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Unit-I

Demography

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Demography

Unit – I

1.1 Definition:

Demography is the scientific study of human population, including, its size, distribution, composition, and the factors that determine changes in its size distribution, composition. From this definition demography focuses on the five aspects of human population:

1. Size
2. Distribution
3. Composition
4. Population dynamics
5. Socioeconomic determinants and consequences of population change.

- Population size- it is simply the number of persons in a given area at a given time.
- Population distribution- it refers to the way the population is dispersed in geographic space at a given time.
- Population composition- it refers to the numbers of person in sex, age and other "demographic" categories.

Demography is the study of population processes and characteristics.

- The processes include growth, fertility, morality, migration and population ageing.
- Characteristics are varied-age, sex, birthplace, family structure, health, education and occupations.

The definition of demography can be extended to include and to cover the social, economic, historical and political characteristics of the population and related demographic processes.

1.2 Nature of Demography:

- Demography is concerned with the description, analysis and understanding of population phenomena. It seeks a mathematical and statistical description of human populations.

- Demography is a social science discipline and generally considered an interdisciplinary subject.
- Demography data and observations display patterns and trends which often require some explanations. Such explanations often go beyond the pure statistics collected to explain the causes and/or consequences of the observed patterns and trends.
- The demographer has to relay on other subjects in the social and medical sciences which study events which impinge on the demographic processes. This reflects the multi-disciplinary aspects of demographic study.
- The medical pathologists help the students of population to account for the trends in morbidity and the cause of death.
- The biologist explores the physiology of procreation and therefore throws light on some of the factors affecting fertility.
- The economist helps the student of population to understand the relationship between material resources and the number of people a particular area can support.
- The geographer's contribution might shed light on why people move as well as on prevailing land-use systems which impinge on the life and well-being of the population.

1.2.1 Development of Demography

- Demographic thoughts traced back to antiquity, and were present in many civilizations and cultures, like Ancient Greece, Ancient Rome, China and India. Demography is made up of two word Demos and Graphy. The term Demography refers to the overall study of population.
- In the Middle ages, Christian thinkers devoted much time in refuting the Classical ideas on demography. Important contributors to the field were William of Conches, Bartholomew of Lucca, William of Auvergne, William of Pagula, and Muslim sociologists like IbnKhaldun.
- One of the earliest demographic studies in the modern period was Natural and Political Observations Made upon the Bills of Mortality (1662) by John Graunt, which contains a primitive form of life table. Among the study's findings were that one-third of the children in London died before their sixteenth birthday. Mathematicians, such as Edmond Halley, developed the life table as the basis for life insurance mathematics. Richard Price was credited with the first textbook on life contingencies published in 1771, followed later by Augustus de Morgan, 'On the Application of Probabilities to Life Contingencies' (1838).
- In 1755, Benjamin Franklin published his essay Observations Concerning the Increase of Mankind, Peopling of Countries, etc., projecting exponential growth in British colonies. His work influenced

Thomas Robert Malthus, who, writing at the end of the 18th century, feared that, if unchecked, population growth would tend to outstrip growth in food production, leading to ever-increasing famine and poverty (see Malthusian catastrophe). Malthus is seen as the intellectual father of ideas of overpopulation and the limits to growth. Later, more sophisticated and realistic models were presented by Benjamin Gompertz and Verhulst.

- In 1855, a Belgian scholar Achille Guillard defined demography as the natural and social history of human species or the mathematical knowledge of populations, of their general changes, and of their physical, civil, intellectual, and moral condition.
- The period 1860-1910 can be characterized as a period of transition where in demography emerged from statistics as a separate field of interest. This period included a panoply of international 'great demographers' like Adolphe Quételet (1796– 1874), William Farr (1807–1883), Louis-Adolphe Bertillon (1821–1883) and his son Jacques (1851–1922), Joseph Körösi (1844–1906), Anders Nicolas Kaier (1838– 11 1919), Richard Böckh (1824–1907), Émile Durkheim (1858-1917), Wilhelm Lexis (1837– 1914), and Luigi Bodio (1840–1920) contributed to the development of demography and to the toolkit of methods and techniques of demographic analysis.

1.2.2. Scope of Demography:

The scope of demography is very wide. It includes the subject matter of demography, is it a micro or macro study? Whether it is a science or art? These are vexed questions about the scope of demography about which there is no unanimity among writers on demography. We discuss them as under:

Size and Shape of Population:

Generally, the size of population means the total number of persons usually residing in a definite area at a definite time. The size and shape of population of any region, state or nation are changeable. It is because every country has its own unique customs, specialties, social-economic conditions, cultural atmosphere, moral values, and different standards for acceptance of artificial means of family planning and availability of health facilities, etc.

