due to different types of sickness?

(c) Comment on the links between the illnesses and seasons.

(d) Comment on frequency of different types of diseases.

Do this for as many months as you can, and preferably for a whole year. Different groups may also choose schools in different areas. Discuss the linkages, if any, to social groups.

4. Figure 6.2 shows the amounts that different regions have spent on health. [18] This is given in terms of per capita health expenditure for each region converted into US dollars using exchange rates as in 1990.

5. Write down over each country/ region given in the Figure 6.2, its per capita health expenditure.

6. Tabulate the values of DALY loss from Figure 6.1 and the per capita expenditure for each country/ region. Which country manages to reduce its DALY loss with a minimum per capita health expenditure?

7. Comment on the relation between per capita health expenditure in a region and the health of the people there. Obtain the product of DALY and per capita expenditure for different regions. What can you say about the countries with a large value of the product? Which country has the minimum value? Comment on its health performance.

8. Carry out a literature search to find out more about China's health care system. On the basis of your findings write a page on what lessons it has for India in the context of health services.

9. The people of the industrialised world seem to spend a lot on health care. Where do you think this money is being spent: in the public or private sector? For preventive or curative care?

10. Do you think there are similarities between the expenditure heads in the USA and the Indian expenses on health? What might be the differences? In what ways are the health priorities of the two countries similar and different?

11. Survey your own area for the number of private clinics versus municipal clinics or hospitals. You can also do this in a different township or locality. Discuss your findings about availability of health facilities in different parts of your town, district and State.

12. Find out what services are covered under public health in the developed countries like the USA. Will it include water supply, sanitation, vaccination programmes? What services will come under public health in India and China?

Several factors have combined to result in improved health status in many parts of the world. Unfortunately, Sub-Saharan Africa continues to lag way behind global averages. You have just discussed through the example of China that better health does not necessarily mean spending large amounts of money. The developed countries, especially those like the USA, spend large amounts on health care, especially in the private sector. Hospitals, doctors, drugs and other related health services seem to gobble up large amounts of US health expenditure. It is to be seen what is happening in India.

Countries differ in the systems they use for financing and delivering health care to their people. China, Chile, Sri Lanka and Zimbabwe have a highly efficient public sector health system. They reach out to the remotest corners of the country. Most countries have a mixed system of both public

and private delivery of clinical services, financed either by the government or by private agencies.

6.2 Reaching health services to the people

The 1993 World Development Report recommends certain steps for improving the effectiveness of reaching health services to the people. [9] There are three aspects involved in reaching health and clinical facilities to the people, and this constitutes the health care delivery systems.

Allocation efficiency The extent to which funding allocated for different health measures reaches its target.

Technical efficiency The extent to which facilities like technically trained people, equipment, etc., are available for a given spending on health.

Reaching the poor The extent to which the poor can access the essential health facilities.

