

Human Population and the Environment

INTRODUCTION

A population may be defined as a group of organisms of the same species occupying a given area at the same time. It is subdivided into demes or local populations, which are groups of interbreeding organisms or the smallest collective unit of a population. A population may consist of either *unitary* or *modular organisms*. Insects, fish, amphibians, birds, mammals are examples of unitary organisms where each individual is produced from a zygote and the form and development of individuals is highly predictable. But in modular organisms, the zygote develops into a unit of construction or module, which produces further modules to form a branching structure, therefore form and development of individuals are unpredictable. Sponges, Corals and plants are examples of modular organisms.

POPULATION GROWTH

The most important features of population is the growth i.e. the capacity of increase in individual members. By measuring the size or density of a given population from time to time, we can get rate of increase and can also predict future changes in its size. It can be defined in following ways—

(a) **Logistic growth** : When a population is allowed to grow in a limited space (environment) it shows logistic growth. If we plot a graph between number of bacteria or cells against time, we find a typical S shaped sigmoid curve called population growth curve.

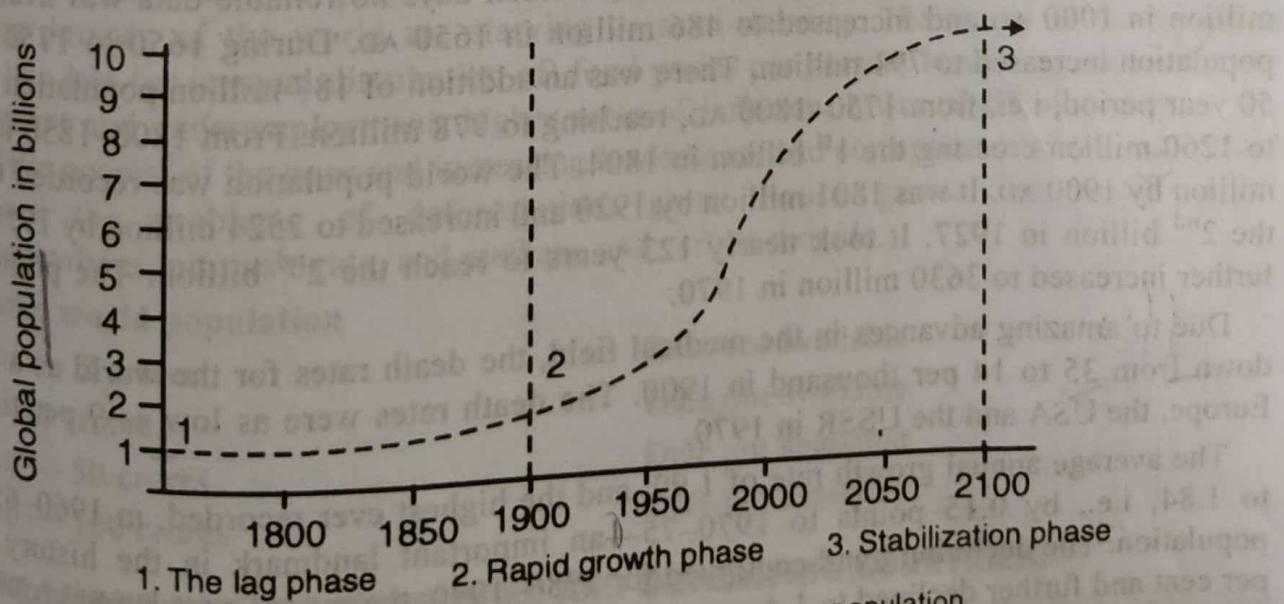


Fig. 13.1. The three phases of growth of human population

It has four phases i.e. 1st phase shows slow rate called lag period, second is accelerating stage followed by a phase of extremely rapid population. The last phase is accelerating multiplication followed by equilibrium phase where there is essentially no net change in population called saturation level or carrying capacity. It is represented by letter K.

The logistic equation shows density dependent growth i.e. growth of a simple population in a limited space with limited resources. It may be written as—

$$\frac{dN}{dt} = \gamma N(1 - N/K)$$

where

$\frac{dN}{dt}$ = rate of growth of population

γ = intrinsic rate of increase (per individual of population)

N = Population size (No. of organisms in population at time t)

K = Carrying capacity of population

(1 - N/K) = density - dependent factor.