Aspects Related to Birth Rate and Death Rate:

Birth rate and death rate are the decisive factors that influence the size and shape of the population and therefore their importance in population studies is crucial. In addition to these, factors like marriage rate, belief regarding social status and marriage, age of marriage, orthodox customs related to marriage, early marriage and its effects on the health of the mother and the child, child infanticide rate, maternal death, still birth, resistance power, level of medical services, availability of nutritious food, purchasing power of the people, etc. also affect the birth and death rate.

Composition and Density of Population:

In the subject matter of demography, the study of composition and density of population is important. In the composition of population factors like the sex ratio, race wise and age- group wise size of population, the ratio of rural and urban population, distribution of population according to religion and language, occupational distribution of population, agricultural and industrial structure and per sq. km. density of population are very important.

Socio-Economic Problems:

Out of the many problems relating to population growth, the effects of high density due to industrialization in the urban areas are of more importance as they affect the socioeconomic life of the people. Problems like slum areas, polluted air and water, crime, addiction to liquor, juvenile delinquency, and prostitution, are also important subjects of study in demography.

Quantitative and Qualitative Aspects:

Along with the quantitative problems of population, the qualitative problems also form part of population studies. Moreover, the study of demography includes the availability of physicians in the total population, number of hospitals, the number of beds in hospitals, expectation of life at birth, daily availability of minimum calories, resistance power, advertisement of family planning programmed and its development, the changes brought in the attitudes of people regarding child birth and adequate medical facility for delivery, etc.

Main Sources of Demographic Data

1. Population Census 2. Registration 3. Sample Surveys.

1. Population Census: A population census is an official enumeration of the inhabitants of a country with statistics relating to their location, age, sex, marital status, literacy status, language, educational level, economic activity, number of children, migration, etc. Population census is a regular feature of all progressive countries, whatever be their size and political set up. It is conducted at regular intervals, usually every 10 years, for fulfilling well-defined objectives.

Salient Features of Census: A census has the following features:

- A census is usually conducted after an interval of 10 years.
- The census covers the entire country or a part of it.
- The census operations are completed within specified dates.
- It is organized and conducted by the Government through the Census Commission of the country.
- For conducting the census a reference period is determined by the Census Commission at that point of time.

- A household or family is treated as a unit. However in large census operations, migrant individuals and homeless persons are also enumerated at night at their places of rest or sleep.
- Before starting the census operations, some preliminary steps are taken by the Census Commission such as preparation of schedules, lists of households in each area, training of enumerators, etc.
- The filled up census schedules are collected, examined and analyzed statistically by the Census Commission.
- The census data are published for circulation.
- The census operations involve collection of information from households from door to door by enumerators. In some countries, schedules are sent by post and the required information is collected.

Uses of Census:

- ❖ It provides primary population data relating to age, sex, marital status, economic activities, occupations, migration, literacy, etc.
- ❖ Population data throw light on the socio-economic problems of the country such as the status of women, male-female sex ratio, population density, literacy level, urbanization, living standards, etc.
- ❖ These data help researchers, administrators, planners and social organizations to suggest and adopt measures to solve the various problems.
- ❖ Census data are used for constructing life tables by insurance companies.
- ❖ They are highly useful for making population projections.

2. Registration: Another source of population data is the registration of life or vital statistics. Every person is required by law to register with a specified authority such demographic events as birth, death, marriage, divorce, etc. Unlike the census, registration of vital events is a continuous process throughout the year. It is an important source of information about citizenship, marital status, succession rights and settlement of disputes regarding birth and death.

Registration is a secondary source of demographic data which is available from four sources:

(1) Vital Registration (2) Population Register (3) Other Records, and (4) International Publications.

1. Vital Registration: Recording of vital events (or vital statistics) like births, deaths, marriages, divorces, etc. is obligatory on the part of every citizen in a country. For instance, the birth of a child has got to be registered with the municipal corporation of the town where the child is born in India.

2. Population Register: This is another secondary source of collecting population data. A number of European and Asian countries like Belgium, Sweden, Korea, Israel, etc. maintain permanent population register for administrative and legal purposes. It contains the names,

addresses, age, sex, etc. of every citizen, of those who migrate to other countries and who enter the country. The population registers helps in verifying the correctness of the census figures for that year.

3. Other Records: Besides the population register, there are other records which are secondary sources of demographic data in developed countries. They maintain population records to meet social security schemes like unemployment insurance and allowance, old age pension, maternity allowance, etc. In some countries, insurance companies maintain life tables relating to births and deaths and population trends. Selective demographic data are also available from electoral lists, income tax payers' lists, telephone subscribers' lists, etc. Though such administrative data are limited, they are helpful in providing for carrying out sample surveys.