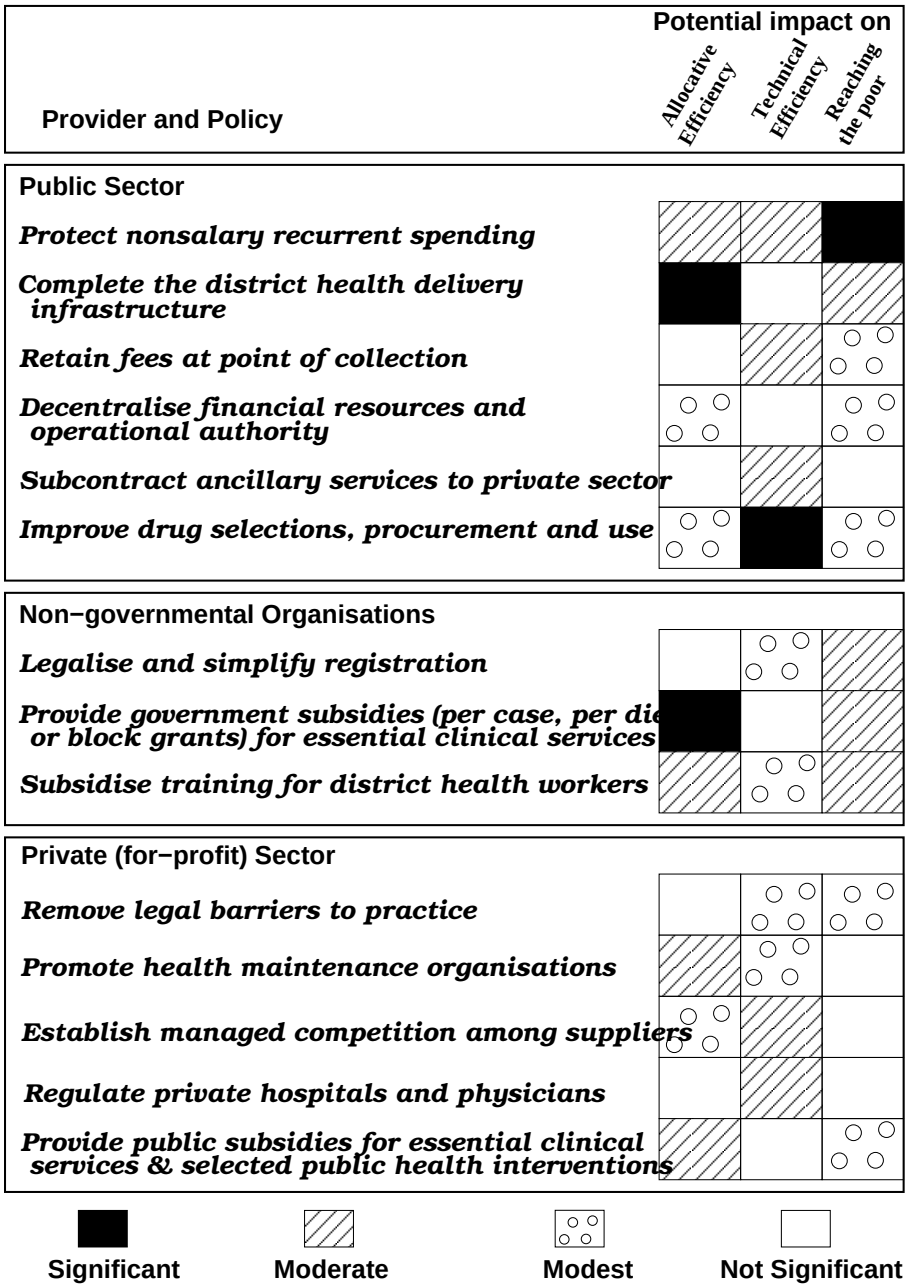
Figure 6.3 shows in tabular form the combination of providers and policies that affect the three aspects of health care delivery systems to different extents. [9] Study the figure and discuss the issues raised below.

1. Figure 6.3 lists several policies under public sector, NGOs and private sector. Choose a partner to discuss with and together explain what each policy suggestion means and its impact. For instance, what does *protecting non-salary recurrent spending* by the public sector mean? How will this contribute towards reaching health services to the poor? What specific (moderate) impact will it have on allocation and technical efficiencies?

2. Study the policy, "*Complete the district health delivery infrastructure*". Find out through a survey and library search the nature of primary health care centres in different districts in India. How are they distributed in the *talukas* and *tehsils* under different districts? How will this policy affect allocation efficiency and technical efficiency of health services? Will it provide to the poor greater access to health care? Do your ideas match with the rating given in Figure 6.3?

3. Rate each policy suggestion as relevant or irrelevant to India. You could choose scales as 1 for relevant, zero for unsure, and -1 for not relevant. Discuss your rankings and arrive at the majority ranking in the class.

Figure 6.3: Policies to improve delivery of health care.



4. Discuss other policies that you think should be included under one of the three heads to improve the health care delivery system in India. Write up a draft recommendation along with a letter giving plausible arguments for your stand. Send the letter and recommendations to the district (or municipal) health officer and to your local newspaper.

5. How do NGOs help in health delivery systems in India? Are there any NGOs operating in your areas? Collect information about what they do in terms of improving the health status of your community. Which aspects of health delivery will improve through partnerships between the government and the NGOs? Find out from local NGOs as well as your local health office (district or ward) about the success of these partnerships in the leprosy and polio awareness programmes.

6. Discuss the role of the private sector in clinical (curative) services. Do you believe India is an efficient provider and policy maker with regard to health issues? Justify your stand with as many examples as you can.

