

UNIT 2 DEMOGRAPHIC CONCEPTS

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2.0 INTRODUCTION

We have discussed the concept and development of population education in Unit-1. While studying Unit-1 you must have noticed that population education encompasses demography as one of its components. Thus, in the context of population and development education, study of demography assumes greater significance all over the world. It is primarily because ever-growing population in developing and under-developed countries in particular and developed countries in general strains social, economic and political systems, amongst others, due to concomitant dynamics within and across the nations. It is, therefore, essential that you are introduced to the demographic concepts in Unit-2 so that your understanding of further units of this Block would be easy, smooth, clear and comprehensive.

2.1 OBJECTIVES

In this Unit, the focus of our discussion will be on the concept, nature and scope of demography and population studies. We will also highlight the inter-relationship between demography and population studies and also their relationship with other disciplines. After going through this unit, it is expected that you should be able to:

- Define the concepts of demography and population studies;
- Explain the meaning of different terms/concepts as are used in the study of demography and in population studies;
- Distinguish between demography and population studies; and
- Discuss different aspects or components of demography.

2.2 DEMOGRAPHY: CONCEPT, NATURE AND SCOPE

In this section, we will present you the concept, nature and scope of demography. As a part of its nature and scope, we will also highlight the interrelationship of demography with other disciplines.

2.2.1 Concept of Demography

Demography, in fact, originated when human beings started forming civilized society. As the time passed, every society and nation realized the need and necessity of maintaining proper records of human population for smooth running of administration and for solving many social as well as economic problems associated with growth of population. Different countries began registration of vital events in different periods and for variety of reasons. Thus, demography has assumed much more significance in modern times. Realizing the importance, the churches started keeping records of baptisms, marriages and death of their members in some countries from the beginning of 15th century. In fact, credit goes to John Graunt (1620-74) for starting demographic studies during modern times. He brought out his famous volume entitled, "Natural and Political Observations upon the Bills of Mortality" (1662) which made him the real founder of demographic studies. In this volume he analysed and discussed the number

and causes of death of certain places and the need and necessity of such analysis, the births, migrations, family growth and similar other problems of some places in sonic details. He analysed the population which was capable of serving in the army, amongst others. He suggested that the population should be studied on the basis of sex, religion, age, occupation, status and state.

John Graunt (1662) believed that fertility, mortality and migration were interrelated processes and that these were based on definite postulates. According to him male birth rate was always greater than that of females, if in a given society the number of both the sexes was the same. Then his another finding was that mortality rate was higher in urban as compared to rural areas and also it was higher, at the beginning of life, than at any after-stage. He also had knowledge of sample survey, because where the records were not available, he compiled them on the basis of such surveys. Credit also goes to him for the preparation of life tables. While discussing the contribution of John Graunt, Peter. R. Cox said (quoted in Hans Raj, 1986, pp.2-3): "Graunt's work covers so wide an area of interest that it may be said that a large part of demography was born all at once. The developments that occurred subsequently were in the nature of consolidations".

The word 'demography' comes from the Greek words, '*demos*' which means population, and '*graphy*' which means to describe or draw (Luczkovich, See <http://www.grin.com/en/e-book/60766/demography>). Though the term 'demography' had been casually used by many persons, it was first used in a rational or scientific way in 1855 by Guillard, and since then the term has been gaining currency.

The economists, geographers, social scientists and others have defined it in different ways suiting to their convenience and viewpoints. According to Frank Lorimer (1959): "In broad sense, demography includes both demographic analysis and population studies. Demography studies both qualitative and quantitative aspects of population."

Stenford (Quoted in Hansraj, 1986) views it as follows: "In its most formal sense, demography is a very technical and highly mathematical study of the vital statistics of human population (especially birth, death and migration) as well as of the characteristics of population structure (including age, sex and marital status) as they contribute to an understanding of population change." In the words of Irene Tanker: "With improved data, new techniques and measurement of the demographic transition that is occurring, demography has become science rather than literature" (Hansraj, 1986). *Demography is the statistical study of human population*. It can be a very general science that can be applied to any kind of dynamic human population, that is, one that changes over time or space (*population dynamics*). It encompasses the study of the size, structure and distribution of these populations, and spatial and/or temporal changes in them in response to *birth, migration, aging and death*. (<http://en.wikipedia.org/wiki/Demography>). These definitions raise the status of demography from studies to a science of population.

2.2.2 Nature and Scope of Demography

From the above definitions of demography, it becomes amply clear that some have made its scope very wide, whereas others have made it considerably narrow.

Accordingly, there are broader, narrower and balanced views about its nature and scope.

- i) **Broader view:** According to this view, the scope of demography is wide and it studies the causes of slow or rapid change in birth rate, death rate, population growth, sex ratio, health conditions, etc. According to holders of this view, in demography many economic problems such as those related to employment and income conditions of the masses; labour conditions and their living standard, information about production and consumption, saving habits of the population belonging to all sections of the society, rate of growth of population, working efficiency of the masses and the relationship of economic development, population change and overall quality of life, could be understood and analysed.

Demographic studies can be placed broadly under *four categories*, namely,

- a) *Descriptive Demography*, under which are studied census and registration statistics,
- b) *Analytical Demography*, which deals with analysis of the data collected, and rates and ratios of population change,
- c) *Comparative demography*, which covers study of different aspects of population and their determinants at two different places and at two different points of time, and
- d) *Historical Demography*, under which time series, and study of rates and ratios of population change are studied.

Reflecting on social problems, Hans Raj (1986, p.11) believed that demography helps in the study of many problems such as marital status, composition of the family and growing trends about caste, religion, education, etc. Geography can also be studied with the help of demography, e.g. trends in urbanisation and problems of migration from villages to the cities, etc. These thinkers also believe that demography is collective or comprehensive, or interdisciplinary study of human life. It deals with individual ancestries, hereditary nature of the population and collects physical, social and vital facts. It registers facts, from birth to death including family, marriage, divorce and sickness, human growth structure and strength. It also studies, at some length, the diseases and their relation with human body. In this sense it can be considered as population studies. UNO (Hans Raj, op.cit) has said that under demography we study the determinants and consequences of population change.

In this connection it may be pointed out that there is close relationship between demography and population data. But, population data becomes socially useful only when demographers draw their inferences from it. *It means when demographers study population, demography emerges itself into population studies. In other words, population studies includes demography.*

- ii) **Narrower view:** As against the broader view, there is also a narrower view about the nature and scope of demography. This view, among others, is represented by Phillip and Otis (1959, p.2). According to them the scope of demography is not as wide as we have been made to believe by some thinkers.

It is argued by them that demography deals with all subjects; but does it mean that in the study of demography all subjects can be studied? Urbanization, for example, is one subject of study under demography. It includes transportation, communication, rehabilitation, banking, administrative system, electrification, entertainment, etc. All these subjects, however, cannot be included under demography and obviously cannot be studied with the help of this subject. Therefore, scope of demography will have to be defined and restricted. Any unnecessary widening will do more harm than good to it. If we are studying urbanization under demography we can and should cover the effects of births, death, migration, etc.; and if we go on covering everything under demography, then whole study will become just unmanageable. They believe that “Demography has got to be limited to one discipline”.

- iii) **Balanced view:** There is a third school of thought which claims to have presented balanced view of the nature and scope of demography. According to Warren, S. and Thompson (1953), under demography, we can study death, birth and actual rates of growth of population, information about female population, their education, health conditions, marital status, distribution of population and their classification according to their occupations, their socio-economic conditions, etc.

In fact, today it is accepted that demography is the study of human society and has very little to do with individualistic human problems. While dealing with groups it takes the help of figures and arithmetic.

2.2.3 Relationship of Demography with other Disciplines

To have more clarity about demography, let us look at the interrelationship of demography with other disciplines.

Demography deals with composition, organization and distribution of population in human society. It is concerned with different aspects of human life, e.g. biological, geographical, social, economic, cultural and so on. Each of these subjects focus on only particular aspect or selected aspects of human being or human life. However, all subjects or disciplines gradually expanded their scope to the extent possible and got closely linked with each other. Here, we look at how demography is related with certain disciplines.

- i) **Sociology and Demography:** Demography primarily studies and is concerned with collecting data and information about biological, economic and social problems. Sociology believes that man is a social animal. Similarly, demography also accepts human being as a unit of a society and a group in which a man is born, lives and dies. The group, however, continues. The relation between the two subjects is that in actual life all problems connected with population studies are also social problems. For instance, demography covers birth (birth rates) which is closely linked with marriage, and sociologists also study the institution of marriage with keen interest.
- ii) **Demography and Anthropology:** Demography is concerned with population figures of the whole world, whereas anthropology is concerned only with the study of few sections of society. In anthropology we are concerned with the development and growth of only few tribes/sections and not with the whole data which a demographer will collect.

- iii) **Demography and Human Ecology:** Population is an outcome of births, and birth of human beings and their living is the main concern of human ecology. In human ecology along with human births and environment, relationship between them is also studied. It is well known fact that population of an area is effected by the environments around it, and at the same time, environment is also affected by the density and quality of populations. From the ecological viewpoint, population can be seen in terms of the extent to which people share in exploiting and developing the same environmental resources.
- iv) **Demography and Geography:** Importance of human geography has increased more as compared to physical geography. In other words, geographers have also started keenly studying population growth and problems. According to Ackerman (quoted in Hans Raj, 1986, p.24) "Recent geographers have taken the cultural features of the earth, analysed them generically and in their space-relations and established covariant relations of cultural features with each other and with the physical and biotic environment. These distributional features are common both to demography and geography".

Then another point of similarity that exists between demography and geography is that the census is conducted in a geographical area. It is during census that we study regional imbalances and disparities and compare regional growths. Today both the demographers and the geographers try to analyse population so that area differentiations are brought to focus. Geographers such as Dodge, Steigenga and Trewaftha have deeply studied birth, death and migration rates of many areas. By these studies they have tried to achieve, what usually demographers aim to achieve (Hans Raj, 1986, p.24).

The geographers of today are keen to study ethnic distribution of population – races and their distribution – in different parts of the country and the world and also study health, race and sex problems. In geography, like in demography and population studies, important problems such as those related to urbanization and non-urbanization, etc are covered. The geographers are showing more interest in population in economic dynamics, with which demographers are also concerned very much.

- v) **Demography and Economics:** Relationship between demography and economics has considerably increased during 20th century and both the subjects have come quite closer and nearer to each other. This perhaps, is the reason that today demography is considered as a branch of economics. Where there is more population, economic activities are bound to increase. Population problems are directly linked and connected with education, employment, transportation, rehabilitation, industrialization, per capita income, etc.

Demography influences economics in different ways. Changes in population influence labour force and the source of production. Depending upon the changes in labour force the economists shall be in a position to find out what amount of socially useful and productive labour is available in the country and whether it is the labour-intensive or capital-intensive techniques

that suit nation's economy, and so on. Demographers will help economists in finding out the extent of unemployment and the types of training and opportunities needed by the country to remove unemployment from the soil.

- vi) **Statistics and Demography:** There is no social science subject which can do without statistics. Demography is rather more dependent on statistics than many other disciplines. Main aim of a statistics is to collect figures/data and leave its interpretation to the social scientist. Hence, it is quite often said that statistics is value-neutral. This equally applies to demography. Main aim of demographer too is to collect data about population. Demography is, thus, closely linked or related to all other social science disciplines. In case these subjects are not closely studied the results are bound to be misleading.

2.2.4 Institutionalisation of Demography: Terminological Changes

Demographic studies received greater importance with increasing population growth and associated problems. As a result, efforts at institutionalization of demographic studies or population research began.

The Central Family Planning Board, set up in 1956, appointed a sub-committee on Demographic Studies under the chairmanship of Dr. V. K. R. V. Rao. This sub-committee recommended the establishment of four demographic research centres in different parts of the country, where studies might be conducted in fertility, mortality and associated factors. As a result, the *Demographic Training and Research Centre* was established in Bombay in 1956; followed by the Demographic Research Centres in Calcutta, Delhi and Trivandrum in 1957 and one at Dharwar in 1960. In 1959, the Demographic Advisory Committee was appointed by the Ministry of Health, mainly to co-ordinate research on population. The 'Family Planning Communication Action Research Committee' was set up in 1960 to coordinate and promote research in family planning communication and motivation. The two committees were merged in 1967 to form the 'Demographic and Communication Action Research Committee' which became defunct when its term expired on November 3, 1971. This committee was reconstituted on December 6, 1972 as the 'Committee on Socio-Economic Studies on Family Planning' to cover the economic, sociological, educational, psychological, communicational and demographic aspects of population growth and family planning. Subsequently, Centres for Population Studies came into existence. In addition to these, at present, there are fifteen *Population Research Centres* (as they are now called) in different parts of the country and four more centres have recently been sanctioned (Asha and Tara, 2006, p.18).

