1. Introduction

Welcome to the series of E-learning modules on Population growth – growth and rate of growth of population based on births, deaths and Cross migration.

By the end of this session, you will be able to:

- Explain the concept of Population growth such as,
 - o Growth and Rate of growth of population based on births
 - Deaths and Cross migration

Let us start with an Introduction:

- Change is measured by the differences between population sizes at different dates
- The absolute amount of change is obtained by subtracting the population at the earlier date from that at the later date
- Using the population at the earlier census as the base of period of change is dictated partly by logic and partly by convenience

Population growth is the change in a population over time, and can be quantified as the change in the number of individuals of any species in a population using "per unit time" for measurement.

In biology, the term population growth is likely to refer to any known organism, but this article deals mostly with the application of the term to human populations in demography.

A "natural population increase" occurs when the birth rate is higher than the death rate. While a country's population growth rate depends on the natural increase and on migration. Global population growth is determined exclusively by the natural increase.

Population growth is determined by four factors, births, deaths, immigrants, and emigrants. Formula is expressed as delta P is equal to birth minus Death plus immigrants minus emigrants.

In other words, the population growth of a period can be calculated in two parts, natural growth of population and mechanical growth of population, in which Mechanical growth of population is mainly affected by social factors, e.g. the advanced economies are growing faster while the backward economies are growing slowly even with negative growth.

In demography, population growth is used informally for the more specific term population growth rate, and is often used to refer specifically to the growth of the human population of the world.

Simple models of population growth include the Malthusian Growth Model and the logistic model.

2. Population Growth Rate

In measuring population change,

- One should be sure that the population of the area or group is comparable over the period in question
- > The area should be constant
- > The group should be defined on a consistent basis
- > The accuracy of coverage or classification should not vary appreciably
- And yet as a practical matter, adjustments are rarely practical; unless the modification is fairly extreme
- The change is usually computed on the basis of the published figures
- Knowledge of these differences is important for analysis

Population growth rate can be defined as follows:

- In demographics and ecology, population growth rate is the rate at which the number of individuals in a population increases in a given time period as a fraction of the initial population
- Specifically, population growth rate ordinarily refers to the change in population over a unit time period
- It is often expressed as a percentage of the number of individuals in the population at the beginning of that period
- This can be written as the formula: PGR is equal to Individuals at the time period t2 minus the individuals at the time period t1 divided by t2 minus t1
- The most common way to express population growth is as a percentage, not as a rate
- The change in population over a unit time period is expressed as a percentage of the population at the beginning of the time period

That is: Percentage growth is equal to growth rate into 100.

For small time periods and growth rates, the added population is the growth rate multiplied by the time period.

A positive growth ratio or rate indicates that the population is increasing, while a negative growth ratio indicates the population is decreasing.

A growth ratio of zero indicates that there were the same number of people at two times

A growth rate may be zero even when there are significant changes in the birth rates, death rates, immigration rates, and age distribution between the two times.

Equivalently, percent death rate is equal to the average number of deaths in a year for every 100 people in the total population.

If the length of the time is taken smaller and smaller, the PGR approaches the logarithmic derivative of the population function 'P'.

If the population as a function of time is exponential, say P of t is equal to C into exponential of 'at', the logarithmic derivative is 'a'.

Thus, the PGR approximates the exponent 'a' for populations with exponential growth.

A related measure is the net reproduction rate.

In the absence of migration, a net reproduction rate of more than one indicates that the population of women is increasing, while a net reproduction rate less than one (sub-replacement fertility) indicates that the population of women is decreasing.

Let us now discuss about Excessive growth and decline:

- Population exceeding the carrying capacity of an area or environment is called overpopulation
- It may be caused by growth in population or by reduction in capacity
- Spikes in human population can cause problems such as pollution and traffic congestion; these might be resolved or worsened by technological and economic changes
- Conversely, such areas may be considered "under populated" if the population is not large enough to maintain an economic system
- Between these two extremes, sits the notion of the optimum population

Let us discuss about the steps in measuring PGR.

- Choose the location for which you want to calculate the population growth rate
 This could be for the entire country or a specific region, state or smaller area,
 - depending on the purpose of your calculation and how you will use that data
 - This example will focus on the city of Kolkata and Chennai
- 2. Determine the years you want to compare
 - This could be the population growth rate from one year to another, or you might want to determine what the increase or decrease was over a longer span of time, such as 10 or even 50 years
 - As an example, let's calculate the population change from 2000 to 2007 for Kolkata and Chennai
- **3.** Determine the population in the starting year for your population growth rate comparison
 - The Indian Census Bureau has a website with information to help you find these numbers for the location you are comparing
 - For example the starting population in Chennai, for the year 2000, is 4 lakh 78 thousand 4 hundred 34
- 4. Determine the population for the ending date for the area
 - Once again, this can be found at the resource
 - The population in Kolkata in 2000, is 5 lakh 58 thousand 8 hundred 80
- **5.** Subtract the population from your starting date from the population from your ending date.
 - This will tell you how much the population has changed. A positive number indicates the population has grown, and a negative one indicates the population has dropped in that time frame
 - Take 5 lakh 58 thousand 8 hundred 80, Kolkata population for 2007 and subtract 4 lakh 78 thousand 4 hundred 34, Chennai population for 2000