(b) **Exponential Growth** : When a population growth curve quickly begins to rise very steeply, the population shows exponential growth. It is J shaped (Fig. 13.1). A population growing exponentially increases accordingly to the equation

$$N_t = N_0 e^{rt}$$

where

N_t = The number of individuals in the population after t units of time

N_0 = initial population size ($t = 0$)

r = exponential growth rate

e = the base of the natural logarithm (about 2.72)

(c) **Geometric Growth** : Geometric growth may be defined as the population growth in which the rate of increase is proportional to the number of individuals in the population at the beginning of the breeding session. When young ones are added to the population only at specific times of the year during well defined reproductive periods, the population is said to have geometric growth. The equation for this is

$$N_t = N_0 \lambda^t$$

where

λ = the geometric growth rate.

POPULATION - GROWTH

Demographers have back projected it as (in olden days no reliable data was available) 275 million in 1000 AD and increased to 486 million in 1650 AD. During 1650 to 1750 the world population increased to 791 million. There was an addition of 187 million population in another 50 year period, i.e., from 1750–1800 AD, reaching to 978 million. From 1800–1850 it increased to 1260 million crossing the 1st billion in 1804. The world population was recorded to be 1650 million by 1900 AD. It was 1801 million by 1920 and increased to 2524 million by 1950, crossing the 2nd billion in 1927. It took nearly 123 years to reach the 2nd billion. The population has further increased to 3630 million in 1970.

Due to amazing advances in the medical field, the death rates for the world as a whole fell down from 35 to 14 per thousand in 1900. The death rates were as low as 9 per thousand in Europe, the USA and the USSR in 1970.

The average annual growth rate of 1.99, and the highest ever recorded, in 1960–65 declined to 1.84, i.e., by 0.15 points to 1970–75—an important landmark in the history of world population. The declining trend continued for 1980–1990, the rate of population growth was 1.7 per cent and further declined to 1.4 percent during 1995–2000.

The first billion (100 crores) was reached by 1804 AD (probably 29 lakhs year to reach the first billion on the earth).

The second billion was added only in next 123 years i.e., in 1927.

The third billion was reached in 1960, i.e., 33 years after 1927.

The fourth billion was added in 1974, in just 14 years.

The fifth billion was added in 1987, i.e., in 13 years.

The sixth billion was added in 1999 in just 12 years and it will be increased by 80 million people a year to reach 8th billion by 2025.

Doubling time : The concept of doubling time implies the time needed for the population to get doubled. It shows that more the growth rate, less will be the doubling time. (Table 13.1)

Table 13.1

Pop (billion) from 0.8 (1750)	Years to 1.6 (1900)	Doubling 150 time (years)
1.25 (1850)	2.5 (1950)	100
2.5 (1950)	5.0 (1987)	37
3.0 (1960)	6.6 (1993)	33

Growth rate %	Population doubling time
Slow growth	< 0.5
Moderate growth	0.5–1
Rapid growth	1–1.5
Very rapid growth	1.5–2
Explosive growth	2–2.5
	3–3.5

On July 11th 2000, the world population was 6.5 billion. According to United Nations estimates the world population will reach 7 billion mark in 2011, 8 billion in 2025 and 9 billion in 2042.

If the population explosion occurs in such a way the world will be more crowded, more polluted, warmer, and more unequal between north and south and more tension ridden. Now itself half billion persons of the world are starving or semi-starving. The world is facing grave problems like less (or unequal distribution of) food grains per person, less living space, greater unemployment and underemployment, higher rates of inflation, lower physical quality of life (PQL) of the poorest of the poor and increasing lawlessness and corruption every where. Added to this are the problems of deforestation, green house gases, low level ozone, chlorofluorocarbons, nitrous oxide, and methane and carbon dioxide.

Estimated world population

3,000 BC — 2 crores	Date not available
1 AD — 25 crores	Date not available
1650 AD — 50 crores	Date not available
1800 AD — 100 crores	Date not available

VARIATION AMONG COUNTRIES

DEVELOPED AND DEVELOPING COUNTRIES

POPULATION GROWTH IN INDIA

India's population was estimated as 120 million in 1800, 194 million in 1860 and 255 million in 1871. The modern population census was started in the year 1881; since then the population

which declined to 238.4 million in 1901, due to severe famine, weak monsoons (failures) and epidemic of plague.