The 1961 Census of India provided first ever wealth of data to students of demography, and a large number of reports and monographs based on these data were published later. The Sample Registration Scheme initiated by the Registrar-General of India in 1964-65; was a step forward in solving the problem of obtaining reliable estimates of birth and death rates and rates of natural growth. The progress made by this system in obtaining reliable estimates has been quite promising. Subsequent censuses continued to provide rich and reliable data about Indian population thereby facilitating more and more research studies related to population.

What was formerly known as the Demographic Training and Research Centre, Bombay has become the premier institute, after its renaming as *International Institute for Population Sciences* popularly called by its acronym, IIPS known for training and research in population studies in India. This Institute has *four functions*, namely, teaching, research, consultative services and documentation. Establishment of Centres for Population Studies and from the change of nomenclature of DTRC into IIPS indicates that the terms 'Population Studies' and 'Population Sciences' are more broader and include in them demography as well.

Now let us look at the relationship between demography and population studies and between population studies and other disciplines.

2.3 POPULATION STUDIES: CONCEPT AND SCOPE

The study of human population is popularly known by two terms: i) Demography, and ii) Population studies. We have already discussed the concept of demography. In this section, we will focus on population studies including its relationship with other disciplines.

2.3.1 Concept of Population Studies

As mentioned in the preceding section, demography is derived from the Greek words 'demos' which means population, and 'graphy' which means to describe or to draw. It means, it describes population (situation). This concept has gradually been broadened by the demographers by enlarging its scope; a study of population (population studies) and later (i.e. currently) the science of population (population science). As a result, these terms 'demography' and 'population studies' are often used interchangeably by some and distinctly by others, thereby creating a confusion. We deal with these terms among other terms and their distinction from each other in detail in Unit-5. However, we will discuss in brief about the relationship between demography and population studies below so that the concept of population studies becomes very clear.

2.3.2 Relationship between Demography and Population Studies

Though the terms, 'demography' and 'population studies' are often used interchangeably, some scholars have tried to distinguish between 'demographic analysis' and 'population studies'. It is considered that (Philip and Otis, 1959, p.2): "demographic analysis is confined to a study of the components of population variation and change", whereas "population studies are concerned not only with population variables but also with the relationships between population changes and other variables – social, economic, political, biological, genetic, geographical and the like" The term 'demography' may be used in a narrow sense, as synonymous with 'demographic analysis' or 'formal demography', which is primarily concerned with quantitative relations among demographic phenomena in abstraction from their association with other phenomena. Demography may also be conceived in a broad sense to include, in addition to the quantitative study of population, the study of interrelationship between population and socio-economic, cultural and other variables.

Some scholars do not approve of creating such an artificial distinction between demography and population studies. Frank Lorimer (quoted in Asha and Tara, 2006, p.24) highlights, “a demographer limited to the mere formal treatment of changes in fertility, mortality, and mobility would be in a position like that of a ‘formal chemist’ observing the compression of mercury with no information about associated changes in temperature or the constitution of the liquid. ‘Pure demography’ as a concept is like the skeleton of science and is therefore an illusion”. Any meaningful study of population, therefore, has to be interdisciplinary.

With independence of countries in many parts of the world, there have been raising aspirations and hopes for the removal of poverty, for raising the standard of living of the people, and for ensuring them a better quality of life. As result, a new era of planning for development dawned in many countries, including India, after their independence, and the terms such as ‘economic planning’, ‘planning for development’, ‘five-year plans’, etc., came to be widely used which encompassed all the demographic and other terms and concepts in them. This has led to use of more broader term ‘population studies’ that subsumed ‘demography’ as well.

2.3.3 Relationship between Population Studies and other Disciplines

The above discussion has provided the clarity about the distinction between demography and population studies. Now, we will see the interrelationship between population studies and other disciplines.

- i) ***Population Studies and Biology:*** The study of fertility provides a good illustration of the relationship-between population and biology. It is a biologically determined fact that only females can give birth to children and, that too, only during certain age span. Similarly, in the study of mortality, it is known that the age and sex differentials are biologically determined. Even the sex ratio among the new-born is biologically determined. Population genetics have been an important area of specialisation. The knowledge of reproduction, so necessary for the study of fertility, is gained mainly from reproductive physiology, an area of biology. An effective regulation of fertility through improvements in contraceptive techniques has been the contribution of applied research workers in the field of reproductive physiology. It is also well-known that advances in the medical sciences and the adoption of widespread public health measures have been responsible for declining mortality rates even in developing countries, irrespective of the level of development in these countries.
- ii) ***Population Studies, Mathematics and Statistics:*** Quantification is an important element in population studies, as population data are available in a discrete quantifiable form. The relationship of population studies with mathematics, therefore, assumes great importance. The study of population size, growth, structure and components is entirely done with the help of mathematics. Population experts have attempted to build various mathematical models regarding population growth. Mathematics is, thus, an important tool in the study and understanding of population phenomena.

Population studies also depend on statistics, as a tool. It may be recalled that the development of statistics fostered the development of demography in

the nineteenth and the twentieth centuries. The theory of probability has been extremely useful for an analysis of mortality. The actuarial science was useful in the preparation of life tables with a high degree of precision and sophistication mainly because of its use of the probability theory.

- iii) ***Population Studies and Social and Behavioural Sciences:*** Till recently, population studies was generally regarded as a branch of sociology or economics or even geography. Most of the variables and the theories which explain demographic phenomena originated in the social sciences. The theory of demographic transition is based on an understanding of such other disciplines as economics, sociology, political science, psychology, anthropology and geography. Many of the fertility theories are based on biology, sociology and economics. The changes in the birth rate cannot be explained as independent phenomena. Rather, their explanations have to be sought in the changing economic, social, cultural, psychological and political situations in which they occur. Similarly, the levels and trends in mortality are related to socio-economic factors. In recent times, another dimension has been added to the study of population; demographic questions such as those related to fertility regulation are examined with reference to humanistic issues like human rights and the status of women.

Though it is possible to speak broadly of the inter-relation between population studies and the social and the behavioural sciences considered together, it would be more useful if we consider the social and behavioural sciences separately with population studies to understand their specific inter-relationships.

- iv) ***Population Studies and Sociology:*** Kingsley Davis (1959, p.314) has referred to the following areas of study which require a combination of demographic and sociological skills: 1) Fertility in connection with attitudes and social institutions; 2) Population changes in relation to social and economic change; 3) The labour force with respect to population structure and social organisation; and 4) The family with regard to demographic behaviour. International and internal migration are two other areas of study mentioned by Davis, where a knowledge of sociology and demography need to be combined. Even the study of mortality, age and sex differentials, though biologically determined, may have sociological bases, and, therefore, need to be recognised as such (Asha and Tara, 2006, p.26).
- v) ***Population Studies, Psychology and Social Psychology:*** Several questions connected with family planning and fertility regulation can be answered only when the reproductive behaviour of individuals is understood in the context of the social standards and cultural norms which influence and govern such behaviour. For instance, some questions which are often asked are: What is the family size norm in a community? How is it determined? Is it possible to modify this norm by stimulating planned change? Even in the field of mortality, utilization patterns of healthcare services can be understood only when individual behaviour is explored and the relevant social norms are studied. Movements of people from rural to urban areas can also be studied only by understanding the motivation behind such migrations.

- vi) **Population Studies and Economics:** The study of population is an important area of investigation in the field of economics, specially since problems of economic development and development planning have come to the forefront in most developing countries, In order to gain a better understanding of the relationship between population trends and economic growth the following topics have emerged over the years and continue to occupy an important place, both in economics and population studies: a) population and development; b) manpower studies; c) the economics of fertility; and d) comprehensive economic-demographic models.
- vii) **Population Studies and Geography:** Students of population studies are usually interested in the geographical distribution of the population and its movements between rural and urban areas. Those geographers who are interested in geography not only as an academic discipline but also as a geographic point of view to understand the world, point out that it is useful to know how the various issues facing the world, for instance, rapid population growth, urbanization, race-relations, etc. assume different forms in different regions or contents (Asha and Tara, 2006, p.23).
- viii) **Population Studies and Law:** The inter-relationship between population and law becomes clear when an attempt is made to study what the present and the future laws of any country can do to solve the problem of over-population. Chandrasekhar (1976, p.51) has pointed out that population laws may be defined as “that body of law which relates directly or indirectly to the three basic demographic variables of fertility mortality and migration and their various components, which in turn affect the more general problems of the size, growth and distribution of the population”. Population laws, could, therefore, relate to “public health and sanitation; food preparation, distribution and sale; drugs and pharmaceuticals; clinics, hospitals and medical personnel; migration, marriage, fertility, child care and all aspects of education and the role and status of women. The Indian Medical Termination of Pregnancy Act of 1972, which has made induced abortion fairly easy, is the illustration of how the law of the land can affect an important demographic variable, that is, fertility”.

Check Your Progress

Notes: a) Space given below the question is for writing your answer.

b) Check your answer with the one given at the end of this unit under “Answers to ‘Check Your Progress’ Questions”.

1) Explain the interrelationship between demography and economics.

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2.4 POPULATION DISTRIBUTION

In any demographic or population study the concern is not only about finding out how many people live in a particular area at a given point of time but also about whether the number is larger than what it was and what it is likely to be in the future, what will be its effect, and so on. Such facts are needed for industrialists, particularly those concerned with providing social utility services like education, medical aid, as well as for legislators and social scientists. It is with the help of these figures that the government and planners can develop their future plans, strategies and expansion activities. It is again after getting this actual and estimated data that production for consumer goods can be increased and arrangement for providing basic facilities to the society can accordingly be made. A demographer also likes to find out the extent of changes, but he is also required to find out the causes of such changes – the changes in the births, deaths, migration; poor medical and other facilities; lack of awareness among the masses about their health, etc. This is all a complex process involving systematic application of different tools and techniques.

Nevertheless, in this sub-section, we will just begin to understand population distribution. Population distribution is always discussed with reference to the size of population at particular point of time, over a period of time and over specific geographical space. Of course, other details related to distribution by sex, age, sex and age, and so on are also studied.

2.4.1 Distribution of Population by Size – At a Point of Time

The size of population gives us an idea of how many people live in a given place at a given point of time. But, the size can be accurately found out by clearly defining the terms 'place', 'person' and 'time'. For instance, see population distribution in different states in 2011 as given in Table 2.1.

Table 2.1: List of States and Union Territories by Total Population (Size) and Rank - 2011

Rank	State/Union Territory	Population	% of Total Population
1	Uttar Pradesh	199,581,520	16.49%
2	Maharashtra	112,372,972	9.29%
3	Bihar	103,804,637	8.58%
4	West Bengal	91,347,736	7.55%
5	Andhra Pradesh	84,665,533	7.00%
6	Madhya Pradesh	72,597,565	6.00%
7	Tamil Nadu	72,138,958	5.96%
8	Rajasthan	68,621,012	5.67%
9	Karnataka	61,130,704	5.05%
10	Gujarat	60,383,628	4.99%

11	Orissa	41,947,358	3.47%
12	Kerala	33,387,677	2.76%
13	Jharkhand	32,966,238	2.72%
14	Assam	31,169,272	2.58%
15	Punjab	27,704,236	2.29%
16	Haryana	25,353,081	2.09%
17	Chhattisgarh	25,540,196	2.11%
18	Jammu and Kashmir	12,548,926	1.04%
19	Uttarakhand	10,116,752	0.84%
20	Himachal Pradesh	6,856,509	0.57%
21	Tripura	3,671,032	0.30%
22	Meghalaya	2,964,007	0.24%
23	Manipur ^a	2,721,756	0.22%
24	Nagaland	1,980,602	0.16%
25	Goa	1,457,723	0.12%
26	Arunachal Pradesh	1,382,611	0.11%
27	Mizoram	1,091,014	0.09%
28	Sikkim	607,688	0.05%
UT1	Delhi	16,753,235	1.38%
UT2	Puducherry	1,244,464	0.10%
UT3	Chandigarh	1,054,686	0.09%
UT4	Andaman and Nicobar Islands	379,944	0.03%
UT5	Dadra and Nagar Haveli	342,853	0.03%
UT6	Daman and Diu	242,911	0.02%
UT7	Lakshadweep	64,429	0.01%
Total	India	1,210,193,422	100.00%

Source: http://en.wikipedia.org/wiki/Demographics_of_India

The data in Table 2.1 is self-explanatory regarding the size and rank and does not require any elaborate discussion — we can easily say which is the biggest State/UT in terms of its population size. To read more, by taking the total population of the States with ranks 1-7, we can notice that they together account for more than 60% of the total population of the country in 2011.

Similarly, we can say which particular city is bigger or smaller in terms of its population compared to any other city. For example, see the Table 2.2.