4. International Publications: Other sources of demographic data for the world and different countries are the United Nations Demographic Year Book and Statistical Year Book. The World Health Organization (WHO) publishes a monthly journal Epidemiological and Vital Records which gives data on public health and mortality of different countries. The United Nations Development Programmed (UNDP) in its Human Development Report and the World Bank in its World Development Report publish annually demographic data relating to population growth, projections, fertility, mortality, health, etc. for countries of the world.

3. Sample Surveys: Sample survey is another source of collecting population data. In a sample survey, information is collected from a sample of individuals rather than from the entire population. A sample consists of only a fraction of the total population. Several different population samples can be drawn on the basis of sample surveys such as the number of abortions, contraceptives used, etc. for the study of fertility. Some countries conduct national sample surveys based on Random Sampling or Stratified Random Sampling. Whatever method is adopted, care should be taken to select a representative sample of the total population.

Limitations: The sampling method has certain limitations.

- It is highly subjective and it is possible to arrive at different data with different samples of the same population.
- There are bound to be errors in coverage, classification and sampling of population data.
- As the survey requires many surveyors who may not be efficient and sincere, it is subject to large errors.
- If the informants in the sample do not cooperate with the surveyors, the survey will not give accurate results.

Current status:

- The current population of India is 1,434,697,700 as of Monday, December 18, 2023, based on World meter elaboration of the latest United Nations data [1].
- India 2023 population is estimated at 1,428,627,663 people at midyear.
- India population is equivalent to 17.76% of the total world population.

- India ranks number 1 in the list of countries (and dependencies) by population.
- The population density in India is 481 per Km^2 (1,244 people per mi^2).
- The total land area is 2,973,190 Km2 (1,147,955 sq. miles)
- 36.3 % of the population is urban (518,239,122 people in 2023)
- The median age in India is 28.2 years.

1.3 Chandrashekar-Deming index:

Chidambara Chandrasekaran, (1911–2000), was noted Indian demographer and statistician, was educated in India, UK and the US. He graduated from Morris College, Nagpur, with a B.Sc. degree, followed by a M.Sc. degree from Nagpur University, and a PhD degree in Statistics from University College London in 1938. He was also awarded an MPH degree from Johns Hopkins School of Hygiene and Public Health in 1947. He was related to two Nobel Prize winners: C. V. Raman was his uncle and Subrahmanyan Chandrasekhar was his cousin.

He was a Professor of Biostatistics at the **All India Institute of Hygiene and Public Health, Calcutta**, from 1941-48 and 1954-58. This was followed by a stint as the Director of the Demographic Training and Research Centre, Mumbai (later renamed as the International Institute of Population Sciences) from 1959-64.

One of his most important contributions to the field of demography was in developing a technique to estimate the number of vital events by comparing results from two different systems (such as a sample survey and a vital registration system). This technique is commonly known as Chandra-Deming formula (also known as Dual Record System) and was first proposed in an article in 1949 [4]"On a method of estimating birth and death rates and the extent of registration."

Chanrasekharan and Deming (1949) developed the method to estimate the number of births or deaths missed by the Registrars. To estimate the missing number of events they matched individuals from two independent lists originally a" Registrar"s list and the list obtained via house to house canvass, called "Investigator's list (Dual enumeration) Each list is supposed to miss some births or deaths and each serves as a criteria for judging the completeness of the other . The basic characteristics of this method allowed estimation of the ""dark figure "" and in some cases standard errors and confidence interval as well.

In the development of the theory, allowance was made for the fact that the chance of an event being missed by one list (" Registrar's list or house to house canvass) may not be independent of its chance of being missed on the other list, where there is likely to be lack of independence.

This is done by sub dividing the data into small homogeneous groups, such as might be formed by small areas, sex and age classes, domiciliary and institutional births: then by estimating number of events in these groups separately and summing them for a total.