In 1911, the population of our country was 252 million, which fell to 251.3 million in 1921. After the world war, the entire country was swept by the distinct waves of the world wide pandemic of influenza. Due to epidemic there was a slight decline in the population. The year 1921 is called *the year of great divide* because it distinguishes the earlier period of declined population growth from the period of moderately increasing growth. From here the absolute number of population added in each decade increased. It is the turning point which marks the beginning of a regular growth in India's population and also the beginning of a rapid and massive population growth in India.

As a result of improved agricultural techniques, advancement in medical and health technology to control epidemics and diseases, improved sanitary and health services, improved transport, communication and infrastructural facilities, the population of India progressively increased from 251.3 million in 1921 to 361 million in 1951, a net addition of 110 million people. From 1951, population started growing at a phenomenal rate. The population of India was more than doubled during 1951 and 1991. The net addition to the population was 485 million during this 40 years period, reaching to 846 million in 1991. India's population touched 1 billion mark on 11th of May 2000 and according to 2001 census the population of India was 1027 million (i.e., 102.7 crore).

The percentage decadal growth of the country as a whole declined from 23.86 during 1981–91 to 21.34 during 1991–2001, a decline of about 2.52 percent in the decadal growth rates.

Currently, India ranks second in size of the population, next to China. It is estimated that by 2025 AD India's population will touch 1414.3 million mark passing China's population and become the most populous country in the world.

India has only 2.4 percent of the world's land area, but it has to support 16.7 percent of the world's population with an annual growth rate of 1.93 percent (2001). Today for every 2 seconds, 1 baby is born in India and per year 17.6 million babies are born. The absolute addition to the population during the decade 1991–2001 was more than the estimated population of Brazil, the fifth most populous country in the world.

By state wise, Uttar Pradesh is the most populous state in the country with more than 166 million people (which is more than the population of Pakistan, the sixth most populous country in the world). Maharashtra (96.7 million), Bihar (82.8 million) are the second and third largest states in respect of population.

Almost half of the country's population lives in five states, namely, UP, Maharashtra, Bihar, West Bengal and Andhra Pradesh. Interestingly, in the last decade Andhra Pradesh achieved the sharpest decline in the annual growth rate of population (from 2.2 percent during the eighties to 1.3 percent during the nineties), mainly by increasing the level of contraception. However, some states like Bihar continue to register an increase in the annual rate of growth of population (from 2.1 percent in the eighties to 2.5 percent in the nineties).

POPULATION EXPLOSION

As we have seen growth rate of a population is expressed as the number of individuals by which the population increases divided by the amount of time that elapses i.e.

$$\text{Growth rate } (r) = \frac{\text{No. of birth } (b) - \text{Number of deaths } (d)}{\text{average population in time interval}}$$

There are many cases where b is substantially large than d for a period of time, following which conditions change so that d becomes much larger than b . This sort of variations are exponential called "Population explosion" during favourable conditions, followed by a "Crash" when conditions change. For example, diatom populations in Lake Michigan USA undergo such exponential increases at different time of years.

In 20th century population growth increased too much. This is also called population explosion. Economist Malthus said, resources increases 1, 2, 3, 4, ... while population increases 2, 4, 6, 8, ... respectively. In India population growth is much more than twice. Fertility period is of 30 yrs (from 16 to 46 yrs of age). World population is also increasing day by day is 150 per minute 220,000 in one day. Growth rate is 2.2%, with this population will go 7 billion by 2010. World population increase by 9 crore 20 lac per year i.e. one Mexico every year. Do we have the resources and provisions for feeding, housing, educating and employing all those people being added every year. On 11th May 2000 we become one billion i.e. one person out of every 6 persons in this world.

Our resources like land, water, fuels, minerals, forests grasslands etc. are limited and due to population explosion these resources are getting exhausted. Social, economic, religious all type of reasons are responsible for the high rate birth in our country. The important reasons are lower marriage age, lack of education, joint family system, importance of male child, religious misbeliefs, decline in death rate, increased protection of life from natural risks, increase life span, better means of transport and other facilities.

Due to overpopulation some serious problems are like food supply, space (accommodation), unemployment, education, human health, energy crisis etc. There is a fierce debate on population explosion to reduce fertility rates through world wide birth control programmes. This can be achieved by proper education, mass media, educational institutions, raising the marriage age from 18 to 22, providing the facilities like contraceptives, intra uterine devices, birth control bills, sterilization etc. Family planning programme which is Govt. sponsored programme is also one of the effective means to reduce fertility. It was started in India in 1951.