Table 2.2: Largest Cities in India in 2001

Rank	Name of the City	State	Population
1	Mumbai	Maharashtra	13,830,884
2	Delhi	Delhi	12,565,901
3	Bengaluru	Karnataka	5,438,065
4	Kolkata	West Bengal	5,138,208
5	Chennai	Tamilnadu	4,616,639
6	Lucknow	Uttar Pradesh	4,589,651
7	Hyderabad	Andhra Pradesh	4,068,611
8	Ahmedabad	Gujarat	3,959,432
9	Pune	Maharashtra	3,446,330
10	Kanpur	Uttar Pradesh	3,421,435
11	Surat	Gujarat	3,344,135
12	Jaipur	Rajasthan	3,210,570
13	Nagpur	Maharashtra	2,447,063
14	Patna	Bihar	1,875,572
15	Indore	Madhya Pradesh	1,854,930
16	Bhopal	Madhya Pradesh	1,792,203
17	Thane	Maharashtra	1,807,616
18	Ludhiana	Punjab	1,740,247
19	Agra	Uttar Pradesh	1,686,976
20	Pimpri	Maharashtra	1,637,905

Source: en.wikipedia.org/wiki/demographics_of_India.

The study of demography does not confine to only such data based on just one aspect, as it is not much useful.

2.4.2 Distribution of Population over the Period of Time and Space

Data on size of population at particular point of time provides us very little information. So, to have somewhat better understanding of population we can consider its distribution over a period of time i.e. at different points of time. For example, see the distribution of population given in Table 2.3 below.

Table 2.3: Population Growth in India — 1901-2011

Census Year	Population	Decadal growth		Average annual exponential growth rate (per cent)	Progressive growth rate over 1901 (per cent)
		Absolute	Per cent		
1	2	3	4	5	6
1901	238,396,327	—	—	—	—
1911	252,093,390	13,697,063	5.75	0.56	5.75
1921	251,321,213	-772,177	-0.31	-0.03	5.42
1931	278,977,238	27,656,025	11.00	1.04	17.02
1941	318,660,580	39,683,342	14.22	1.33	33.67
1951	361,088,090	42,427,510	13.31	1.25	51.47
1961	439,234,771	78,146,681	21.64	1.96	84.25
1971	548,159,652	108,924,881	24.80	2.20	129.94
1981	683,329,097	135,169,445	24.66	2.22	186.64
1991	846,387,888	163,058,791	23.86	2.14	255.03
2001	1,027,015,247	180,627,359	21.34	1.93	330.80
2011	1,210,193,422	183,178,175	17.8%	1.78	407.64

Notes:

- 1) In working out 'Decadal Growth and Percentage Decadal Growth' for India 1941-51 and 1951-61 the population of Tuensang district for 1951 (7,025) census and the population of Tuensang (83,501) and Mon (5,774) districts for 1961 Census of Nagaland state have not been taken into account as the areas were not covered for the first time in 1951 and the same are not comparable.
- 2) The 1981 Census could not be held owing to disturbed conditions prevailing in Assam. Hence, the population figures for 1981 of Assam have been worked out by 'interpolation'.
- 3) The 1991 Census could not be held owing to disturbed conditions prevailing in Jammu and Kashmir. Hence, the population figures for 1991 Census for Jammu and Kashmir have been worked out by 'interpolation'.
- 4) It may be further noted that the figures have been adjusted for the territorial changes which occurred because of the partition of the Indian subcontinent into two countries, India and Pakistan.
- 5) For 2011, the figure under column (2) is obtained from http://en.wikipedia.org/wiki/Demographics_of_India, and accordingly the rest of the figures are calculated.

Table 2.3 presents the growth of India's population as per the censuses from 1901 to 2011. This gives us more information to study the population at different

points of time. For instance, we get more information from it and can infer the following points.

- i) The course of population growth up to 1931 was undulating. The decades of marked increases alternated with decades of small increases, while during 1911-1921 a negative growth was experienced.
- ii) The absolute number of people added to the population during each decade has been on the increase from 1921 onwards. The decennial rate of growth has also increased from 1921 up to 2011, although there were fluctuations in the positive growth rate. From 1951 onwards, India's population has been growing at a phenomenal rate. While during 1941-1951, the average decennial growth rate was 13.31 per cent, during 1951-1961 it increased to 21.6 per cent, and during 1961-1971, it was 24.8 per cent. From 1901 to 2011, there has been an increase of 407.64 per cent in the population. India's population has more than doubled in a period of 50 years, that is, from 1921 to 1971.
- iii) The year 1921 is designated as "the great divide" in the sense that it is the turning point which marks the beginning of not only regular/continuous growth but also the beginning of a rapid and massive population growth in India.
- iv) The decennial population growth rate during 1961-71 was 24.80 per cent, during 1971-81 it was 24.66 per cent, during 1981-91 it was 23.85 per cent, during 1991-2001 it was 21.34 per cent and during 2001-2011 it was 17.8 per cent. Thus, it can be observed that while the population size has been growing, the rate of population growth has decreased from 1981 onwards.

Nevertheless, Table 2.3 does not give us other relevant information such as the nature of changes that took place during these periods which resulted in the change of the size of the population over time. If we know the reasons underlying the changes in the population that will provide us more meaningful information to understand these changes. It requires additional efforts to enlarge the scope of coverage beyond simply the distribution of population over time and space. For instance, for our better understanding of the above data, we can look at the following additional information.

- During 1901-1911, the seasonal conditions were much more favourable, according to the census reports, which refer to the agricultural conditions as being "normal" or even "prosperous." No indication of any famine being an important cause of high mortality is found in these reports. It appears, therefore, that the days when people died in large numbers due to local crop failures were over. Improved transportation and communication because of the building of roads and railways had reduced the isolation of certain areas. These changed conditions were reflected in population growth, and the rate of this growth rose to 5.7 per cent during the "normal" decade of 1901-1911.
- In the decade 1911-1921, there is a phenomenal decrease in population of India. All the fluctuations in the population growth in the preceding periods pale into insignificance when the situation during 1911-1921 is considered. This decade was extraordinary in many ways. The natural checks which are

known to curb the growth of population were found to operate during this period. Though agricultural conditions were on the whole favourable, an epidemic of plague took a toll of nearly three million lives. The First World War took place during this decade and, most important, after the War, the entire country was swept by distinct waves of a worldwide pandemic of influenza. This epidemic may be considered the most severe and the most deadly of its kind for, even according to the conservative estimates of official reports, nearly 12 to 13 million people died of this disease during the short span of three or four months. In this disastrous year of 1918, the official death rate rose to 63 per thousand population, whereas it was 33 in 1917 and 36 in 1919. J. T. Marten reported in the Census Report of 1921 that rural areas were severely affected by this epidemic. Mortality was particularly high among adults between the ages of 20 and 40. Women were the worst affected. "In the worst period, whole villages were absolutely laid desolate by the disease. There was sometimes no means of disposing of the dead; crops were left unharvested. To add to the distress, the disease came at a period of widespread crop failure and reached its climax in November, when the cold weather set in. And, as the price of cloth happened at the time to be the highest, many were unable to provide themselves with the warm clothing that was essential in the case of illness that so readily attacked the lungs. All these are mentioned here to highlight the usefulness of the census surveys.

Distribution of population over geographical area and time: If our interest is to know the size of other countries in terms of their population at a particular point of time, then we will look for relevant information accordingly. For example, see Table 2.4 in this regard.

Table 2.4: Countries with a Population of Over 100 Million — 1998 and 2050 (Population in Millions, Medium Variant)

Countries with a Population of Over 100 Million								
In 1998			By 2050					
1.	China	1256	1.	India	1529	11.	Mexico	147
2.	India	982	2.	China	1478	12.	Philippines	131
3.	USA	274	3.	USA	349	13.	Vietnam	127
4.	Indonesia	206	4.	Pakistan	346	14.	Russian Fed.	122
5.	Brazil	166	5.	Indonesia	312	15.	Iran	115
6.	Pakistan	148	6.	Nigeria	244	16.	Egypt	115
7.	Russian Fed.	147	7.	Brazil	244	17.	Japan	105
8.	Japan	126	8.	Bangladesh	213	18.	Turkey	101
9.	Bangladesh	125	9.	Ethiopia	170			
10.	Nigeria	106	10.	Democratic Republic of the Congo	160			

Source: United Nations Population Division, *World Population Prospects: The 1998. Revision.* (See <http://www.aph.gov.au/library/pubs/rm/1999-2000/2000r09.htm>)

According to Table 2.4, the number of countries with a population of over 100 million will increase from ten in 1998 to 18 in 2050, only three of which (United States, Russia and Japan) are located in the more developed world. India will replace China as the most populous country with a population of 1529 million by 2050.

To get more details, the distribution of population of a country can be sub-divided depending upon any other special criteria. For example, in a population study one would be interested to find out the population living in advanced urban industrial areas, in newly developing or growing urban industrial areas, in pre-urban industrial areas, in rural areas and so on including the reasons for changes in these populations. This calls for complex data.

Table 2.5: Rural-Urban Composition of Indian Population – 2001

Sl No	India/State/ Union Territory	Population, 2001			Urban Population as Percentage of Total Population 2001	Decennial Growth Rate of Population (Per cent) 1991-2001		
		Total	Rural	Urban		Total	Rural	Urban
1	2	3	4	5	6	7	8	9
	India	1,028,610,328	712,490,639	286,119,689	27.82	21.54	17.90	31.20
1.	Andhra Pradesh	76,210,007	55,401,067	20,808,940	27.30	14.59	13.60	14.60
2.	Arunachal Pradesh	1,097,968	870,087	227,881	20.75	27.00	15.20	10.30
3.	Assam	26,655,528	23,216,288	3,439,240	12.90	18.92	16.70	36.20
4.	Bihar	82,998,509	74,316,709	8,681,800	10.46	28.62	28.30	29.30
5.	Chhattisgarh	20,833,803	16,648,056	4,185,747	20.09	18.27	NA	NA
6.	Goa	1,347,668	677,091	670,577	49.76	15.21	-2.20	39.40
7.	Gujarat	50,671,017	31,740,767	18,930,250	37.36	22.66	17.10	32.70
8.	Haryana	21,144,564	15,029,260	6,115,304	28.92	28.43	20.60	50.80
9.	Himachal Pradesh	6,077,900	5,482,319	595,581	9.80	17.54	16.10	32.40
10.	Jammu & Kashmir	10,143,700	7,627,062	2,516,638	24.81	29.43	25.60	40.70
11.	Jharkhand	26,945,829	20,952,088	5,993,741	22.24	23.36	NA	NA
12.	Karnataka	52,850,562	34,889,033	17,961,529	33.99	17.51	12.10	28.80
13.	Kerala	31,841,374	23,574,449	8,266,925	25.96	9.43	10.10	7.60
14.	Madhya Pradesh	60,348,023	44,380,878	15,967,145	26.46	24.26	22.00	31.20
15.	Maharashtra	96,878,627	55,777,647	41,100,980	42.43	22.73	15.20	34.30
16.	Manipur	2,166,788	1,590,820	575,968	26.58	24.86	36.60	12.80
17.	Meghalaya	2,318,822	1,864,711	454,111	19.58	30.65	28.30	37.10

18.	Mizoram	888,573	447,567	441,006	49.63	28.82	21.00	38.70
19.	Nagaland	1,990,036	1,647,249	342,787	17.23	64.53	63.40	69.40
20.	Orissa	36,804,660	31,287,422	5,517,238	14.99	16.25	13.80	29.80
21.	Punjab	24,358,999	16,096,488	8,262,511	33.92	20.10	12.30	37.60
22.	Rajasthan	56,507,188	43,292,813	13,214,375	23.39	28.41	27.50	31.20
23.	Sikkim	540,851	480,981	59,870	11.07	33.06	30.10	62.10
24.	Tamil Nadu	62,405,679	34,921,681	27,483,998	44.04	11.72	-5.20	42.80
25.	Tripura	3,199,203	2,653,453	545,750	17.06	16.03	13.40	28.80
26.	Uttar Pradesh	166,197,921	131,658,339	34,539,582	20.78	25.85	24.10	32.90
27.	Uttarakhand	8,489,349	6,310,275	2,179,074	25.67	20.41	NA	NA
28.	West Bengal	80,176,197	57,748,946	22,427,251	27.97	17.77	16.90	20.20
29.	A.&N. Islands	356,152	239,954	116,198	32.63	26.90	16.60	26.90
30.	Chandigarh	900,635	92,120	808,515	89.77	40.28	39.20	40.50
31.	D&N Haveli	220,490	170,027	50,463	22.89	59.22	34.10	330.30
32.	Daman & Diu	158,204	100,856	57,348	36.25	55.73	86.40	20.60
33.	Delhi	13,850,507	944,727	12,905,780	93.18	47.02	1.50	51.30
34.	Lakshadweep	60,650	33,683	26,967	44.46	17.30	48.90	-7.40
35.	Puducherry	974,345	325,726	648,619	66.57	20.62	12.00	25.40

NA= Not available

Source: Census of India 2001. Registrar General India

But, studying the distribution of population on a limited geographical area and its sub-division becomes easier. For instance, the study of spatial distribution of population in a particular country/geographical area such as rural, urban, farm, non-farm, etc as well as the ratios of these groups of people including the causes for such distribution in a country or a state is easier. For example, see the urban-rural distribution of population in India.