Derivation of formula:

Let

R: The list prepared by the Routine Registrar

I : The list prepared by the Investigator

C: Number of events registered by both" R" &" I "
N_1: Number of events registered "R" only (Not in "I")
N_2: Number of events registered by "I" only (Not in "R")
Y: Number of events missed by both" R" &" I "
N: number of events actually occurred

The objective is to estimate Y and subsequently N

Based on the above information following table can be constructed:

List prepared by	Number of events detected	Number of events missed
R	$C+N_1$	$N-(C+N_1)$
I	$C+N_2$	$N-(C+N_2)$

Probability that an event is detected by 'R' (p_1) = $(C+ N_1) / N$
Probability that an event is detected by " I "(p_2) = $(C+ N_2) / N$
Probability that an event is missed by " R"(q_1) = $1- (C+ N_1) / N = (N-C- N_1)/ N$
Probability that an event is missed by " I"(q_2) = $1- (C+ N_2) / N = (N-C- N_2)/ N$

Since the events are collected by two independent agencies, therefore the probability that an event is missed by both" R" &" I "is

$$q_1 q_2 = \frac{(N-C-N1)}{N} - \frac{(N-C-N2)}{N}$$

Therefore expected number of events missed by both" R" &" I "

$$= \frac{N(N-C-N1)}{N} \quad \frac{(N-C-N2)}{N} \qquad \ldots\ldots\ldots(1)$$

$$= \frac{(N-C-N2)(N-C-N2)}{N}$$

Again the number of distinct events collected by both" R" &" I" = $C+ N_1 + N_2$

Y=The number of distinct events missed by both" R" &" I "= $N- (C+ N_1 + N_2)$ …… (2)

Equating (1) and (2)

$$\frac{(N-C-N2)(N-C-N2)}{N} = N- (C+ N_1 + N_2)$$

or, $(N-C- N1) (N-C- N2) = N(N-C- N_1 - N_2)$
or, $N_1 N_2 = C (N-C- N_1 - N_2)$
or, $N_1 N_2 = C Y$
or, $Y = N_1 N_2 / C$

Hence the estimated number of events missed by both "R"& I "(Y) = $N_1 N_2 / C$ and subsequently estimated number of events(N) = $C + N_1 + N_2 + N_1 N_2 / C$

It can be shown that estimated value of N is the unbiased estimate in the limit when N becomes large and the assumption just mentioned is valid.

The standard error of $N = \sqrt{N}\, q_1 q_2 / \sqrt{p_1 p_2}$.

95% Confidence interval of $N = N \pm 1.96 \sqrt{N}\, q_1 q_2 / \sqrt{p_1 p_2}$

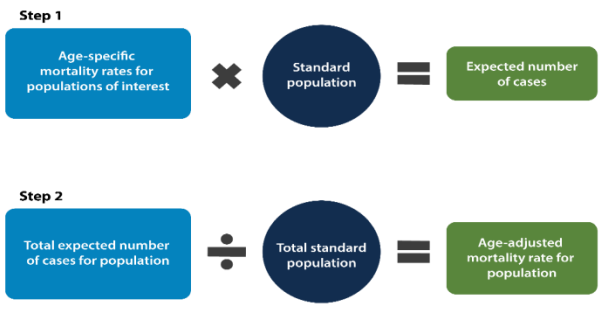
1.4 Adjustment of Age:

Sometimes, health statistics are used to compare different groups to assess how healthy two different groups of people are or how healthy a certain group is during two different time periods. However, different groups or even the same group at different time points may not be comparable due to various factors like population size, and confounding variables such as age or sex. To compare these different groups accurately, health statistics need to be standardized or **adjusted**.

For example, since older people are more likely to get ill, and younger people are more likely to injure themselves, age-adjustment (or age standardization) can make studies more accurate. Although age-adjustment is the most common type of adjustment, health statistics can be adjusted using other factors like sex as well.

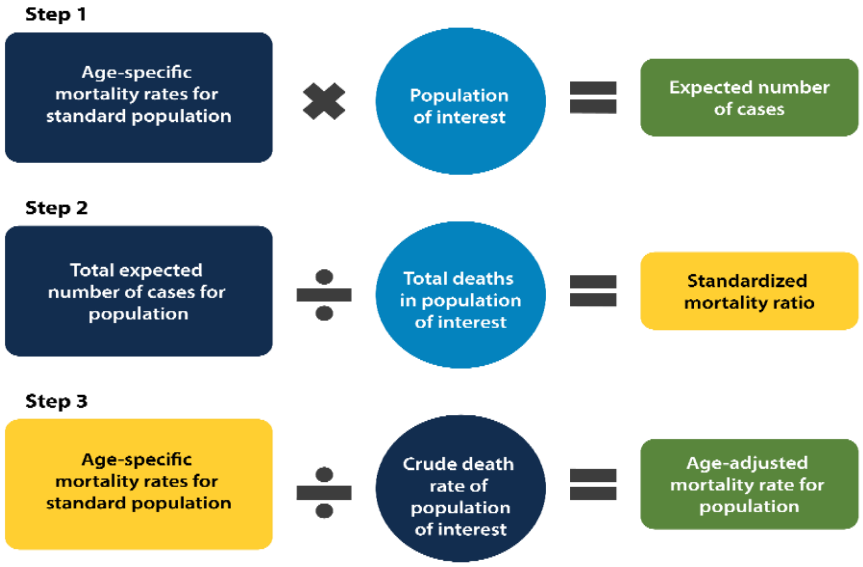
Age is the most common confounding variable that is adjusted or controlled for in studies. As stated earlier, a confounder is a variable that is related to both the independent and dependent variables. Without adjusting for a confounder, the effects of the confounder are mixed in with the effects of the independent variable of interest. If that's the case, then the conclusions drawn from the statistics may be inaccurate.