NATIONAL FAMILY WELFARE PROGRAMME

Previously this programme was known as National Family Planning Programme. In the year 1977 the name was changed to *National Family Welfare Programme*. Family planning programme was launched in India in 1952. India was the first country to do so.

Beginning of the programme was modest, i.e., establishment of few FP clinics, distribution of FP educational material, training of health functionaries and research. During the third 5-year plan (1961-66) family planning was declared as *centre of planned development*. Then the emphasis was shifted from *clinic approach to extensive education approach* (i.e., motivating people about *small family norm*). A separate Department of Family Planning was created in 1966 in the Ministry of Health. In 1972, the MTP Act was passed. In April 1976, National Population Policy was framed.

During the emergency period (1976), forcible sterilisation campaign led to the defeat of Congress in 1977 elections. In June 1977, new Janata Government formulated a new population policy and made family planning as voluntary and renamed it as *Family Welfare Programme*. The acceptance of primary health care approach as the key to the achievement of health for all by 2000 AD led to the formulation of National Family Welfare Programme in 1982.

Importance of Family Welfare Programme

1. The family welfare programme occupies an important position in the nation's socio-economic development.

2. Indian population which was 34 crores in 1947 has crossed 100 crore mark by 2000 AD. India has only 2.4% of world's land area but it supports about 15.5% of world's population.
3. India's population is increasing by 1.8 crores every year. To check this galloping growth, the country has laid down long-term demographic goal of achieving an NRR of one by the year 2000 AD.
4. Acceptance of the family welfare services is made voluntary.
5. The programme was 100% centrally sponsored scheme. FP programme was integrated with the MCH services.

ORGANISATIONAL SET UP

1. Central level

At central level Central Cabinet Subcommittee is present. It is headed by Prime Minister. Next level is Population Advisory Council. This is headed by Union Minister of Health and Family Welfare. Members are representatives of various professional bodies and some technical persons. Next level is Central Family Welfare Council, which is headed by union minister and ministers of health and family welfare of all states. It coordinates the work of the programme.

National Institute of Health and Family Welfare, situated in Delhi, is the apex institute. It undertakes research and training in family welfare. Directorate General of Health Services was the central programme officer for Family Planning. He advises Government of India on various aspects of family welfare.

2. State level

Ministry of Health and Family Welfare is the apex organization at the state level. This is headed by the minister of health and family welfare of the respective state. At the state level the family welfare work is organised by State Family Welfare Bureau. The State Family Welfare Bureau has three wings:

- (a) Administrative wing (headed by state family welfare officer and associated by some officers)
- (b) Education and information wing (headed by mass media information officer)
- (c) Field operation and evaluation wing (headed by statistical officer).

3. District level

At district level the work of family welfare is organized by *District Family Welfare Bureau*. This has three wings like the state level. At some districts *Regional Family Welfare Training Centres* are present. These will undertake training of medical officers and para-medical staff.

4. Peripheral level

In rural areas the family welfare work is looked after by *rural family welfare centres* attached to PHC while in urban areas *urban family welfare centres* will take after this work.

5. Village level

At village level the MPHA(F) and MPHA(M) are mainly responsible for the programme. They will take the assistance of CHG, TBA and anganwadi workers..

Goals of National Population Policy

1. NRR 1 (which implies two-child norm)
2. Birth rate 21/100 population
3. Death rate 9 per 1000 population

Programme Strategies

1. Integrated approach
2. Cafeteria approach
3. Welfare approach
4. At risk approach

1. Integrated approach

It is the integration of all the activities like *raising the age of marriage, increasing female literacy, empowerment of women, raising the overall economy of the country etc.* To achieve these objectives, various anti-poverty programmes have been started.

2. Cafeteria approach

The programme is made voluntary and all pressurizations are removed. It stresses more on motivation and education of the people about the benefits of family welfare programme.

3. Welfare approach

In 1977, the word *planning* was removed and changed to *family welfare programme*. This indicates the government's commitment to family welfare rather than family planning.

4. At risk approach

Like any other programme *NFWP* *stresses to ensure maximum support to those who are in need.*

Now family welfare has been given priority in the health development. The Government of India has evolved a comprehensive population policy.