Before 1961, the definition of 'urban' was not uniformly followed in all the States of India and there was considerable scope for the use of discretionary powers on the part of the State Census Superintendents. Apart from the usual test of a settlement having more than 5000 population, the classification of a place into urban or rural was based on a subjective assessment by the Census Superintendents of the presence of 'urban characteristics'.

A more precise national definition of 'urban' was introduced for the first time by the Census Commissioner in 1961. According to this definition, the 'urban places' were those settlements which satisfied the following criteria: (a) All places within a Municipal Area/Corporation, Cantonment or notified area committee; (b) Selected places with: (i) a population of 5,000, (ii) three-fourths of the working population outside agriculture, and (iii) density of not less than 1,000 persons per sq mile. The definition adopted for an urban area for the 1971 Census followed the 1961 pattern. However, the criterion (b)(ii) was changed from "three fourths of the working population" to "three fourths of the male working population" being non-agricultural.

The study of urban-rural composition of a country is important for a variety of reasons. The developed countries of today had undergone changes as was observed in the demographic transition where we looked at the birth and death rates. Similar change could also be observed in respect to the urban-rural composition of other countries. One finds that the proportion of urban population in the developed countries increased substantially with economic development.

Thus, study of different demographic characteristics of distribution will be useful in different ways. But, if you are interested to engage yourself in a more detailed population study, you need to know about other important aspects of population such as structure or composition of population.

2.5 POPULATION STRUCTURE/COMPOSITION

Population structure or composition covers all the measurable characteristics of given population. The universal characteristics of any population in any geographical area at any point of time or at different points of time are: age, sex, and age and sex taken together. These characteristic components determine the structure of a given population. It is also universally accepted that the composition of a given population varies with changes in its fertility, mortality, and net migration. These demographic processes effect/affect the basic characteristics of the population, viz. age and sex, and thus change the composition or structure of population.

2.5.1 Age Composition: Influencing Factors

i) **Significance of age structure:** There is a functional relationship between age composition of population of a country and other components of population and changes in them. Schedules of nuptiality, fertility, mortality and migration shape the distribution of population by age and are in turn affected by it. Age distribution can be used for inferring the vital rates. Age distribution of a country also has a socio-economic significance. The level of consumption, income, social services needed, participation in productive work, taking part in reproduction process and many other aspects of life is effected by age.

The population pyramid of India is broad-based and conforms to a population of an underdeveloped country; as opposed to this, the age pyramid of a developed country has a narrow base where small number of children are born but they live longer. Some important features of Indian population distribution based on age and their implications are as follows.

- Under-enumeration of children at young ages, especially in the age group 0-4 has been a recognized feature of the Indian census. Gradually, in recent Censuses this feature has changed. Now, partly due to an improvement in the enumeration of younger population and increase in fertility and decrease in mortality there has been a rise in proportion of population below age 15. It has greater social, economic and demographic relevance. Such a young population necessitates more allocation of funds to provide for its health, medical, educational and consumption needs. Such an age-structure dominated by young population also favours a very rapid population increase in coming years.

- Dependency ratio, the ratio of non-workers to workers, is high in which the contribution of children under 15 years of age is overwhelming and implies less per capita produce, if not per worker produce directly. It also affect the productivity of labour, as it reduces the remainder of national income after deducting the high investment needed for satisfying immediate needs of the young population; otherwise that can be mobilized for capital formation.
- Large base of the population means persisting high natural increase, at least in absolute numbers.

ii) **Nature of age data:** The United Nations has defined age as “the estimated or calculated interval of time between the date of birth and the date of census, expressed in completed solar years. It has also recommended that information on age should be collected in the census by asking the date of birth of the individual (day, month and year) or by asking a direct question to obtain information on the age at the last birthday, or by asking both these questions together. Though the question on the date of birth obviously yields more accurate information of age, it is not always possible to obtain date of birth from a population in which the majority are either illiterate or semi-literate and are ignorant about their own age. In such a situation, information on age is collected by asking about “the years completed on the last birthday.”

The Indian age data, therefore, show concentration of population at a certain age, for Indians prefer to report their age in numbers ending with 0 or 5. Errors in age reporting also creep in because of carelessness in reckoning age, misunderstanding of the question or deliberate misstatement.

iii) **Factors determining the age structure of populations:** *Fertility, mortality and migration* are the main causes of the growth rate of any population and are also responsible for determining its age structure. Growth rate is mathematically determined by the levels of fertility, mortality and migration. However, the world situation with regard to national population policies, commitments, international power structure, and world-wide economic trends is changing fast; and this has implications for the growth of population from national as well as global point of view.

- *The age structures of various populations of the World:* The age structures of different populations are usually compared in terms of three broad age groups — working age (15-64), children below the working age (i.e. below 15) and persons above the working age (i.e. above 64). Accordingly, the persons are identified with particular group. As the developed countries have a much lower proportion of population consisting of dependent children, their over-all dependency ratios are also of smaller values than those in developing countries.

iv) **Analysis of the age structure:** Age data are usually available in the form of single years, that is, the number of persons in the population of age 13, 14, 15, etc. For demographic analysis, however, age data are seldom used in discrete form. It is customary to classify them in five-year age-groups such as 0-4, 5-9, 10-14, 15-19, 20-24 and so on. The age data, thus, classified in mutually exclusive age groups are used for an analysis of the age structure of any population, and are also useful for a wide variety of analytical and comparative purposes.

The age-structure of any population is most commonly studied with the help of a simple mathematical measures like the per cent distribution and an equally simple measure like the age pyramid. The other measures used for an analysis of the age structure are the average age (mean, median, mode), and a few other indices based on the distribution of persons in various age-groups.

The simplest measure is the percentage distribution of the population based on the absolute numbers in various five-year age-groups. This measure is helpful in forming an idea about the age structure of any population, and is used for describing it. It is also used to compare the age structures of two or more populations at a point of time or to compare the age structure of the same population at different points of time. The age-sex histograms, known as the age-sex pyramids, which we will discuss in sub-section 2.5.3, may be used precisely for the same purposes.

Table 2.6 is, just an illustration of, the age-group-wise percentage distribution of the population of India as in 1991, which is presented in five-year age-groups both in terms of absolute numbers and percentages.

Table 2.6: Distribution of Population of India according to Five-year Age-Groups – 1991

<i>Age Group</i>	<i>Population (Figures in Thousands)</i>	<i>Percentage</i>
0-4	102378	12.21
5-9	111295	13.27
10-14	98692	11.77
15-19	79035	9.42
20-24	74472	8.88
25-29	69239	8.26
30-34	54804	6.96
35-39	52399	6.25
40-44	42556	5.07
45-49	36134	4.31
50-54	31114	3.71
55-59	21473	2.56
60-64	22749	2.71
65-69	12858	1.53
70-74	10554	1.26
75-79	4146	0.49
80-84	3989	0.48
85-89	1146	0.14
90-94	825	0.10
95-99	263	0.03
100+	152	0.02
Age not specified	4695	0.56
All ages	838568	100.00

Source: Registrar General and Census Commissioner of India. *Census of India, 1991*. India (Excluding Jammu and Kashmir).

Table 2.7: Distribution of the Population of India according to Broad Age-groups — 1901-1991

Age Group	1901	1911	1921	1931	1951*	1961*	1971*	1981	1991
0-14	38.58	38.45	39.05	40.02	37.45	41.08	42.10	39.56	37.25
15-44	46.60	46.69	45.82	46.35	45.99	44.01	43.52	43.25	44.84
45-64	—	12.47	12.64	11.46	12.97	11.99	11.62	10.70	13.29
65+	—	2.39	2.49	2.17	3.59	2.92	2.76	6.49	4.05
All Ages	100.00	100.00	100.00	100.00	100.0	100.00	100.00	100.00	100.00

* Percentages based on adjusted figures.

Sources:

- 1) United Nations. 1956. The Aging of the Populations and its Economic and Social Implications, *Population Studies*. No.26, p.114.
- 2) Registrar General and Census Commissioner of India. *Census of India 1961, India Paper No.2, Age Tables, Part II*, p.35.
- 3) Registrar General and Census Commissioner of India. *Census of India 1971, Series I - India, Miscellaneous Studies, Paper-2 of 1974, Age and Life Tables (one per cent sample)*, pp. 8-10.
- 4) Registrar General and Census Commissioner of India. *Census of India 1991. India (Excluding Jammu and Kashmir)*.

Table 2.8 presenting the age distribution of the population of India (1991) and of the United States (1995) in broad age-groups illustrates how the age distribution of two countries may be compared with the help of percentage distribution.

Table 2.8: Comparison of Age Group-wise Percentage Distribution of Population of India (1991) and the United States of America (1995)

Age Group	India (1991)	United States (1995)
0-4	12.21	7.46
5-14	25.04	14.51
15-24	18.30	13.68
25-34	15.22	15.55
35-44	11.32	16.15
45-54	8.02	11.73
55-64	5.27	8.04
65+	4.05	12.88
Age not stated	0.57	—
All ages	100.00	100.00

Source: 1) Registrar General and Census Commissioner of India. *Census of India, 1991, India, (Excluding Jammu and Kashmir)*. New Delhi.

2) United Nations. 1997. *Demographic Year Book 1995*. New York, pp.192-193.

It is evident from Table 2.8 that the age distribution of the Indian population differs a great deal from that of the American population. The percentage of Indians in the age group 0-4 is a little less than twice that of the Americans. On the other hand, the percentage of Americans above age 65 is more than three times that of Indians. From this information, it is clear that there is high promotion of children in the Indian population compared to the US population, and high proportion of elderly people in the American population compared to that of India.

Table 2.9: Percentage Distribution of Population in Broad age-groups for some Developing and Developed Countries

Country	Year	0-14	15-64	65+	Age not Stated	All ages
India	1991	37.25	58.13	4.05	0.56	100.00
Kenya	1989	47.84	48.73	3.43	—	100.00
Pakistan	1995	41.33	54.92	3.75	—	100.00
Bangladesh	1990	43.78	46.26	9.46	—	100.00
Sri Lanka	1994	35.20	60.48	4.32	—	100.00
China	1990	27.69	66.73	5.58	—	100.00
Japan	1994	16.33	69.60	14.07	—	100.00
United Kingdom	1994	19.49	64.76	15.75	—	100.00
United States	1995	21.97	65.15	12.88	—	100.00
Thailand	1994	29.99	65.74	4.27	—	100.00
Sweden	1994	18.86	63.68	17.46	—	100.00
Philippines	1995	37.36	58.76	3.88	—	100.00
Ethiopia	1995	48.18	47.15	4.67	—	100.00
More Developed	1997	20.00	66.00	14.00	—	—
Less Developed		35.00	60.00	5.00	—	100.00

Sources: 1) United Nations. 1997. *Demographic Year Book 1995*. New York, pp.180-212.

2) Population Reference Bureau. 1997. *World Population Data Sheet 1997*. Washington D.C.: United Nations.

2.5.2 Sex Composition

Like age composition, sex composition also has its significance in the study of population structure.

Sex Structure: Sex is an easily identifiable characteristic and its dichotomous nature presents few problems for classification. The data on sex are also easily obtained. For the study of the sex-structure of any population, the following two measures are generally adopted: 1) the percentage of males in the population or masculinity proportion, and 2) the sex ratio. Of these two measures, the latter is more frequently used in the study of population.

2.5.3 Age and Sex Structure: Population Pyramid and its Implications

Study of population structure by age and sex, taken together, gives us better understanding of population structure than its study by taking age or sex only.

- i) **Sex and Age Structure:** Sex and age are the basic characteristics or the biological attributes of any population which affect not only its demographic structure but also its social, economic and political structure. They influence marriages, birth and death rates, internal and international migration, population composition, manpower, gross national product, planning regarding housing, educational and medical services, and so on.

For better understanding of population structure by age and sex we can look at Table 2.10.