- This gives you a positive change in population of 80 thousand 4 hundred 46 people
- 6. Divide your result in Step 5 by the population of your starting year.
 - This will tell you the population rate growth or decline rate in a decimal form
 - Multiply it by 100 to convert that rate to a percentage
 - In our example, divide the population change of 80 thousand 446 by the starting population of 4 lakh 78 thousand 4 hundred 34
 - This gives you a decimal answer of zero point 1681
 - Multiply this decimal by 100 and you have a positive population rate growth from 2000 to 2007 in Chennai as 16 point 81 percent

There are a number of ways in which a national population or the population of a subnational area may be redefined.

A change from a defacto to a dejure as is in taking a census will not have a great deal of effect on the intercensal change at the national level, but it will often affect the change in the population of certain geographic subdivisions.

3. Birth Rate & Demographic Transition

- The birth rate is typically the rate of births in a population over time.
- The rate of births in a population is calculated in several ways: Live births from a universal registration system for births, deaths, and marriages; Population counts from a census and Estimation through specialized demographic techniques
- The birth rate along with mortality and migration rate is used to calculate population growth
- The crude birth rate is the number of births per 1,000 people per year
- Another term used interchangeably with birth rate is natality
- When the crude death rate is subtracted from the crude birth rate, the result is the rate of natural increase. This is equal to the rate of population change excluding migration
- Crude birth rate is the childbirths per 1,000 people per year
- This is a common measure of fertility for a given population
- Crude birth rate is frequently used in population geography and demography and is a useful indicator in studies of population around the world

The crude birth rate could be of concern for particular countries that may be experiencing population decline, or for national governments who are worried about population growth rates that are higher than their country can sustain.

The crude birth rate may be measured as the number of births in a given population during a given time period such as a calendar year, divided by the total population and multiplied by 1,000.

- Another frequently-used indicator is the total fertility rate which is the average number of children born to a woman during her lifetime
- The total fertility rate is generally a better indicator of current fertility rates because unlike the crude birth rate, it is not affected by the age distribution of the population

Fertility rates tend to be higher in less economically-developed countries and lower in more economically-developed countries.

Factors affecting birth rate are as follows:

- Government population policy, such as pronatalist or antinatalist policies (for instance, a tax on childlessness
- Availability of family planning services, such as birth control and sex education
- Availability and safety of abortion and the safety of childbirth
- Infant mortality rate: A family may have more children if a country's infant mortality rate is high, since it is likely some of those children will die
- Existing age-sex structure
- Typical age of marriage
- Social and religious beliefs, especially in relation to contraception and abortion

- As people require more training to earn money, parents tend to have fewer children and invest more resources in each child; the higher the level of technology, the lower the birth rate (the demographic-economic paradox)
- Economic prosperity or economic difficulty: In difficult economic times, couples delay (or decrease) childbearing.
- Poverty levels
- Urbanization
- Pension availability
- Conflict
- Illiteracy and unemployment

Demographic transition:

Demographic transition refers to the decline in population mortality and fertility with social and economic development.

The two major factors affecting demographic transition are the crude birth rate (CBR) and the crude death rate (CDR).

Demographic transition may be considered in four stages.

- During the first and second stages, the CBR remains high because people still live in agrarian cultures and require farm labour; infant mortality is high
- During the third stage, the CBR begins to decline due to women's increasing participation outside the home and a reduced need for farm labour
- During the fourth stage, the CBR is sustained at a low level, with some countries having rates below the replacement level in other countries

The total birth rate which includes all births—typically indicated as births per 1,000 populations—is distinguished from an age-specific rate which is the number of births per 1,000 persons in an age group.

The crude birth rate is equal to the number of live births (b) in a year divided by the total midyear population (p). This number is then usually multiplied by 1,000 to arrive at the actual crude birth rate.

Therefore, the formula for crude birth rate is: $CBR = (b/p)^*1000$

Example:

In 2007, there were 3 thousand 2 hundred 50 births in a city with population of 2 lakh 23 thousand.

Therefore: CBR is equal to 3 thousand 2 hundred 50 by 2 lakh 23 thousand into thousand which is equal to 14 point 57.

Hence, there were 14 point 57 births for every 1,000 people in the city.

4. Migration

Let us now discuss about Migration:

Migration of human is the movement of people from one place in the world to another for the purpose of taking up permanent or semipermanent residence, usually across a political boundary.

An example of "semi-permanent residence" would be the seasonal movements of migrant farm laborers.

People can either choose to move ("voluntary migration") or be forced to move ("involuntary migration").

Migrations have occurred throughout human history, beginning with the movements of the first human groups from their origins in East Africa to their current location in the world. Migration occurs at a variety of scales: intercontinental (between continents), intracontinental (between countries on a given continent), and interregional (within countries). One of the most significant migration patterns has been rural to urban migration—the movement of people from the countryside to cities in search of opportunities.