Direct Standardization: To be able to better compare groups while adjusting for age (or any confounder), we use a process called **direct standardization**. When we use direct standardization, we assume both groups have the same number of people. Then we calculate the expected number of deaths and death rates in both groups. By doing this, the two populations can be directly compared, independent of the age distribution of each group. With direct standardization, the specific death rates per group (usually age) must be known.



Indirect Standardization:

If the age-specific mortality rates (these are used to calculate expected deaths) for the population of interest are not known, researchers can use **indirect standardization**, which requires only the observed deaths and age structure of the population of interest. Direct standardization is generally preferable because the populations of interest are compared to just one standard population (usually the U.S. Census population). Indirect standardization, however, can be preferable with small sample sizes in different age groups.



It is important to remember that age-adjusted rates are not the actual rates of death or disease in the population – the actual unadjusted rates are called **crude rates**. Age-adjusted rates are only useful for comparisons to other populations.

1.5 Whipple's index:

Whipple's index (or **index of concentration**), invented by American demographer George Chandler Whipple (1866–1924), is a method to measure the tendency for individuals to inaccurately report their actual age or date of birth. Respondents to a census or other survey sometimes report their age or date of birth as a round number (typically ending in 0 and 5), or to be more culturally favorable, for example, so that they appear younger or to have been born on a date considered luckier than their actual date of birth. The process of reporting a rounded or "lucky" age is known as **age-heaping**.

Whipple's index detects a preference for ages ending in0, 5, or both. Whipple's index is constructed for the age group of 23–62 years using the following formula:

$$\text{Whipple's index for the 5-year range} = \frac{\sum(P25+P30+P35+\cdots+P60)\times 100}{1/5\sum(P23+P24+P25+\cdots+P62)}$$

$$\text{Whipple's index for the 10-year range} = \frac{\sum(P30+P40+..+P60)\times 100}{1/10(\sum(P23+P24+P25+\cdots+P62)}$$

Whipple's index varies from 0 to 500. A value of 0 indicates that digits '0' and '5' are not reported, 100 means there is no preference for '0' or '5', and a maximum of 500 is seen when only the digits '0' and '5' are reported in the age data. The inference about age distribution based on this index is as follows: greater than105 = highly accurate; 105–109.9 = fairly accurate; 110–124.9 = approximate; 125–174.9 = rough; greater than 175 = very rough.

1.6 Myer and US indices

- It is conceptually similar to Whipple`s index, except that the index considers preference (or avoidance) of age ending in each of the digits 0 to 9 in deriving overall age accuracy score.
- The theoretical range of Myers` Index is from 0 to 90, where 0 indicates no age heaping and 90 indicates the extreme case where all recorded ages end in the same digit.

Measurement of Myer and UN indices:

Myer's blended index is calculated for the age above 10 years and shows the excess or deficit of people in ages ending in any of the 10 digits expressed as percentages. It is based on the assumption that the population is equally distributed among the different ages. The steps in the calculation of Myers' blended index are as follows:

- Sum of populations ending in each digit over the whole range starting with the lower limit of the range (e.g., 10, 20, 30, 40… 11, 21, 31…)
- Ascertain sum excluding the first population combined in step 1 (e.g., 20, 30, 40… 21, 31, 41…)
- Weight the sums in steps 1 and 2 and add the results to obtain a blended population (e.g., weights 1 and 9 for 0 digit, weights 2 and 8 for 1, etc.)
- Convert distribution in step 3 into percentages.
- Take the deviation of each percentage in step 4 from 10.0, which is the expected value for each percentage.
- A summary index of preference for all terminal digits is derived as one half of the sum of the deviations from 10.0%, each without regard to signs.