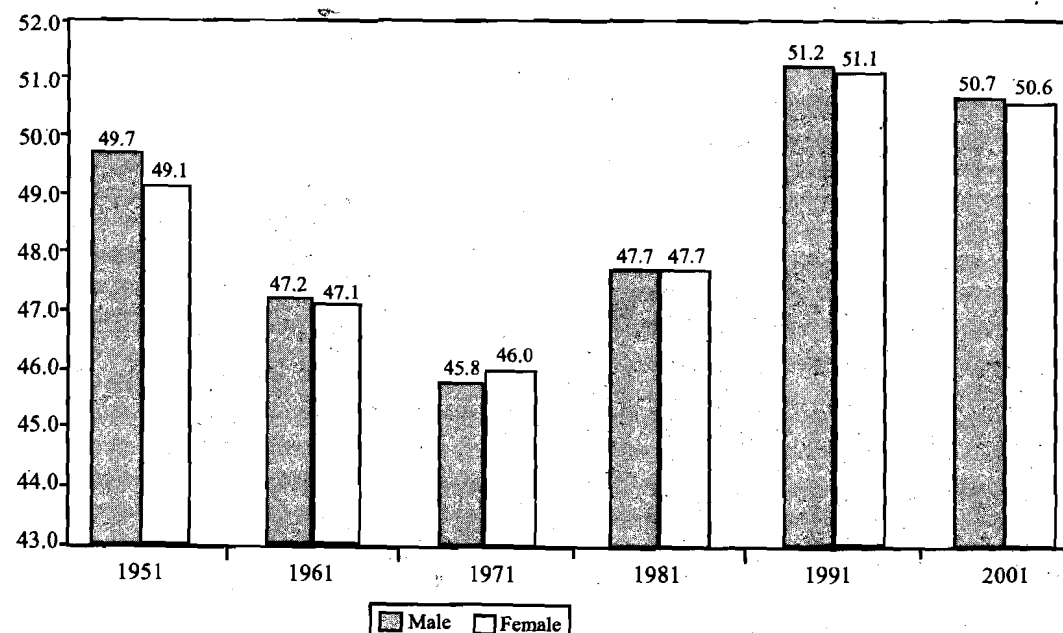
Table 2.10: Percentage Distribution of Population of India by Age and Sex: 1951-2001

Year	Age Groups (in years)					
	0-14		15-49		50+	
	Male	Female	Male	Female	male	Female
1951	38.2	38.6	49.7	49.1	12.1	12.2
1961	40.9	41.1	47.2	47.1	11.8	11.7
1971	41.7	42.2	45.8	46.0	12.3	11.8
1981	39.6	39.8	47.7	47.7	12.7	12.5
1991	36.5	35.9	51.2	51.1	12.4	13.0
2001	35.6	35.1	50.7	50.6	13.4	14.0

Source: Census, Registrar General, India

Note: Totals may not add up to 100 due to rounding off.

Figure 2.1: Percentage Distribution of Population by sex in the Age Group 15-49, years India



Population data are invariably classified by sex and age and then made available to data users. All data on fertility, mortality, migration, marital status, and economic characteristics are first presented separately for males and females and are cross-classified according to age. Sex and age are very important because they are the visible, indisputable, definite and convenient indicators of social status.

- ii) **Population pyramid and its implications:** Let us understand the impact of population structure in the form of population pyramid. Population pyramid is a widely used graphical device to show the age-sex composition of a population. It consists of a number of horizontal bars representing successive age-groups in ascending order, from the lowest age at bottom to the highest age at top. The length of a bar for any age-group represents the number or percentage of males or females in that age-group, according to a scale along the horizontal axis.

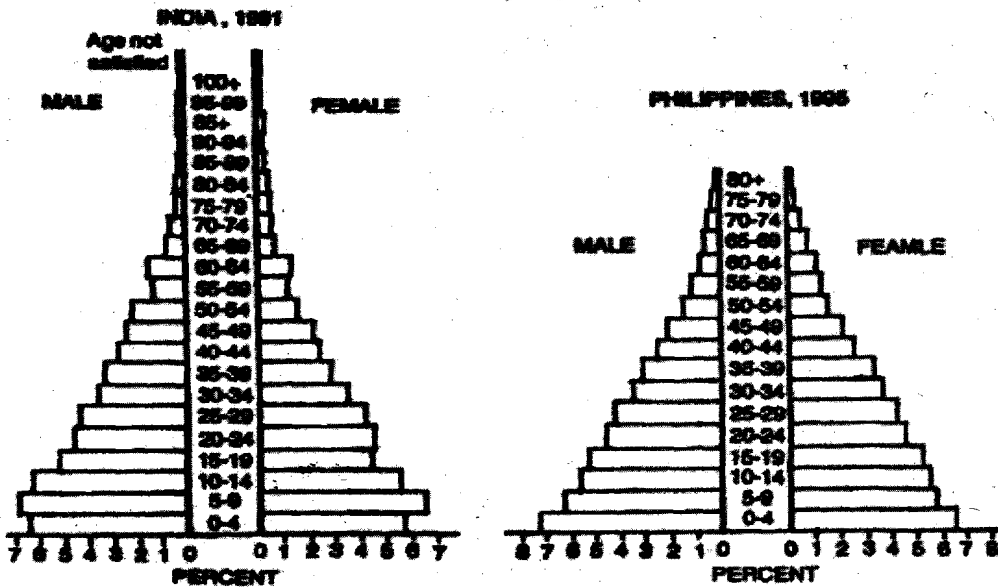
The pyramid can be made either way, in age-groups of width of 5 or 10 years or of single year. In any case the highest bar refers to an open age interval (say 80 years and above). The number of males and females can directly be traced on the graph or represented in percentage form, without producing any change in the geometrical shape of the pyramid. It is notable that the percentage in sex-age-group is calculated as in the total population and not in the population of that sex. Depending on the trends of fertility, mortality and migration, pyramid can take various shapes. The relative length of the bar at the bottom indicates whether the recent fertility has been high or low. Protuberances and indentations in the shape of pyramid reveal that corresponding periods of either high fertility, immigration or low mortality, or low fertility, emigration or high mortality. If the historical trend does not confirm the shape, it can, then, be explained by errors in reporting of age-data. Pyramid made for the single-year-age distribution of population can also show the phenomenon of digital preference or digit avoidance in reporting of age.

Figure 2.2 below contains the age-sex pyramids of two developing countries, India and the Philippines, and two developed countries, Sweden and the United Kingdom.

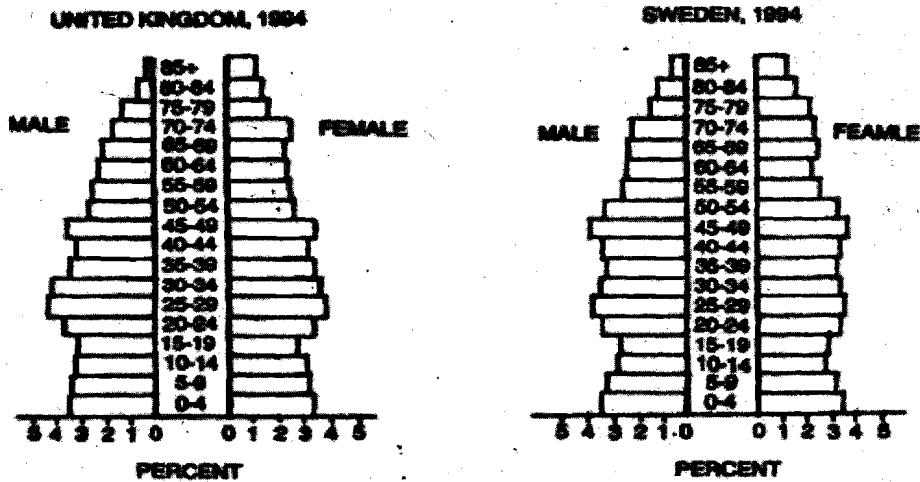
From Figure 2.2, it is obvious that the pyramids are of two sets of countries which have two different shapes. i) The pyramids of the two developing countries, India and the Philippines, have broad base and steeply sloping sides, indicating a large proportion of children and young persons and a small proportion of old people in the population. ii) The pyramids of the two developed countries, Sweden and the United Kingdom, are almost rectangular in shape, with a slight sloping at the older ages. These pyramids indicate a lower proportion of children and a higher proportion of the adults and the elderly in the population. Those populations which have a higher proportion of children and young persons are termed as “Young” populations, while those with lower proportions of children and youth and a higher proportion of adult and old population are known as “old” populations. It is, therefore, ironical to observe that old countries, in the sense of having long histories, such as India, Egypt and China, have very “young” populations, while comparatively young countries like the United Kingdom, France, Sweden and the United States have “old” populations. Thus, it must

be clearly understood that there is a distinction between the chronological age of a nation, which is measured from the time of a country's inception, and the "age" of the population, that is, the age distribution of the population. Similarly, the distinction between the age of an individual in the population and the age of the population must also be kept in mind. The former, that is, the age of an individual, moves only in one direction, that of an inexorable increase as time passes, while the population may get older or younger as time passes, in the sense that *the proportions of different age-groups may undergo changes with the passage of time.*

For Population Age Pyramids



Source: 1. Census of India, 1991, Social and Cultural Tables.
 2. United Nations, Demographic Year Book 1995, New York, 1997.



Age-Sex Pyramids for India (1991), the Philippines (1995), United Kingdom (1994) and Sweden (1994)

Figure 2.2: Population Pyramids of Two Developing and Two Developed Countries

Thus, demographic data is of great help in studying various aspects of population and the factors influencing the same. Based on some preliminary data available from the current census, among others (Family Welfare Year Book, 2009 and

http://en.wikipedia.org/wiki/Demographics_of_India) some demographic characteristics are given below.

Demographic characteristics of India, Census 2011

Population	1, 210, 193, 422 (2011 estimate)
Male Population	623,700,000 (623.7 millions)
Female Population	586,500,000 (586.5 million)
Sex Ratio	914 females per 1000 males
Growth Rate	1.41% (2009 estimate)
Birth Rate	22.22 births /1000 population (2009 est)
Death Rate	6.4 deaths / 1000 population (2009 est)
Life Expectance	69.89 years (2009 est)
Male Life Expectance	67.46 years (2009 est)
Female Life Expectance	72.61 years (2009 est)
Total Fertility Rate	2.68 (2010 est)
Infant Mortality Rate	30.15 deaths /1000 live births
Density	382
Sex Ratio	940
Literacy Rate	74.0 (2011)
Female Literacy	65.5 (2011)
Male Literacy	82.1 (2011)

Due to constraints of space, time and scope we will not discuss all such characteristics of population here. However, we will discuss below the measures of population distribution and population change.

2.6 MEASURES OF POPULATION DISTRIBUTION AND POPULATION CHANGE

In the preceding section, we have discussed at length the concepts of population distribution and its structure or composition. In this section, we will deal with the measures of population distribution and of its changes.

2.6.1 Measures of Population Distribution/Composition

In this sub-section, we will focus on the measures of population distribution and/or its composition mainly pertaining to population density (how densely it is distributed), sex ratio (distribution by males and females) and dependency ratio (distribution of the young, old and other dependents).

2.6.1.1 Population Density

The density of population in an area is usually computed as the number of persons per square km or per square mile of land area. It is, however, a misleading index

of population distribution since different areas are not uniformly inhabited. For an example, the density of population living in Madhya Pradesh and Rajasthan is much less than those in Kerala and West Bengal.

The densities of urban areas are much higher than those of rural areas. Countries with vast areas under deserts, mountains, forests, icecaps, etc., have low densities. The most thinly-settled countries are those in the Antarctic Circle.

As an illustration, population density of different States and Union Territories in India is presented in Table 2.11.

Table 2.11: Ranking of States and Union Territories by Density – 1991 and 2001

Rank in 2001	States and Union territories*	Density (per sq. km.)		Rank in 1991
		2001	1991	
1	2	3	4	5
1	Delhi*	9,294	6,352	1
2	Chandigarh*	7,903	5,632	2
3	Pondicherry*	2,029	1,683	3
4	Lakshadweep*	1,894	1,616	4
5	Daman & Diu*	1,411	907	5
6	West Bengal	904	767	6
7	Bihar	880	685	8
8	Kerala	819	548	7
9	Uttar Pradesh	689	403	9
10	Punjab	482	429	11
11	Tamil Nadu	478	372	10
12	Haryana	477	282	12
13	Dadra & Nagar Haveli*	449	316	15
14	Goa	363	286	13
15	Assam	340	274	14
16	Jharkhand	338	257	16
17	Maharashtra	314	263	18
18	Tripura	304	242	17
19	Andhra Pradesh	275	235	19
20	Karnataka	275	211	20
21	Gujarat	258	203	21
22	Orissa	236	158	22
23	Madhya Pradesh	196	129	23
24	Rajasthan	165	133	26

25	Uttaranchal	159	130	24
26	Chhattisgarh	154	73	25
27	Nagaland	120	93	31
28	Himachal Pradesh	109	82	27
29	Manipur	107	79	28
30	Meghalaya	103	77	29
31	Jammu and Kashmir	99	57	30
32	Sikkim	76	34	32
33	Andaman & Nicobar Islands*	43	33	33
34	Mizoram	42	33	34
35	Arunachal Pradesh	13	10	35

Note: While working out the density figures for Jammu and Kashmir for 1991 and 2001 censuses, the entire area and population of those portions of Jammu and Kashmir which are under illegal occupation of Pakistan and China have not been taken into account.