ENVIRONMENT AND HUMAN HEALTH

Environment is the main determinant of health status of a community. Poor housing is a contributor to low physical and mental efficiency. The relation of poor housing and prevalence of disease is easily recognisable. Certainly if we aimed at obtaining optimum conditions for physical and mental well being, in addition to preventing disease, we must include improvement of housing conditions in the programme. Since poor housing is related to poverty, public opinion has tended to consider it an unavoidable evil.

Environment is defined as, "all the external factors (living or non living, material or non-material) present around man." So it is the entire medium in which the population lives and interacts. The environment may be divided into four components:

1. Physical environment
2. Biological environment
3. Social environment
4. Cultural environment

1. Physical environment: Physical environment is defined as, "All those non living things and physical forces present around man". The important components of physical environment are water, air, housing, temperature, lighting, noise and vibration, radiation, refuse and waste such as human excreta etc.

2. Biological environment: Biological environment is defined as, "All those living things (plants, animals, rodents, insects, microbes and other human) present around us".

VALUE EDUCATION

Introduction. Man acts to satisfy his needs or wants. Any thing which satisfies a human need becomes thereby a thing of **Value**. It is the element of desirability and satisfaction that is common to all values, material or non material. In psychology the term value is generally employed to designate a dominant interest, motive or broad evaluative attitude. Value has been defined variously by different educationists, but on the whole it is interpreted to be either a set of feeling or an action. Human behaviour is governed by his values. These are socially approved desires or goals, conceptions or standards by which things are approved or disapproved. Value is a dynamic term used in different aspects. Indian philosophy has used it in sense of state free from pleasure and pain, psychologists in the sense of "psychic energy", sociologists in the sense of "use of time, energy and money" for certain ends. The last theory is named as "Integral theory".

The progress and development of a nation depends upon the quality of the values cherished by its citizens. One of the serious criticism against our educational system is that it lacks value orientation. Our 1986 National Policy on Education and its modifications have strongly advocated value education.

IMPORTANT VALUES

Important values may be described as follows—

- (i) **Religious Value :** It is defined in terms of faith in God. The outward acts of behaviour expressive of this value are going on pilgrimage, is linking in simple life, having faith in religious leaders, worshipping God and speaking the truth. Students (Higher studies) prefer least the religious value.

- (ii) **Social Value** : It is defined in terms of charity, kindness, love and sympathy for the people, efforts to serve God through the service of mankind, sacrificing personnel comforts and gain to relieve the needy and affected of their misery.
- (iii) **Democratic Value** : This value is characterized by respect for individuality, absence of discrimination among persons on the basis of sex, language, religion, caste, colour, race and family status, ensuring equal social, political and religious rights to all and respect for all democratic institutions.
- (iv) **Aesthetic Value** : It is characterized by appreciation of beauty, from proportion and harmony, love for fine arts, drawing painting, music, dance, sculpture, poetry and architecture, love for literature, decoration and the surroundings. It is also the least preferred values in schools.
- (v) **Economic Value** : This value stand for desire for money and material gains. A man with high economic value is guided by consideration of money and material gain in the choice of his job.
- (vi) **Knowledge Value** : This value stand for love of knowledge or theoretical principles of an activity and love of discovery of truth. A man with this value considers a knowledge of theoretical principles underlying a work essential for success in it. He values hard work in studies.
- (vii) **Hedonistic Value** : It is the conception of desirability of loving pleasure and avoiding pain. For a hedonist the present is more important than the future. He indulges in pleasure of senses and avoids pain.
- (viii) **Power Value** : It is defined as the conception of desirability of ruling over others and also of leading others. A man with this value prefers a job where he gets opportunity to exercise authority over the others.
- (ix) **Family Prestige Value** : It is defined as the conception of desirability of such items of behaviour roles, functions and relationship as would become one's family status. It implies respect for roles which traditionally characteristic of different castes of Indian society.
- (x) **Health Value** : It is the consideration for keeping the body in a fit state for carrying out one's normal duties and functions. It also implies the consideration for self preservation.

AIMS AND VALUES

People all over the world are going through "Value Crisis" due to science and technology. Future India is also most likely to suffer the 'Future shock' of value crisis. Because of this space age value crisis, the need for the preservation and inculcation of moral values of human life is keenly felt with a growing sense of urgency all over the world.