1.7 Population size and growth in India

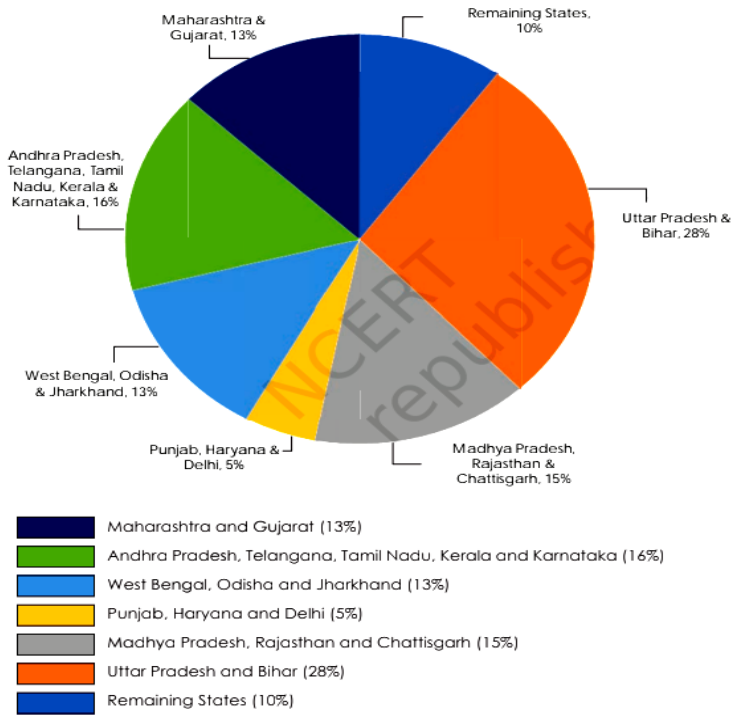
India is the second most populous country in the world after China, with a total population of 121 crores (or 1.21 billion) according to the Census of India 2011. The growth rate of India's population has not always been very high. Between 1901and 1951 the average annual growth rate did not exceed 1.33%, a modest rate of growth. In fact between 1911 and 1921 there was a negative rate of growth of – 0.03%. This was because of the influenza epidemic during

1918–19 which killed about 12.5 million persons or 5% of the total population of the country (Visaria and Visaria 2003: 191). The growth rate of population substantially increased after independence from British rule going up to 2.2% during 1961-1981. Since then although the annual growth rate has decreased it remains one of the highest in the developing world.

The comparative movement of the crude birth and death rates. The impact of the demographic transition phase is clearly seen in the graph where they begin to diverge from each other after the decade of 1921 to 1931. Before 1931, both death rates and birth rates were high, whereas, after this transitional moment the death rates fell sharply but the birth rate only fell slightly. The principal reasons for the decline in the death rate after 1921 were increased levels of control over famines and epidemic diseases. The latter cause was perhaps the most important. The major epidemic diseases in the past were fevers of various sorts, plague, smallpox and cholera. But the single biggest epidemic was the influenza epidemic of 1918-19, which killed as many as 170 lakh people, or about 5% of the total population of India at that time.

Improvements in medical cures for these diseases, programmes for mass vaccination, and efforts to improve sanitation helped to control epidemics. However, diseases like malaria, tuberculosis, diarrhoea and dysentery continue to kill people even today, although the numbers are nowhere as high as they used to be in the epidemics of the past. Surat witnessed a small epidemic of plague in September 1994, while dengue and chikungunya epidemics are since reported in various parts of the country.

Chart 2: Regional Shares of Projected Population Growth upto 2041



Age Structure of the Indian Population:

India has a very young population — that is, the majority of Indians tend to be young, and the average age is also less than that for most other countries. Table 2 shows that the share of the under 15 age group in the total population has come down from its highest level of 42% in 1971 to 29% in 2011. The share of the 15–59 age group has increased slightly from 53% to 63%, whilethe share of the 60+ age group is very small but it has begun to increase(from 5% to 7%) over the same period. But the age composition of the Indian population is expected to change significantly in the next two decades.

Most of this change will be at the two ends of the age spectrum – as Table 2 shows, the 0-14 age group will reduce its share by about 11% (from 34% in 2001 to23% in 2026) while the 60 plus age group will increase its share by about 5% (from 7% in 2001 to about 12% in 2026.) Chart 3 shows a graphical picture of the 'population pyramid' from 1961 to its projected shape in 2026.