Barclay (1958) has suggested another measure of density which relates to the "ratio between requirements of a population and the resources made available to it by production in the area it occupies".

$$\text{Density} = \frac{NK}{SK''}$$

Where:

N = Total population,

K = the quantity of requirement per capita,

S = area in square kilometers, and

K'' = the quantity of resources produced per square kilometer.

2.6.1.2 Sex Ratio

Sex ratios are the measures of composition of either sex of the given population.

- a) **Masculinity proportion:** The simplest measure of sex composition of a population is the masculinity ratio defined as the percentage of males in the population. The formula for the masculinity proportion is:

$$\frac{P_m}{P_m + P_f} \times 100 \quad \text{or} \quad \frac{P_m}{P_t} \times 100$$

Where:

P_m and P_f denote the population of males and females respectively, and P_t denotes the total population.

- b) **Sex ratio:** This is the most widely used and principal measure of sex composition that has enjoyed the maximum use in analytical demography. It is usually defined as the number of females per 1000 males in a population, that is,

$$\text{Sex ratio} = \frac{P_f}{P_m} \times 1000$$

But, some demographers use it as, $\text{Sex ratio} = \frac{P_m}{P_f} \times 1000$ as well, i.e. number of males per 1000 females.

It is obviously directly related to masculinity proportion. The points of balance of sexes of the two measures, i.e. masculinity proportion and sex ratio are 50 and 1000. It means, a masculinity proportion of less than 50 indicates excess of females than males and if it is more than 50 it indicates excess of males. Similarly, a sex ratio more than 1000 depicts the excess of females over males and a sex ratio below 1000 indicates an excess of males.

Sex ratio can be calculated for various brackets of the population. It can be used for evaluation of data providing a check for internal consistency. It is essentially a function of: (a) sex ratio at birth; (b) sex ratio of migrants; and (c) differential mortality patterns of the two sexes.

Example: Sex ratio for India, 1971.

Population of males $P_m = 284,049,276$

Population of females $P_f = 264,110,376$

$$\text{Masculinity proportion} = \frac{P_m}{P_m + P_f} \times 100 = 51.82$$

$$\text{Sex ratio} = \frac{P_f}{P_m} \times 1000 = 929.8$$

The study of sex ratio in a population is important primarily because of two reasons. *Firstly*, analysis of the sex ratio can help us in drawing several inferences regarding the dynamics of demographic phenomena; and *secondly*, it has bearing upon the marriage rate, birth rate, death rate and even on the rate of migration directly.

In India, however, sex differential of external migrants, even if it exists cannot explain the deficit of females, simply because the external migration in relation to the size of population of India is small; migration may have slight effect at the state level, and in urban and rural areas.

Sex ratio is invariably lower in the urban areas than in the rural areas. One finds a much higher proportion of males in the working ages in urban India. This is certainly because of migration of single males from rural to urban areas for educational, economic or such other related purposes. Thus, there exists variations in the sex ratios between the States of a given country or those of different countries as well.

In Table 2.12 we can observe the differences in the sex ratio of selected countries.

Table 2.12: Overall Sex ratios of Selected Developed and Developing Countries

Country	Year	Sex Ratio (Males per 1000 females)
Indian	2001(c)	1072
Pakistan	1995	1060
Bangladesh	1990	1067
Indonesia	1995	995
Japan	1994	963
Iran	1991(c)	1063
Nepal	1991(c)	995
Sri Lanka	1994	1040
Philippines	1995	1010
Singapore	1995	1010
United States of America	1995	954
China	1990(c)	1060
Argentina	1993	956
Brazil	1994	976
United Kingdom	1994	959
France	1993	949
Sweden	1994	977
Germany	1994	946
Thailand	1995	1005

Note: C = Census Year; Data is accessed as available for the particular year for the selected country.

Source: United Nations. 1997. *Demographic Year Book 1995*, New York, pp.182-213.

Tables 2.13, 2.14 and 2.15 show the differentials in sex ratios of India as a whole and of different States and Union Territories respectively at different time periods as computed based on the data available in the relevant sources.

Table 2.13: Sex Ratios of different States and Union Territories in India (1901-1971)

State/UT	(Female per 1000 males)							
	1901	1911	1921	1931	1941	1951	1961	1971
Andhra Pradesh	985	992	993	987	980	986	981	977
Assam	919	915	896	874	876	868	869	896
Bihar	1,054	1,044	1,016	994	996	990	994	954

Gujarat	954	946	944	945	941	952	940	934
Haryana	867	835	844	841	869	871	868	867
H.P.	884	889	890	897	890	912	938	958
J. and K.	882	876	870	865	869	873	878	878
Karnataka	983	981	969	965	960	966	959	957
Kerala	1,004	1,008	1,011	1,022	1,027	1,028	2,022	1,016
M.P.	990	986	974	973	970	967	953	941
Maharashtra	978	966	950	947	949	941	936	930
Manipur	1,037	1,029	1,041	1,065	1,055	1,036	1,015	980
Meghalaya	1,036	1,013	1,000	971	996	949	937	941
Nagaland	973	993	992	997	1,021	999	933	871
Orissa	1,037	1,056	1,086	1,067	1,053	1,022	1,001	988
Punjab	832	780	799	815	836	844	854	865
Rajasthan	905	908	896	907	906	921	908	911
Sikkim	916	951	970	967	920	907	904	863
Tamil Nadu	1,044	1,042	1,029	1,027	1,012	1,007	992	978
Tripura	874	885	885	885	886	904	932	943
U.P.	937	915	909	904	907	910	909	879
West Bengal	945	920	905	890	852	865	878	891
Andaman and Nicobar Island	318	352	303	495	574	625	617	644
Arunachal Pradesh	—	—	—	—	—	—	894	861
Chandigarh	771	720	743	751	763	781	652	749
Dadra and Nagar Haveli	960	967	940	911	925	946	963	1,007
Delhi	862	793	733	722	715	768	785	801
Goa, Daman and Diu	1,085	1,103	1,122	1,088	1,028	1,083	1,071	989
Lakshadweep	1,063	987	1,027	994	1,018	1,043	1,020	978
Mizoram	1,113	1,120	1,109	1,102	1,069	1,041	1,009	946
Pondicherry	NA	1,058	1,053	NA	NA	1,030	1,013	989

Table 2.14: Overall Sex Ratio in India — 1901-2011

<i>Census Year</i>	1901	1911	1921	1931	1941	1951	1961	1971	1981	1991	2001	2011
<i>Sex ratio* (Females per 1000 males)</i>	972	964	955	950	945	946	941	930	934	927	933	940
<i>Sex ratio** (Males per 1000 females)</i>	1029	1037	1047	1053	1058	1057	1063	1075	1071	1079	1072	1064

Sources: * <http://censusmp.gov.in/censusmp/All-PDF/06Gender%20Composition.pdf>.

** Computed from the above data in second row.

Table 2.15: State-wise Sex Ratio in India in 2011 compared with 2001 Census

Code	States / Union Territory #	Total 2001	Total 2011	Change
INDIA		933	940	0.75%
1	Jammu & Kashmir	892	883	-1.01%
2	Himachal Pradesh	968	974	0.62%
3	Punjab	876	893	1.94%
4	Chandigarh #	777	818	5.28%
5	Uttarakhand	962	963	0.10%
6	Haryana	861	877	1.86%
7	NCT of Delhi #	821	866	5.48%
8	Rajasthan	921	926	0.54%
9	Uttar Pradesh	898	908	1.11%
10	Bihar	919	916	-0.33%
11	Sikkim	875	889	1.60%
12	Arunachal Pradesh	893	920	3.02%
13	Nagaland	900	931	3.44%
14	Manipur	974	987	1.33%
15	Mizoram	935	975	4.28%
16	Tripura	948	961	1.37%
17	Meghalaya	972	986	1.44%
18	Assam	935	954	2.03%
19	West Bengal	934	947	1.39%
20	Jharkhand	941	947	0.64%
21	Orissa	972	978	0.62%
22	Chhattisgarh	989	991	0.20%
23	Madhya Pradesh	919	930	1.20%
24	Gujarat	920	918	-0.22%

25	Daman & Diu #	710	618	-12.96%
26	Dadra & Nagar Haveli #	812	775	-4.56%
27	Maharashtra	922	925	0.33%
28	Andhra Pradesh	978	992	1.43%
29	Karnataka	965	968	0.31%
30	Goa	961	968	0.73%
31	Lakshadweep #	948	946	-0.21%
32	Kerala	1058	1084	2.46%
33	Tamil Nadu	987	995	0.81%
34	Puducherry #	1001	1038	3.70%
35	Andaman & Nicobar Islands #	846	878	3.78%

Source: <http://updateox.com/india/state-wise-sex-ratio-in-india-in-2011-compared-with-2001-census/>

2.6.1.3 Dependency Ratio

Another aspect of population composition is dependency ratio. The dependency ratio is measured as follows.

$$\text{Dependency Ratio} = \frac{P_{0-14} + P_{60+}}{P_{15-59}} K$$

Where:

- P_{0-14} , P_{60+} and P_{15-59} denote the populations in the age groups 0-14, 60+ and 15-59 respectively, and
- K is 100.

e.g. If a country has 263065, 43172 and 358772 population in the age-groups 0-14, 60+ and 15-59 respectively, the dependency ratios are calculated as follows.

$$\text{Young Dependency Ratio} = \frac{263065}{358772} \times 100 = 73.33$$

$$\text{Old Dependency Ratio} = \frac{43172}{358772} \times 100 = 12.03$$

$$\text{Total Dependency Ratio} = \frac{263065 + 43172}{358772} \times 100 = 85.36$$

Total Dependency Ratio = Young Dependency Ratio + Old Dependency Ratio

$$\text{i.e. } 85.36 = 73.33 + 12.03.$$

The dependency ratio is not a completely accurate measure for assessing the dependency burden, because not all persons in the working age are employed, nor all those in the dependent age are economically-dependent. This measure, however, gives us a broad idea of economic dependency in any population and is, therefore, widely used.

Check Your Progress

Notes: a) Space given below the question is for writing your answer.

b) Check your answer with the one given at the end of this unit under “Answers to ‘Check Your Progress’ Questions”.

2) What is dependency ratio? Explain, in brief, its importance in population analysis. Compute it with any hypothetical/actual data of your choice.

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3) Explain the importance of population pyramid analysis.

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2.6.2 Measures of Population Change

It is needless to mention that population always refers to a fixed boundary or area, such as a Country, State, Province, District, Village, etc. The size of the population in any area increases through births and immigration and decreases mainly through death and out-migration.

Study of population change over time and space is an important aspect of demography. Population change implies the change not only in its size but also in its internal composition and structure with respect to its various characteristics and spatial distribution. Before one envisages to study the implications of such changes in population on various social, economic, political, cultural and eco-systems including the demographic processes such as births, deaths and migration, one needs the measurement of such change so as to have assessment of its actual impact and magnitude of change potential on any given populations.

The total population of an area may be determined by a census count in two ways. The easier way is the “*de-facto*” head-count in which all the persons are to be counted in a place where they are found at the time of enumeration irrespective of the fact that they actually belong to that place or not. This system has greater chance of counting the moving population and ensures maximum coverage of the population. It, however, fails to provide the exact area-wise distribution of the population which is very much essential not only for administrative purposes but also for planning various welfare programmes in

different areas and for studying population trends. The other way in which census count is done is known as “*de-jure*” method in which persons are enumerated on the basis of their place of usual residence. Most of the countries follow the *de-jure* system of obtaining the total population of all areas. The concept of “usual residence” is, however, vague and provides enough scope of misjudgement. This does not include foreigners and temporary visitors, though they may be substantial in number to affect the social and economic activities of the population. Most of the modern censuses, therefore, combine the two systems to derive the maximum information about the population.

Simple use of the exponential rate of growth of the population gives the idea of birth and death rates in the remote past. This idea may further be expanded to ascertain the change in birth rate over time.

Ratios and rates: The terms ‘ratio’ and ‘rate’ are not well defined in demography. There are conceptual distinctions between the two, but these distinctions are not consistently observed. For instance, survival rate, frequently used in demography and actuarial science, is the ratio of the number of persons in a cohort at one date to the number at an earlier date. It simply implies survival from a given age to a subsequent age. It is usually calculated from two age distributions of different censuses, or from a life table population. Survival rate fits the definition of a ratio, in situations where one number is related to another number, to provide comparison or relation between these two numbers. However, there are many types of ratios. For more clarity about the ratios and rates, let us discuss them below.

2.6.2.1 Ratios

A “ratio” is a single term which expresses the size of one number in relation to the size of another. Take for example, the sex ratio in the United States. It is possible to express in a single figure — a ratio, - the fact that there are 978 males per 1000 females. A ratio of 1000 would mean that the number of males is equal to the number of females, whereas a ratio over 1000 would mean that there are more men than women, and a ratio less than 1000 would mean there are fewer men than women.