It is known, that aims of life are correlated with the aims of education. But, what aims are to be cherished? The aims of education is the value theory. Aims are value commitments. Aims which arise out of values are to be justified philosophically not based on dogmatic belief. It is suggested that modern civilization cannot survive unless it is inspired by ethical and spiritual values. Among these values the most important, which they stressed was love, greed, hatred, violence, exploitation of others are the order of present society.

Different educational commissions and committees appointed in India in the context of either education in general or value education in particular, have strongly recommended various direct and indirect measures, means and methods for the inculcation of human values through education.

HIV/AIDS

Keywords & Definitions :

AIDS = Acquired Immuno Deficiency Syndrome

Acquired = which is not present since birth but acquired after birth.

Immunodeficiency = Deficiency of immune functional cells; deficiency to perform the immunological function.

Syndrome = A group of diseases and signs and symptoms of illness.

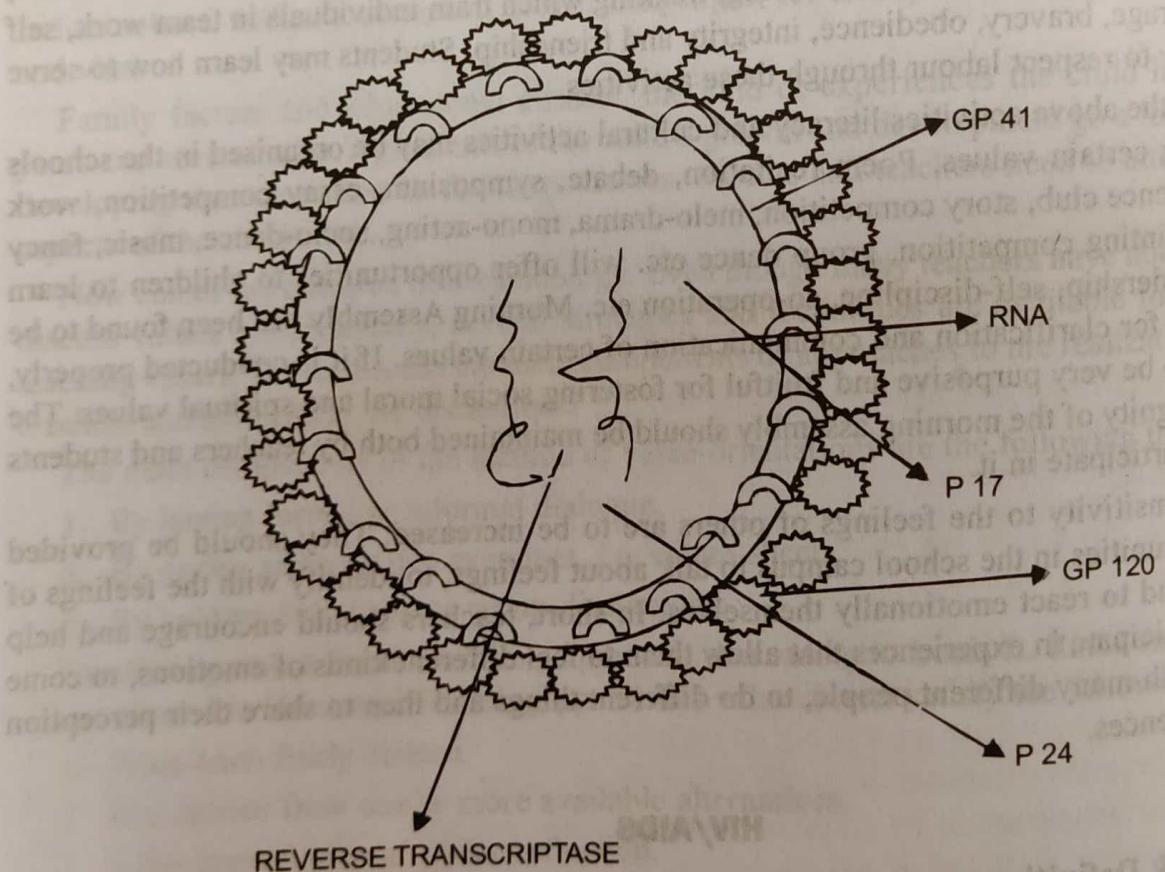
HIV = Human Immunodeficiency Virus

HIV positive = The presence of antibodies against HIV in human body is termed as HIV positivity and the person is called HIV positive (Seropositive). It takes 6-12 weeks after infection for antibodies to rise to detectable levels. There is thus a window period during which the infected person may transmit the infection despite being seropositive.