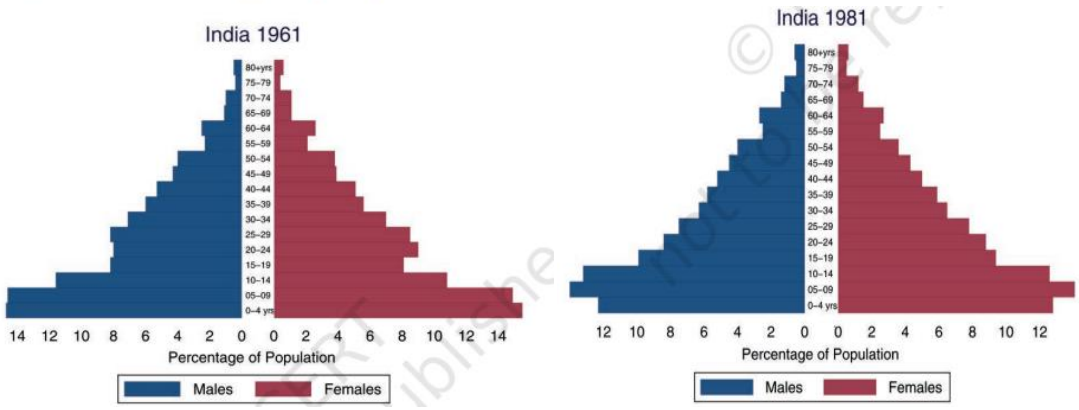
TABLE 2: AGE COMPOSITION OF THE POPULATION OF INDIA, 1961–2026

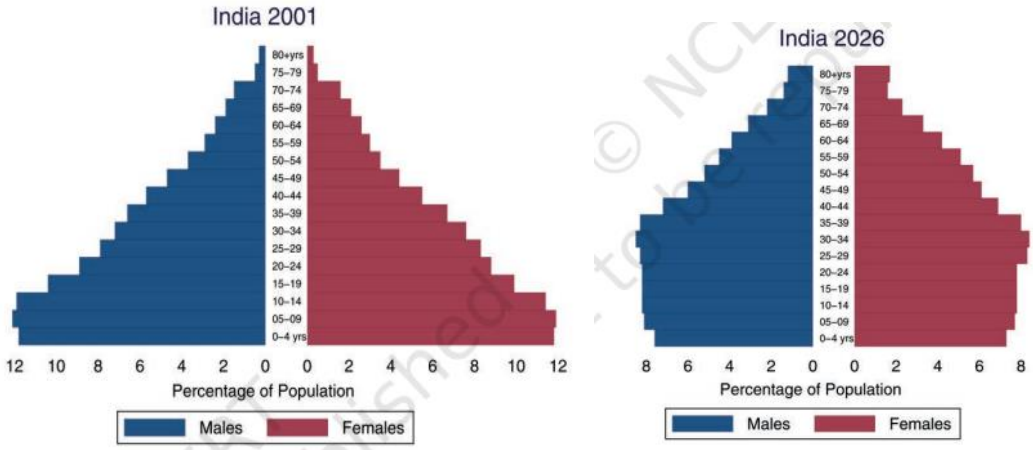
Year	Age Group			Total
	0–14 Year	15–59 Year	60+ Years	
1961	41	53	6	100
1971	42	53	5	100
1981	40	54	6	100
1991	38	56	7	100
2001	34	59	7	100
2011	29	63	8	100
2026	23	64	12	100

Age Group columns show percentage shares; rows may not add up to 100 because of rounding

Source: Based on data from the Technical Group on Population Projections (1996 and 2006) of the National Commission on Population.
Webpage for 1996 Report: http://populationcommission.nic.in/facts1.htm

CHART 3: AGE GROUP PYRAMIDS, 1961, 1981, 2001 AND 2026





1.8 Health surveys and use of hospital statistics:

Demography Health surveys: Demographic and Health Surveys (DHS) are nationally-representative household surveys that provide data for a wide range of monitoring and impact evaluation indicators in the areas of population, health, and nutrition.
There are two types of DHS surveys:

- **Standard DHS Surveys** have large sample sizes (usually between 5,000 and 30,000 households) and typically are conducted about every 5 years, to allow comparisons over time.
- **Interim DHS Surveys** focus on the collection of information on key performance monitoring indicators but may not include data for all impact evaluation measures (such as mortality rates). These surveys are conducted between rounds of DHS surveys and have shorter questionnaires than DHS surveys. Although nationally representative, these surveys generally have smaller samples than DHS surveys.

Use of Hospital Statistics:

Healthcare industry in India comprises of hospitals, medical devices, clinical trials, outsourcing, telemedicine, medical tourism, health insurance, and medical equipment. The healthcare sector is growing at a tremendous pace owing to its strengthening coverage, services, and increasing expenditure by public as well private players.

- The hospital industry in India, accounting for 80% of the total healthcare market, is witnessing a huge investor demand from both global as well as domestic investors. The hospital industry is expected to reach $132 Bn by 2023 from $61.8 Bn in 2017, growing at a CAGR of 16-17%.
- India ranks 10th in Medical Tourism Index (MTI) for 2020-2021 out of 46 destinations of the world. Foreign Tourists Arrival on medical purpose increases from 1.83 lakh in 2020 to 3.04 lakh in 2021.