You have realised by now that a country like India with difficult terrains, and a large population, needs a proper mix of policies involving all the three sectors: public and private sectors and NGOs. This is an important component of health financing and planning.

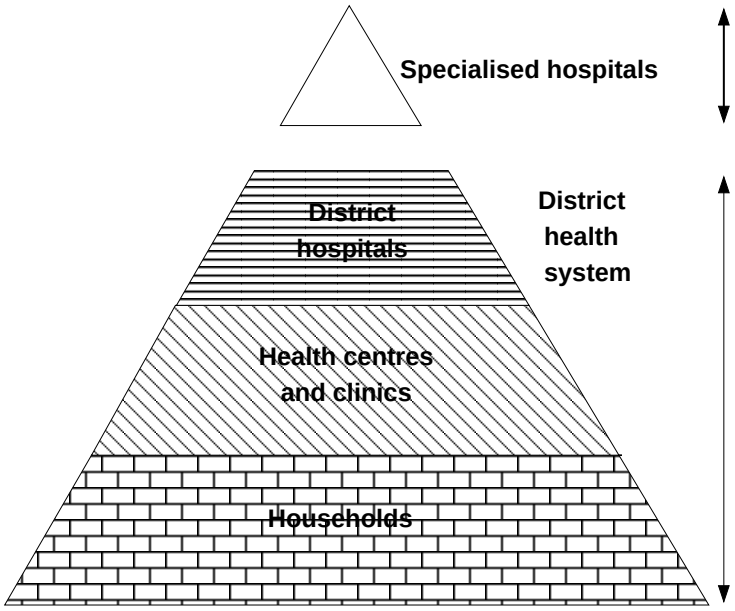
6.2.1 Health system pyramid

A country is said to have a distorted health system if it vests all its facilities, equipment, personnel and drugs in specialised hospitals or district hospitals. What then should be the optimum distribution of health facilities for a country like India? You will answer this question through the activities in this section.
Figure 6.4 is a pyramid showing how the provision of health care should be weighted at different levels of society: households, health centres and clinics, district hospitals and specialised hospitals. [9] Study the figure and discuss the issues raised below.

1. What types of health services does each level of the pyramid represent? For instance, what needs to be reached to households, primary health centres and district hospitals?

2. At which level do the health inputs serve as preventive measures? Inputs at which level will be most cost-effective and beneficial?

Figure 6.4: The health system pyramid, showing where health care is provided.



3. Some countries invest heavily in specialised hospitals. Under what circumstances would such an investment be beneficial? Medical equipment and drugs that are stocked in specialised hospitals can be expensive. Besides these what other expenses would be involved in these hospitals? How many such hospitals are there in your town, city or district? How many of those are financed by the government and how many are financed and managed by private bodies?

4. Find out more about **primary health centres** (**PHC**) in your area? What are the primary duties of those working in the PHC? How many private practitioners are there in the area covered by the PHC? Who is responsible for imparting health education in your area? Are health checks conducted in the municipal schools of your area? How effective are they?

5. You may formulate a questionnaire which you will use for a survey of at least one school in your locality. Write a report on the effectiveness of health checks in municipal schools in your area. Be sure to include the following information in your survey:

   - diseases checked for,
   - follow-up action taken,
   - education and awareness programmes,
   - co-ordination with other departments of the municipality for ensuring basic amenities like clean drinking water and sanitation,
   - provision of nutrient supplements,

   Add your suggestions for improving the health status of your locality.

Nearly all developing countries face a problem of human resource shortage in the health sector. Some of the problems that plague India are:

- Too few primary health care providers, especially in rural areas.
- Neglect of training in public health, health policy and health management.
- Medical graduates find it unsustainable to practice in villages, though medical training in India is highly subsidised by the government.
- Scant attention paid to public health in medical curricula.

Table 6.1: Annual health expenditure in some regions of the world in 1990.

Demographic region	Popn	T.H.E.	H.E.	P.S.	HGNP	USDPC
More Dev. Countries	798	1,483		60	9.2	
Former Soc. Countries	346	49		71	3.6	
India	850	18		22	6.0	
China	1134	13		59	3.5	
Sub-Saharan Africa	510	12		55	4.5	
World	5300	1,702	100	60	8.0	

Note: Popn = Population in millions; T.H.E. = Total health expenditure in billions of US dollars; H.E. = Health expenditure as percentage of world total; P.S. = Public sector health expenditure as percentage of total health expenditure in that region; HGNP = Percentage of GNP spent on health; USDPC = Per capita health expenditure in US Dollar

- The far too academic medical courses do not address local problems and needs.