Rates are computed in the same manner as ratios. Conceptually, a rate may be considered as a special case of a ratio. The difference between the two is the kind of source material/data used for the two numbers, numerator and denominator. In demography, the term ‘rate’ implies a relationship between the numerator and the denominator. The numerator refers to the events and the denominator is the population at risk. The precision of a rate depends upon how closely we relate events in the numerator to the population at risk in the denominator. For instance, the incidence of divorce is often measured by the Crude Divorce Rate, which is defined as the number of divorces in a given year per 1000 (or 100,000) midyear population. This is not a refined measure because it is based on the mid-year population (denominator) which includes, besides the divorced, the never married, widowed and other persons who are not at the risk of being divorced.

2.6.2.2 Rates

As mentioned above, rate may be considered as a special case of a ratio. A “rate” is computed like the ratios, but it has the additional feature of expressing what

has happened in terms of a certain unit of time. Usually, in demographic work, the unit of time is a year if no other time unit is specified. The two most commonly used rates are *crude birth rates* and *crude death rates*.

The use of rates and ratios is clear to most population specialists/scientists. Ratios are used for descriptive purposes, and rates are used in the specific analysis of change. Ratio indicates the degree of growth of a population, but it is not a "rate of growth." A rate of growth should express growth as a relative change in population size per year (Barclay, 1958).

2.6.2.3 Proportions

A "proportion" is a particular kind of ratio. It does not express the size of one part of a whole in relation to the size of another part of the same whole, which you have already noticed under masculinity proportion in sub-section 2.6.1.2 above. A proportion shows the ratio of one part to the whole, or base number. Its value is always between 0 and 1. For example, dividing the number of males in 1960 (89,008,000) by the total population in 1960 (180 million) of the United States gives us 0.494, i.e. the proportion of males in the total population. When there are only two components, as in this case, the proportion of females in the total population can be calculated by subtracting the proportion of males from 1. The sum of all the component proportions of a population must add up to 1.

2.6.2.4 Percents

A "percent" is a proportion multiplied by 100. A percent is a ratio calculated on the assumption that the base number equals 100. For example, if the above proportion of males (0.494) in the United States in 1960 is multiplied by 100, it gives us 49.4, which means the percent of male population, that is, the number of males per 100 population. For popular consumption, demographers turn their proportions into percents, because the percent is more commonly used and more generally understood.

2.7 SOURCES OF DEMOGRAPHIC DATA: SYSTEMS AND METHODS

For any subject, to know data, sources of data are very essential. Data is required for analysis, comparison or drawing conclusions, etc. There are different systems, methods and procedures used for collection of data which provide reliable and rich sources of data about population for use or analysis by the demographers and others.

2.7.1 Systems

The systems existing for population data in general are as follows.

2.7.1.1 Registration of Vital Events: Vital Statistics

The events such as birth, death, marriage, migration, etc are called vital events. The registration of vital events is an important source of population information. It is, therefore, essential to understand the terms "vital events", "vital records" and "vital statistics."

A person's entry into the world (by birth) and a person's departure from it (by death) are considered to be *vital events*; because these events mark the beginning and the end of a person's life. A still birth or a foetal death is also considered as a vital event from the demographic point of view, for it is related to both the events of birth and death. During the span of life from birth to death, a change may take place in an individual's civil condition, that is, he or she may get married or divorced, or may be adopted or move away from place of his/her birth. Such events involving changes in the civil status of a person are also considered vital events.

Vital records may be defined as those concerned with vital events or those which have recorded vital events such as births, deaths, still-births, marriages, divorces, etc. The occurrence of a vital event is reported by the persons concerned to the appropriate authorities. For instance, parents report the occurrence of a birth, relatives report a death in the family or an individual reports his or her own marriage.

Along with the vital events, some ancillary information is also recorded. In case of a birth, such information includes the date of birth, the sex of the baby, the age of the mother and the number of her previous children, the order of the birth, the residence of the mother, etc. In the case of a death, information of the date of occurrence, age and sex of the deceased, place of occurrence, usual residence of the deceased, cause of death, etc., is recorded.

2.7.1.2 Civil Registration in India: Background and Problems

The system of registration of vital events was introduced in India by the British more than a hundred years ago. In the middle of the nineteenth century, administrators began to attach importance to the registration of civil events, especially of deaths. During that time, the death rate in India was very high, perhaps, because sanitary and public health conditions were appalling. In such circumstances, it was necessary to have fairly reliable estimates of death rates, through registration of the number and the causes of deaths.

Though any failure to register births and deaths is punishable by law, the importance of the registration of vital events is neither realized by the masses nor by the local registering authorities. For most Indian people, few occasions arise when birth and death certificates are required. It is, therefore, not surprising that they do not appreciate the necessity of registering vital events.

2.7.1.3 Sample Registration System in India

In 1963-64, a new system, called the Sample Registration System, was initiated in India, in which the technique of the dual report system was used for reliable estimates of vital rates such as birth and death rates as well as the population growth rate for India and different States. The Sample Registration System (SRS) also fulfils the need to measure short-term changes in the rate of population growth with a view to evaluating the effect of the national family planning programme and projecting future trends of population growth. The SRS does this by providing estimates of birth and death rates and population growth rates in India as a whole and separately for rural and urban areas of various States and Union Territories. The estimates of the SRS are considered to be fairly reliable.

2.7.1.4 Dual Reporting System

In many developing countries, in general, the data on births and deaths obtained from the Civil Registration System are inadequate and inaccurate and, therefore, are not useful for computing birth and death rates, the rate of population growth or for any type of demographic analysis. Although efforts to improve the coverage and quality of data on births and deaths have already been initiated, it is not possible to improve the entire registration system in a short period of time. Meanwhile, the need persists for yearly data on births, deaths and population increase. To overcome this problem, a new method of data collection was developed by demographers. This system is referred to as the “dual reporting system”. This method, in some form or the other, was tried out in India, Pakistan, Turkey, Liberia, Colombia, Thailand, Morocco, the Philippines and Kenya, and the experience gained was quite satisfactory. It is now widely recognized that this dual report system is a powerful and useful instrument for demographic purposes.

This new system, i.e. dual reporting system, may be broadly described as follows: In a dual reporting system, each event of birth and death is enumerated by two independent procedures; one is the registration of births and deaths, and the other is the sample survey. The design of this system is based on an appropriate number of small geographic samples. In each of these sample areas, a continuous record is kept of the events of births and deaths as they occur. Ancillary information about the events is also recorded at the same time. In the same sample area, information about births and deaths along with the relevant information is collected through periodic retrospective sample surveys. The information on each event of birth and death, obtained through the continuous current registration and the retrospective sample survey, is matched and the number of events missed by both procedures is mathematically estimated. It is thus possible to arrive at an accurate estimate of total births and deaths in the sample.

2.7.2 Methods

While the systems are in place the methods that the systems follow may be different. However, the popular methods followed all over the world for population data are given below.

2.7.2.1 Census Survey or Census Method

The most fundamental source of data for the study of population is the census survey, which in India, is carried out by the Census Commissioner of India. In fact, the very purpose of a census survey in modern times is to produce statistical data on various aspects of population. Census survey involves a complete enumeration of the entire population and the collection of information about some important characteristics of each person at regular intervals with a view to obtaining knowledge about the trends in population growth, its structure and characteristics, among others.

A census survey of population may be defined “as the total process of collecting, compiling and publishing demographic, economic and social data pertaining, at a specified time or times, to all persons in a country or delimited territory”. In other words, it can be said that census is the collection of information about births, deaths occupational, social and economic conditions of the people of the country at a given time. Census has become a very popular method of collecting

information about the people. It helps not only in collecting figures but is much more informative beyond that. It provides information about the economy of the nation, rates of birth and death, rural-urban migration, living standard of the people, family size, educational achievements, etc.

The first attempt to obtain information about the size of population in India, by actually counting heads, was made during 1867-1872. This count was neither synchronous, nor did it cover the whole country. As the noted demographer Kingsley Davis (quoted in Asha and Tara, 2006, p.32) observed, it was just "an auspicious beginning" of census taking in India. The next census, which was synchronous, covered a wider area and was more modern in nature, was undertaken in 1881. Since then, once in every ten years, a new census has been taken in India. The 1971 census was the eleventh and marked the completion of one hundred years of census taking in India. In 1972, the centenary of the Indian Census was celebrated. The recent 2011 census represents the fifteenth census of India, in this continuous series.

The Census of 1951, the ninth in the series, was in fact the first census conducted in independent India. This census report discussed the growth and structure of the population, and its economic development. The threat posed by the alarming increase in population was properly evaluated, and the need for curbing the rate of growth was emphasized. The practice of preparing district census handbooks was also initiated. Data for smaller administrative units such as a village or an urban block were thus made available, and micro-level planning became possible. The Census of 1961 was marked by further improvements; carefully planned and a great deal of publicity was given to it through the mass media such as newspapers, pamphlets, radio, cinema, etc. The same practice was continued for the 1971, 1981, 1991, 2001, 2011 censuses, with even further improvements wherever possible. The data we have used in some tables in the preceding sections are based on these census reports only.

According to the Indian Census Act of 1948, the Central Government is empowered to notify and conduct a census in the whole country or any part of it. It authorizes census enumerators to ask the prescribed census questions and legally compel all persons to answer these questions truthfully. The Act also guarantees that the information collected at any census from individuals shall be kept confidential, shall be used only for statistical purposes and shall not be used as evidence even in a court of law.

Today, the need and necessity of scientific means and methods of data collection is being increasingly realised. Almost every State has passed a legislation by which it is obligatory on each and every individual to provide relevant information to the census enumerator. Today census covers not only population but also figures are collected about houses, animals, schools, religious and charitable institutions, etc. In fact, with every census every possible effort is made to collect more and more data, since census survey is done, but only once in every 10 years.

Realising the need and necessity of census UNO in a census handbook has given certain guidelines to all nations of the world to conduct census on uniform basis. The data is now collected and brought to the notice of the society as a finished product after putting it through different stages (Hans Raj, 1986, p.40).

Census Procedure: The procedure of census involves the following steps.

- i) Determination of Contents
- ii) Development of Census Schedule
- iii) Division of Work
- iv) Required Propaganda
- v) Household-survey
- vi) Pre-Testing of Questionnaire
- vii) Proper Training
- viii) Stress on Impartiality
- ix) Tabulation of Information
- x) Publication of data

i) **Determination of Contents:** It is the first important stage which decides as to what type of information ought to be collected and what should be omitted. During census operation, information on the following aspects is collected: a) Geographical, b) Personal, c) Economic, d) Cultural, e) Educational, f) Fertility, and g) Other Information.

Though the data on above lines is collected, yet in order to ensure that data is correct, some precautionary steps such as the following are taken:

- All the terms used have been properly defined;
- Enumerators have been properly trained and motivated;
- A climate has been created by which people are made ready to provide information;
- No column is added which seeks information of purely private and personal nature;
- Information to be collected is not very time-consuming;
- Confidentiality of information collected should be fully ensured;
- Information to be collected is manageable;
- Each enumerator is given sufficient time to complete his work;
- There is provision for checking that the information supplied is accurate.

ii) **Development of Census Schedule:** The questions should be so worded that answer to one question can provide information on more than one point. Not only this but also the questions should be so worded that the answers are quite precise, clear and brief. All the questions should be pre-tested and chained in such a manner that answers to one question becomes a link to another question.

iii) **Division of work:** Before census time comes, the whole country should be divided into regions and sub-regions for effective survey. In India, such divisions include States, divisions, districts, tehsils, towns, cities, villages, etc.

- iv) **Required propaganda:** In every country, before census officials approach the respondents to start their work, the people are mentally prepared. With the help of newspapers, posters, T.V., cinema, slides, etc., they are informed that the census time has approached and also that the field-staff will be contacting every person. They are also made to realise the importance and significance of census work and legal obligation which they have in this regard. They are also assured that all the information which will be supplied by them will be kept strictly confidential.
- v) **Household survey:** Few months before actual census work is undertaken an actual household survey is unavoidable. Each area is divided into locality and in each such locality each house is counted. With the help of past census, it is found out in which area new dwelling units have come up and from which areas, the population has migrated and in which areas population has become less. This helps in finding out density and population on the one hand and on the other, it is ensured that at the time of actual census no house is omitted.
- vi) **Pre-testing of questionnaire:** Census operation being both costly as well as time consuming, every country questionnaire to be used at the time of census is pre-tested. Questions included are put on select persons at random and then it is seen, if the questions are so worded that these communicate the same sense in which they were included and also that these do not carry different meanings with different persons. In a country like India, where questionnaires are to be translated into regional languages as well, it is to be seen that each such questionnaire translated into regional language is pre-tested. For this, it is obvious that people will have to be trained in advance and clarity provided.
- vii) **Proper Training:** Since census operation is a very complex process, before the work starts, every effort should be made to see that the staff which is being put on duty is well trained.
- viii) **Stress on Impartiality:** Those who are put on duty may have their own preferences and prejudices. However, they should be made to realise well in advance that while collecting information from the respondents they should not allow personal preferences to creep in. Similarly, they should ensure that they are impartial in their duty and, thus, data collected is unbiased.
- ix) **Tabulation of Information:** During census period thousands are put on duty who collect information from crores of people spread in different parts of the country. The collected information has to be properly tabulated for further processing.
- x) **Publication of data:** All information that is coded and tabulated is published for the use of the society.