Types of Migration are as follows:

Internal Migration: Moving to a new home within a state, country, or continent. External Migration: Moving to a new home in a different state, country, or continent. Emigration: Leaving one country to move to another, for e.g., the Pilgrims emigrated from England.

Immigration: Moving into a new country for, e.g., the Pilgrims immigrated to America.

Population Transfer: When a government forces a large group of people out of a region, usually based on ethnicity or religion. This is also known as an involuntary or forced migration. Impelled Migration (also called "reluctant" or "imposed" migration): Individuals are not forced out of their country, but leave because of unfavorable situations such as warfare, political problems, or religious persecution.

Step Migration: A series of shorter, less extreme migrations from a person's place of origin to final destination—such as moving from a farm, to a village, to a town, and finally to a city. Chain Migration: A series of migrations within a family or defined group of people. A chain migration often begins with one family member who sends money to bring other family members to the new location. Chain migration results in migration fields—the clustering of people from a specific region into certain neighborhoods or small towns.

Return Migration: The voluntary movements of immigrants back to their place of origin. This is also known as circular migration.

Seasonal Migration: The process of moving for a period of time in response to labor or climate conditions, for e.g., farm workers following crop harvests or working in cities off-season.

Migration and immigration are both hot button political issues.

The net migration rate is one tool used in demography and population geography to examine

migration in and out of an area.

Similar to rates of birth, fertility and death, migration rates help to measure internal (domestic) or international migration to and from a particular region or country.

The crude net migration rate is the net number of migrants in a year per 1,000 people in a particular population.

It is calculated as the difference between the net in- and out-migration rates.

Find the net in-migration rate, also known as crude rate of in-migration, the ratio of all migrants who moved into the region (IM) during a given year relative to the total midyear population (p) in the region.

Multiply that number by 1,000 to arrive at the crude rate of immigration: IMR is equal to IM by p into 1000.

Find the net out-migration rate, also known as crude rate of out-migration, the ratio of all migrants who moved out of the region (OM) during a given year relative to the total midyear population (p) in the region.

Multiply that number by 1,000 to arrive at the crude rate of out-migration: IMR is equal to OM by p into 1000.

Subtract the OMR from the IMR to get the crude net migration rate.

For example, say your country has 50 crore people. In a particular year, the country received 2 lakh 50 thousand immigrants (in-migrants) and lost 55 thousand emigrants (out-migrants). The crude net migration rate would be 3 point 9 migrants per 1,000 people:

That is, (2 lakh 50 thousand by 50 crore into 1 thousand) minus (55 thousand by 50 crore into 1 thousand) is equal to 5 minus 1 point 1.

That is, CNMR equal to 3 point 9 migrants per 1,000 people.

5. Mortality

Mortality is explained as follows:

Mortality rates refer to the average number of people who die in a given circumstance. For instance, the fetal mortality rate refers to the amount of fetal deaths in a given year. The infant mortality rate measures the numbers of infants under one year of age who pass away. This number is then usually measured by the thousand.

The effect of mortality on population structures is to reduce the component of the population in which the mortality occurs.

Historically, the most dangerous ages were infancy and old age (variously reckoned accord to circumstances).

In addition, some epidemics of infectious diseases (for e.g Spanish 'flu) had their highest mortality among young adults, whose immune systems were presumably insufficiently primed. War differentially reduces the proportion of younger men.

The majority of infectious diseases of early childhood have been conquered by immunization, and improved nutrition and hygiene have rendered childhood safer.

Antibiotics, welfare state, and improvements in medical, surgical, and palliative care have resulted in great increases in life expectancy in the developed world, where life expectancy is now in the middle to upper 70s or lower 80s, and rising every year.

The effect of this is to raise the population in the upper age groups substantially. Women have high life expectancy than men wherever they live.

The tendency of people to retire to particular resorts means that in some parts of the South Coast of England, the average age of the population is only just below retirement age.

The down side of this is, that the extended lives are often lived in bad health, as the treatments people receive may keep them alive but do little to ameliorate the underlying pain or disability brought on by the diseases, and virtually nothing for the various forms of confused dementia that are increasingly encountered.

When comparing mortality rates, compare the type of mortality. It includes death from cancer, AIDS, drug abuse or the flu. This allows the type to be compared to other parts of the world. For instance, the cancer mortality rate in the United States can be compared to France, England or Italy.

Subsections:

Mortality rates can be general or specific. Providing a subsection allows them to be even more specific.

For instance, the infant mortality rate refers to children who pass away after birth, but before they are one year of age.

A sub-section can also describe a disease in greater detail.

The mortality rate from prostate cancer will be different than that of pancreatic cancer.

Health Indicators:

Generally mortality rates are used to measure the success of a health care system within a

given country.

According to a CIA report in 2010, the infant mortality rate is 178 per thousand in Angola. This highlights the lack of medical care and instability of the region.

The United Arab Emirates has the lowest with about two deaths per thousand.

The United States ranks well at about six deaths per thousand.

Here's a summary of our learning in this session, where we have understood:

- The concept of Population growth such as,
 - > Growth and rate of growth of population based on births
 - Deaths and Cross migration