The Chinese experience in *Public Health* is worth noting. The Union School of Public Health in Beijing, China, has evolved an innovative public health training programme in 1989 to stimulate public health training in the entire country. The course draws students from all faculties, including medicine, environment, economics, management and social sciences. In contrast, in India public health is addressed only in a couple of elite colleges (where the fees are hefty), catering only to medical students!
Considerable restructuring is needed in the health sector in India. The poorest and the remotest should be able to access at least some minimum health services. An efficient system would be one in which even a small input goes a long way in serving the people.

6.2.2 Global per capita health expenditure

To get a good perspective about health status of some of the major global regions, it is of interest to have a look at the expenditure on health related areas at a global level. Table 6.1 uses different measures to contrast the situation in 5 major regions: total health expenditure, public sector health expenditure, and per capita health expenditure. [9]

1. Calculate the health expenditure in each region as a percentage of

the world expenditure on health. Fill your values in the fourth column. Calculate the percentage of world population living in each region. How does the world share of spending on health compare with the world share of population in the different regions? Comment on the patterns in health expenditure. Based on your discussions so far, do you think the spending correlates with the health of the population? Revisit your discussion on the efficiency of spending in Section 6.1.

2. How much does an average Indian spend on health? How does this compare with the spending on health by a Chinese, or a person in the established economy? Calculate these values using columns 2 and 3.

3. What constitutes public sector expenditure on health? Recall the discussion on the health status of the people in Section 6.1. How does the public sector expenditure on health in Sub-Saharan Africa and China compare with the health status of the people in those countries? From this argue that finance is not the only determining factor of the health status in a society.

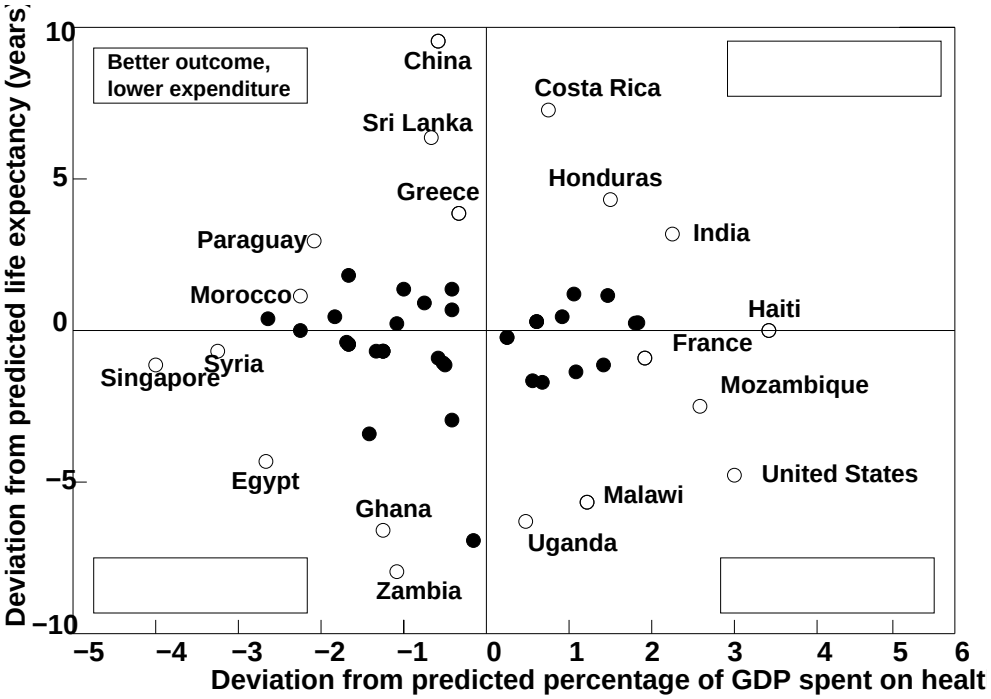
4. Discuss the situation in India with regard to the public sector health expenditure and per capita health expenditure. What do these numbers imply? Does India emphasise preventive or curative care?