The latest killer disease that has created nightmares for the medical experts is the Acquired Immuno Deficiency Syndrome (AIDS). Its terrifying spread has earned it the title of the "Pandemic" or an epidemic, which is out of control. This disease has wreaked the social & economic devastation. In the absence of medical defence against AIDS, public education is the only weapon in the fight to limit the spread of the infection. Only by influencing personal behaviour & life style can we hope to maintain the ravages of AIDS throughout.

Virus : HIV belongs to the family Retroviridae and subfamily Lentivirinae. Two different types of HIV have been recognized and are called as HIV-1 and HIV-2. Both differ in geographical distribution, biological & molecular characteristics and extent of transmissibility. These viruses store their genetic information as RNA. HIV-1 has three groups; HIV-1 major groups (HIV-1 M), outlier (HIV-1 O) and HIV-1 new (HIV-1 N) group. HIV-1 major groups can be further classified into different subtypes or clades designated A-K.

HIV is 120 nm icosahedral, enveloped, RNA virus. HIV comprises of an outer envelope consisting of lipid bilayer with uniformly arranged 72 spikes or knobs of gp 120 and gp 41. Inside the protein core surrounding two copies of RNA. Core also contains viral enzymes, Reverse transcriptase, integrase and protease, all essential for viral replication and maturation.



Major antigens of HIV-1 :

- a. Envelope antigen:
 - Spike antigen
 - Transmembrane Pedicle antigen
- b. Matrix antigen
- c. Core antigen

Antigens :

- | |
|--------|
| gp 120 |
| gp 41 |
| p 17 |
| p 24 |

HIV replication:

Gp120 binds to host cell receptor

Reverse transcription

Proviral DNA synthesis

Integral with host cell DNA

Viral proteins synthesis

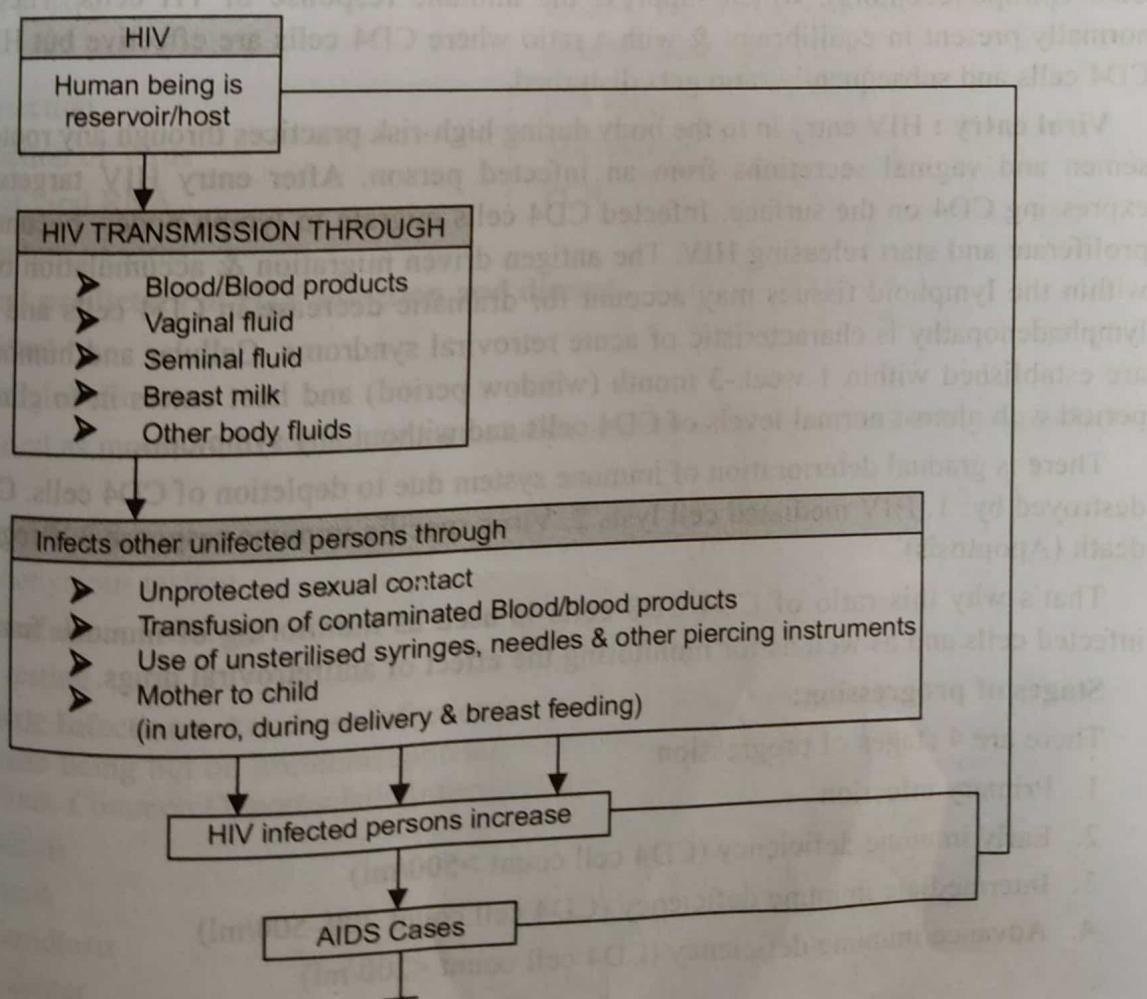
Virus assembly and budding

Maturation of core proteins

Transmission :

HIV infection can be transmitted by following modes and the efficiency of HIV transmission is:

Transmission Route	Percent Efficiency	Percentage of total cases	
		World over	India
Blood Transfusion	90-95	5	7
Perinatal	20-40	10	10
Sex	0.1-1	75	80
Injecting drug abusers	0.5-1.0	10	7.3

Transmission cycle of HIV:

Sex: Homosexual and heterosexual contact with HIV infected partner.

Parenteral: Infected Blood, Blood products; infected needle & syringes, IVDU.

Perinatal: From infected mother to her child (Before 10-30%, during and after delivery 40, 60%) and 30% through breast milk. Most common is the heterosexual contact.

HIV is not transmitted by :

Shaking hands, hugging, dry kissing, sneezing, coughing, mosquito bite, toilet sharing, sharing of telephones, offices, playing, traveling together, sharing cups, living in same room, donating blood aseptically.

NATURAL HISTORY OF HIV INFECTION/AIDS

The natural history of any disease refers to the stages through which a disease passes in the absence of any intervention. Clear knowledge of natural history of a disease helps in identifying the stages of disease vis a vis appropriate intervention to prevent or control the disease.

Usually whenever human body comes in contact with any type of infection, our immune system fights against these agents. However, the horribleness of AIDS lies in fact that it destroys the immune system itself thereby making the body susceptible to the all kinds of diseases and infections.

Further, the major pillars of the immune system are antibody mediated (B Cell or Humoral immunity) and cellular (T cell or CMI) immunity. Of which important T cells are T helper cells (Cells with CD4 epitope/receptors), which cause immunity, and T suppressor cells (Cells with CD8 epitope/receptors), which suppress the immune response of TH cells. These cells are normally present in equilibrium & with a ratio where CD4 cells are effective but HIV destroys CD4 cells and subsequently ratio gets disturbed.

Viral entry : HIV entry in to the body during high-risk practices through any route via blood, semen and vaginal secretions from an infected person. After entry HIV targets onto cells expressing CD4 on the surface. Infected CD4 cells migrate to lymph nodes, become activated, proliferate and start releasing HIV. The antigen driven migration & accumulation of CD4 cells within the lymphoid tissues may account for dramatic decrease in CD4 cells and generalised lymphadenopathy is characteristic of acute retroviral syndrome. Cellular and humoral responds are established within 1 week-3 month (window period) and host enters in to clinical latency period with almost normal levels of CD4 cells and without any symptoms.

There is gradual deterioration of immune system due to depletion of CD4 cells. CD4 cells are destroyed by: 1. HIV mediated cell lysis 2. Virus specific immune response 3. Programmed cell death (Apoptosis).

That's why this ratio of CD4/CD8 cells is used as monitoring of immune functionality of infected cells and as well as for monitoring the effect of antiretroviral drugs.

Stages of progression:

There are 4 stages of progression:

1. Primary infection
2. Early immune deficiency (CD4 cell count $>500/\text{ml}$)
3. Intermediate immune deficiency (CD4 cell count 200–500/ml)
4. Advance immune deficiency (CD4 cell count $<200/\text{ml}$)