2.7.2.2 Sample Surveys

The Sample Survey is another method of demographic data collection for population studies. In a sample survey, information is collected only from a sample, which is representative of the whole of the population, from which

conclusions are drawn by the use of scientific methods. In a country like Afghanistan, where no census was conducted, population data were collected through sample surveys and some estimates were made of its size, growth, structure and characteristics. Even in countries where regular census operations are conducted, the need for collection of population data through sample surveys is felt, for a census is taken in most countries only once in ten years. Therefore, collection of data through sample surveys assumes greater significance in the context of any interim data required on certain aspects of the population.

- ***The National Sample Survey:*** The main objective of the National Sample Survey has been to collect data on some important socio-economic aspects on a comprehensive basis for the whole country through its various rounds by using the technique of sample survey. The First Round of the National Sample Survey (NSS) was conducted in 1950; since then, information on different items has been collected through various rounds of the NSS. The topics covered so far include the following: fertility, mortality, population growth, economically active population, family planning, employment and unemployment, consumers' expenditure patterns, housing conditions, manufacturing industries, physically handicapped persons, conditions of the aged, etc.
- ***The National Family Health Survey (NFHS):*** The NFHS is a collaborative project of the International Institute for Population Sciences, Mumbai, all the Population Research Centers in the country, various data collecting organisations such as the East-West Center/Macro International, United States of America, and the Ministry of Health and Family Welfare, New Delhi.

The National Family Health Survey (NFHS) which is a household sample survey was carried out in 24 states and National Capital Territory of Delhi during 1992-93. During 1998-99 a second round of the NFHS (NFHS-2) was started. The NFHS-2 is another important step to strengthen the database further for the implementation of reproductive and child health approach, adopted by India since 1996. The third survey, (NFHS-3) was taken up in 2005-2006. Thus, these NFHS surveys include:

- National Fertility Household Survey (NFHS) – Phase I, 1992-1993.
- National Fertility Household Survey (NFHS) – Phase II, 1998-1999.
- National Fertility Household Survey (NFHS) – Phase III, 2005-2006.

2.7.2.3 Population Registers

In some countries such as Sweden, Finland, Belgium, Israel, Taiwan and Korea data about population can be obtained from continuously maintained population registers, in which the name of each person in the country is entered. Important migratory movements of individuals are also registered. The primary object of setting up of this system of population registers is to establish the identity of individuals and control them. These registers, however, are also used to obtain such demographic information as current population size, internal migration, data on vital events, etc.

2.7.2.4 International Publications

The United Nations and other international organisations periodically publish demographic data for the world and for different countries. Some of the important publications are:

- **Demographic Year Book:** In this periodical, which is annually published by the United Nations, data for the world and different countries are presented on the following topics: population size, area, density, population growth, population characteristics, number of births and birth rate, number of deaths and death rate, number of marriages and marriage rate, etc. Every year, a special topic is selected for the presentation of data pertaining to it. Detailed information is presented on the special topic selected and may cover one of the following: fertility (natality) mortality, population census statistics, marriage, etc. For instance, the Demographic Year Book for 1974 presents detailed data on mortality. The periodical is very useful not only to the students of population studies but also to all others interested in population studies.
- **Statistical Year Book:** In this annual publication of the United Nations, information on the following topics is available for various countries of the world: national accounts, facilities of hospitals and availability of doctors, energy consumption, food production, educational facilities, newspaper circulation, availability of labour force, etc.
- **Epidemiological and Vital Records:** In this monthly periodical published by the World Health Organisation information on public health and mortality is presented for different countries of the world.

Check Your Progress

Notes: a) Space given below the question is for writing your answer.

b) Check your answer with the one given at the end of this unit under “Answers to ‘Check Your Progress’ Questions”.

4) Present in brief various international sources of population data.

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5) Explain the significance of sample surveys in India.

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2.8 LET US SUM UP

In this Unit, we have explained you important concepts used in demography or population studies. We have highlighted the interrelationship: between demography and other social sciences; between demography and population studies; and between population studies and other disciplines. Further, we have covered the aspects of population distribution and various characteristics of population like age-structure, sex-structure, age- and sex-structure both taken together, population pyramid and its implications, dependency ratio, and urban-rural differentials in the composition. We have also touched upon various national and international sources of demography / population data along with systems and procedures involved in collection of such data.

2.9 ANSWERS TO 'CHECK YOUR PROGRESS' QUESTIONS

- 1) *Interrelationship between Demography and Economics:* Relationship between demography and 'economics has considerably increased during 20th century and thus both the subjects have come quite closer to each other. This, perhaps, is the reason that demography today is even considered as a branch of economics. Economics studies economic problems of the people, and in that the demographic and population studies plays a very vital role. Where there is more population, economic activities are bound to increase. Population problems are directly linked and connected with employment, per capita income, problems of development, rehabilitation, education, transportation, industrialization, etc.

Demography influences economics in many important and different ways. Changes in population influence labour force and the source of production. Depending upon the changes in labour force the economists shall be in a position to find out what amount of socially useful and productive labour is available in the country and whether the labour intensive or capital intensive techniques suit nation's economy, and so on. Demographers will help economists in finding out the extent of unemployment and the types of training as well as the opportunities needed by the country to remove unemployment from the soil.

- 2) *Dependency Ratio:* It is a measure to study the structure of the population. It is calculated as follows.

$$\text{Dependency Ratio} = \frac{P_{0-14} + P_{60+}}{P_{15-59}} K$$

Where:

- P_{0-14} , P_{60+} , and P_{15-59} denote the populations in the age groups 0-14, 60+ and 15-59 respectively, and
- K is 100.

For example, if a country has 263065, 43172 and 358772 population in the age-groups 0-14, 60+ and 15-59 respectively, the dependency ratio is calculated as follows.

$$\text{Young Dependency Ratio} = \frac{263065}{358772} \times 100 = 73.33$$

$$\text{Old Dependency Ratio} = \frac{43172}{358772} \times 100 = 12.03$$

$$\text{Total Dependency Ratio} = \frac{263065 + 43172}{358772} \times 100 = 85.36$$

Total Dependency Ratio = Young Dependency Ratio + Old Dependency Ratio

Therefore, $85.36 = 73.33 + 12.03$.

However, it may be remembered that the dependency ratio is not a completely accurate measure for assessing the dependency burden, for not all persons in the working age are employed, nor all those in the dependent age are economically-dependent. This measure, however, gives us a broad idea of economic dependency in any population and is, therefore, widely used.

- 3) *Population pyramid* is a widely used graphical device to show the age-sex composition of a population. It consists of a number of bars representing successive age-groups in ascending order, from the lowest age at bottom to the highest age at top. The length of a bar for any age-group represents the number or percentage of males or females in that age-group, according to a scale along the horizontal axis.

The pyramid can be made either way, in age-groups of width of 5 or 10 or in single years of age. In any case, the highest bar refers to an open age interval (say 80 years and above). The number of males and females can directly be traced on the graph or represented in percentage form, without producing any change in the geometrical shape of the pyramid. It is notable that the percentage in sex-age group is calculated as in the total population and not in the population of that sex. Depending on the trends of fertility, mortality and migration, pyramid can take various shapes. The relative length of the bar at the bottom indicates whether the recent fertility has been high or low. Protuberances and indentations in the shape of pyramid reveal that corresponding periods of either high fertility or high mortality, low mortality or low fertility, immigration or emigration. If the historical trend does not confirm the shape, it can, then, be explained by errors in reporting of age-data. Pyramid made for the single-year-age distribution can also show the phenomenon of digital preference or digit avoidance in reporting of age.

- 4) *International sources/publications of population data*: The United Nations and other international organisations periodically publish demographic data for the world and for different countries. Some of the important publications are given below.

- *Demographic Year Book*: In this periodical, which is annually published by the United Nations, data for the world and different countries are presented on the following topics: population size, area, density, population growth, population characteristics, number of births and birth rate, number of deaths and death rate, number of marriages and marriage rate, etc. Every year, a special topic is selected for presentation of data

pertaining to it. Detailed information is presented on the special topic selected and may cover one of the following: fertility (natality), mortality, population census statistics, marriage. For instance, the Demographic Year Book for 1974 presents detailed data on mortality. The periodical is very useful not only to the students of population studies but also to all others interested in it.

- *Statistical Year Book*: In this annual publication of the United Nations, information on the following topics is available for various countries of the world: national accounts, facilities of hospitals and availability of doctors, energy consumption, food production, educational facilities, newspaper circulation, availability of labour force, etc.
 - *Epidemiological and Vital Records*: In this monthly periodical published by the World Health Organisation information on public health and mortality is presented for different Countries of the world.
- 5) *Significance of Sample Surveys*: In a sample survey, information is collected only from a sample, which is representative of the whole of the population, and conclusions are drawn for the whole population by the use of scientific methods. In a country like Afghanistan, where no census was conducted, population data were collected through sample surveys and some estimates were made of its size, growth, structure and characteristics. Even in countries where regular census operations are conducted, the need for collection of population data through sample surveys is felt, for a census is taken in most countries only once in ten years. The collection of data through sample surveys has several advantages also.

2.10 REFERENCES

- Asha, A. Bhende, and Tara Kanitkar, 2006. *Principles of Population Studies*. Bombay: Himalaya Publishing House.
- Barclay, George W. 1958. *The Nature of Demography: Techniques of Population Analysis*. New York: John Wiley and Sons.
- Bhaskar, D. Misra, 1980: *An Introduction to the Study of Population*. Madras: South Asian Publishing Pvt. Ltd.
- Chandrasekhar, S. 1976. *Population and Law in India*. Bombay: Blackie and Son (India) Limited.
- Frank Lorimer, 1959. "The Development of Demography", in Philip M. Hauser and Otis Dudley Duncan (Eds.). *The Study of Population*. Chicago: University of Chicago Press.
- Government of India. 2009. *Family Welfare Year Book 2009*. New Delhi: Ministry of Health and Family Welfare.
- Guillard, Achille. 1855. *Elements de Statistique Humaine ou Demographie Comparee*. Paris: Guillaumin et cie.
- Hans Raj. 1986. *Fundamentals of Demography: Population Studies with Special Reference to India*. New Delhi: Surjeet Publication.

<http://en.wikipedia.org/wiki/Demography> - Retrieved on 29-06-2010.

http://en.wikipedia.org/wiki/Demographics_of_India — Retrieved on 25-09-2011.

<http://www.aph.gov.au/library/pubs/rn/1999-2000/2000rn09.htm> — Retrieved on 25-09-2011.

Ian Bowen. 1973. *Economics and Demography*. London: George Alien, and New York: McGraw Hill Book Company.

John Durand. 1962. "Demography's Three Hundredth Anniversary," *Population Index*, Vol.28, No.4, October, pp.333-334.

John Graunt. 1662. *Natural and Political Observations on the London Bills of Mortality*. London.

Kingsley Davis. 1959. "The Sociology of Demographic Behaviour", in Robert K Merton, Leonard Broom and Leonard S. Cottrell Jr. (Eds.). *Sociology Today: Problems and Prospects*. New York: Basic Books.

Luczkovich, see <http://www.grin.com/en/e-book/60766/demography> - Retrieved on 29-06-2010.

Philip M. Hauser and Otis Dudley Duncan. 1959. "Overview and Conclusions", in Philip M. Hauser and Otis Dudley Duncan (Eds.). *The Study of Population*. Chicago: The University of Chicago Press.

Ralph Thomlinson. 1965. *Population Dynamics*. New York: Random House.

United Nations. 1997. *Demographic Year Book 1995*. New York: United Nations.

Warren, S. Thomson. 1953. *Population Problems*. New York: McGraw Hill.

Suggested Readings

Kingsley Davis. 1945. "The World Demographic Transition", *The Annals of the American Academy of Political and Social Science*, Vol.ccxvii, January.

Kingsley Davis. 1968. *The Population of India and Pakistan*. New York: Russell and Russell.

Pathak, K. B., Ram, F. 1992. *Techniques of Demographic Analysis*. Bombay: Himalaya Publishing House.

Shiva S. Halli, and Vaninadha Rao, K. 1992. *Advanced Techniques of Population Analysis*. New York and London: Plenum Press.