Governments play an important role in fostering the health of its people. Building health facilities, providing personnel and drugs constitute its direct involvement. In contrast, government policies concerning education, water supply, sanitation and midday meals also affect your health.
A comparison of India and China with regard to public sector health spending seems to suggest that a higher share of public sector spending leads to efficient spending. An average individual in China spends only USD 11 on health costs, while an Indian spends USD 21 on the average.

6.2.3 Life expectancies and health expenditure

Figure 6.5 shows one possible way to look at correlations between two parameters. [9] The two parameters depicted are life expectancy in a country and the percentage of its GDP that it spends on health. These parameters are not plotted directly. Each country is assigned an *ideal value* for life expectancy and health expenditure that are in keeping with its development status. These are the *predicted* values. The development status is

Figure 6.5: Life expectancies and health expenditures in selected countries: deviations from estimates based on GDP and schooling.



measured through years of average schooling and the GDP. The actual values are also obtained for each country.
The vertical axis indicates how far the actual life expectancy in a country differs from the predicted value. The horizontal axis shows how far total health spending differs from the predicted value as a percentage of the GDP. The activities in this section should help you understand such diverse ways of representing data and analysing the pattern obtained.

1. The scatter plot in Figure 6.5 is divided into four quadrants. Each quadrant can be described in terms of a certain relation between health spending and its outcome for life expectancy. For instance, the countries in the top left quadrant achieve better outcomes with lower health expenditure. Describe the other 3 quadrants in a similar way, and fill the blank boxes.

2. Name the countries in Figure 6.5 that have nearly the same life expectancies as predicted. Does this mean that the health status in these countries is satisfactory? Explain your answer in a few sen-

tences. Recollect that life expectancy is predicted on basis of the country's average years of schooling and GDP.

3. Which countries have life expectancy higher than the predicted value by 5 years or more? Would you say that these countries are doing very well indeed? In fact, does the plot give any indication of the absolute health status of any country? Argue your stand with examples.

4. Name the countries that ought to have a better life expectancy by about 5 years or more based on their levels of income and education. Are you surprised at the countries included in this list? Why?

5. Discuss the relation between health spending and health status in the countries in the upper left quadrant. This is obviously a desirable situation to have. Which country among those shown is the best in this category? How do you think the countries in this category have achieved better health for less money? List all the possible steps that they may have taken.

6. How have you described the quadrant in which India falls? Is India's health status satisfactory? Is it in keeping with her GDP and health spending? What should be the future course of action for India in terms of health spending? Should she spend more on health needs, use the present allocation more efficiently, or change policies to improve delivery systems? List all possible suggestions.

7. Discuss the role of government and the political system in determining the health status of different countries.

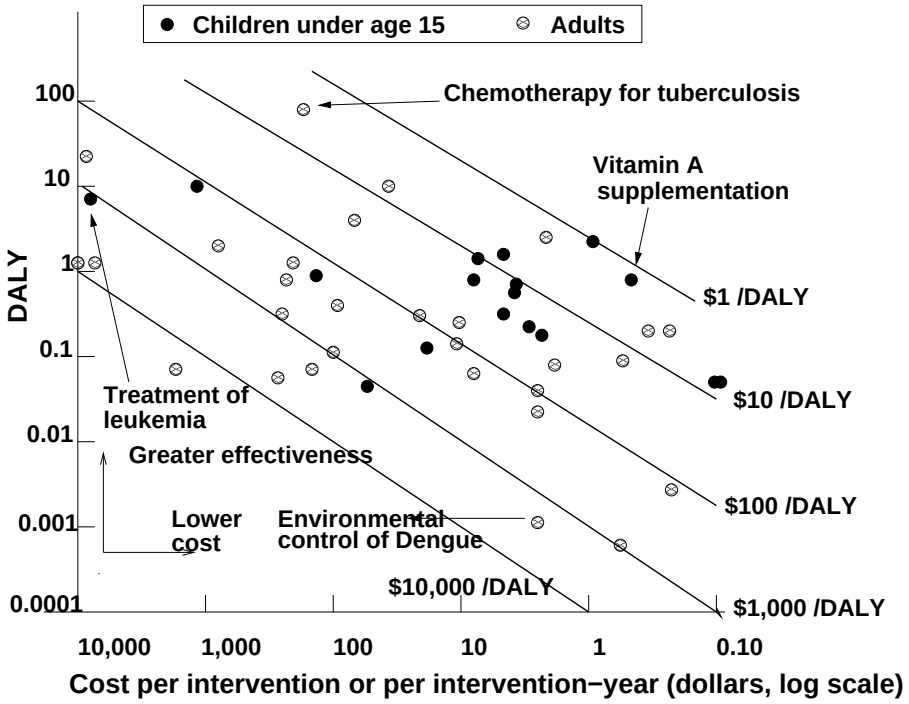
8. Conduct an elocution on the topic: **Higher health spending does not automatically lead to better health, all else being equal**.