- The diagnostics industry in India is currently valued at $4 Bn. The share of the organized sector is almost 25% in this segment (15% in labs and 10% in radiology).
- 1,56,000 Ayushman Bharat centers, which aim at providing primary health care services to communities closer to their homes, are operational in India.
- More than 450 Mn ABHA IDs have been created, 2,19,546 Health Facilities have been registered, and around 2,28,794 Healthcare Professionals have been on boarded under ABDM, which shows that health services are being saturated, including by use of digital tools.

1.9 Population transition theory:

In demography, **demographic transition** is a phenomenon and theory which refers to the historical shift from high birth rates and high death rates in societies with minimal technology, education (especially of women) and economic development, to low birth rates and low death rates in societies with advanced technology, education and economic development, as well as the stages between these two scenarios.

The demographic transition strengthens economic growth process by three changes:

- reduced dilution of capital and land stock,
- increased investment in human capital, and
- increased size of the labor force relative to the total population and changed age population distribution.Although this shift has occurred in many industrialized countries, the theory and model are frequently imprecise when applied to individual countries due to specific social, political and economic factors affecting particular populations.

Demographic transition theory suggests that future population growth will develop along a predictable four- or five-stage model.

Stage 1: In stage one, pre-industrial society, death rates and birth rates are high and roughly in balance. An example of this stage is the United States in the 1800s. All human populations are believed to have had this balance until the late 18th century, when this balance ended in Western Europe. In fact, growth rates were less than 0.05% at least since the Agricultural Revolution over 10,000 years ago. Population growth is typically very slow in this stage, because the society is constrained by the available food supply; therefore, unless the society develops new technologies to increase food production (e.g. discovers new sources of food or achieves higher crop yields), any fluctuations in birth rates are soon matched by death rates.

Stage 2: In stage two, that of a developing country, the death rates drop rapidly due to improvements in food supply and sanitation, which increase life spans and reduce disease. Afghanistan is currently in this stage.

The improvements specific to food supply typically include selective breeding and crop rotation and farming techniques. Other improvements generally include access to technology, basic healthcare, and education. For example, numerous improvements in public health reduce mortality, especially childhood mortality. Prior to the mid-20th century, these improvements in public health were primarily in the areas of food handling, water supply, sewage, and personal hygiene. Another variable often cited is the increase in female literacy combined with public health education programs which emerged in the late 19th and early 20th centuries.

In Europe, the death rate decline started in the late 18th century in north western Europe and spread to the south and east over approximately the next 100 years. Without a corresponding fall in birth rates this produces an imbalance, and the countries in this stage experience a large increase in population.

Stage 3: In stage three, birth rates fall. Mexico's population is at this stage. Birth rates decrease due to various fertility factors such as access to contraception, increases in wages, urbanization, a reduction in subsistence agriculture, an increase in the status and education of women, a reduction in the value of children's work, an increase in parental investment in the education of children and other social changes. Population growth begins to level off. The birth rate decline in developed countries started in the late 19th century in northern Europe. While improvements in contraception do play a role in birth rate decline, it should be noted that contraceptives were not generally available nor widely used in the 19th century and as a result likely did not play a significant role in the decline then. It is important to note that birth rate decline is caused also by a transition in values; not just because of the availability of contraceptives.

Stage 4: During stage four there are both low birth rates and low death rates. Birth rates may drop to well below replacement level as has happened in countries like Germany, Italy, and Japan, leading to a shrinking population, a threat to many industries that rely on population growth. Sweden is considered to currently be in Stage 4. As the large group born during stage two ages, it creates an economic burden on the shrinking working population. Death rates may remain consistently low or increase slightly due to increases in lifestyle diseases due to low exercise levels and high obesity and an aging population in developed countries. By the late 20th century, birth rates and death rates in developed countries levelled off at lower rates.

Stage 5 (Debated): Some scholars delineate a separate fifth stage of below-replacement fertility levels. Others hypothesize a different stage five involving an increase in fertility. The United Nations Population Fund (2008) categorizes nations as high-fertility, intermediate-

fertility, or low-fertility. The United Nations (UN) anticipates the population growth will triple between 2011 and 2100 in high-fertility countries, which are currently concentrated in sub-Saharan Africa. For countries with intermediate fertility rates (the United States, India, and Mexico all fall into this category), growth is expected to be about 26 per cent. And low-fertility countries like China, Australia, and most of Europe will actually see population declines of approximately 20 per cent.