You have realised that high expenditure in the health sector does not guarantee an improved health status. Several other factors too determine health. There are links between health spendings, education, political system, environmental conditions and social attitudes. Together they determine the health status of a country.

6.2.4 Benefits and costs of some health interventions

Health planners often recommend a variety of interventions, especially in the area of public health. Interventions are activities meant to reduce disease risks, treat illnesses by drugs, or relieve the consequences of diseases

Figure 6.6: Benefits and costs of some health interventions.



or disability without curing them. Figure 6.6 plots the health outcome obtained for 47 health interventions — as increase in DALYs — as a function of cost in US dollars per intervention or per intervention-year (this could depend on type of intervention required). [9] An intervention-year is an intervention repeated throughout the year rather than being provided only once. Note that an increase in DALY would also correspond to a reduction in DALY loss which you discussed in Section 2.5.4.
Four specific interventions have been labelled. Both axes are scaled in logarithms (to the base 10). Notice that the values along the x-axis decreases towards the right. Each slanting line corresponds to a certain cost-effectiveness measured by USD per DALY increase.

1. List the interventions (at least 20) which improve the health status of people. Next, classify these interventions as preventive, curative or just giving relief from pain or clinical symptoms (palliative in nature).

2. Locate some of the interventions listed by you on the graph points given. Which point would represent the vaccination programmes, say for polio? Remember, some points refer to interventions for chil-

dren under age 15 and others refer to adults above age 15. Before placement of any point, take cues (guide) from the four marked out interventions. This will be a difficult exercise for you. For each intervention, you will have to estimate the cost as well as the the corresponding DALY gain. You may refer to the information on DALY loss in Chapter 2.

3. How effective is chemotherapy for TB in DALY increase? What are the costs involved? Suggest additional steps that would make this intervention more cost-effective. Discuss this in terms of the spread of the disease.

4. The next time you buy a container of oil or fat, read the ingredients on its label. List some other sources of vitamin A (other than in oil or fat). Read from the graph the cost of supplementation process per DALY increase.

5. Similarly, discuss in your class the treatment of leukemia and the environmental control of dengue. Environmental control of dengue involves spraying of pesticides which is not cost effective. How else can dengue and other insect borne diseases be prevented? Look around your house and make a note of stagnant pools of water. Is it difficult to remove these pools? Write a page connecting the environmental control of insect borne diseases and overall town planning. What activities are included in town planning? Discuss this issue in class.

Many interventions like immunisation, pre- and post-natal care, health education and school mid-day meals, are preventive in nature and reap rich dividends for the society. In contrast, treatment of leukemia and dengue or malaria control by pesticide spraying are less cost-effective, though intervention for leukemia results in a greater increase in DALY. Chemotherapy intervention for TB, though expensive, also leads to greater increase in DALY. Besides, chemotherapy stops further spread of this disease in the community or family. Indeed this should make you realise that cost-effectiveness is not the only criterion for opting for an intervention.
Generally, most of the cost-effective measures can be undertaken even at home or at community levels. Cost-benefit analyses of different interventions reveal the importance of primary health care. Interventions which are largely preventive in nature can give rich health bonuses to a community. Communities and governments need to be aware of the gains of individual interventions and plan health programmes accordingly. The

importance of taking the right decisions when planning health interventions cannot be overemphasised for keeping people in the pink of health.

A Comic Relief

Unscramble these groups of letters to form four words. Then arrange the circled letters in the boxes below to form the words suggested by the cartoon.

TAMID

BELAC

NUMBERK

RAYLEY

What the instructor insisted the Gymnast have for lunch.

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