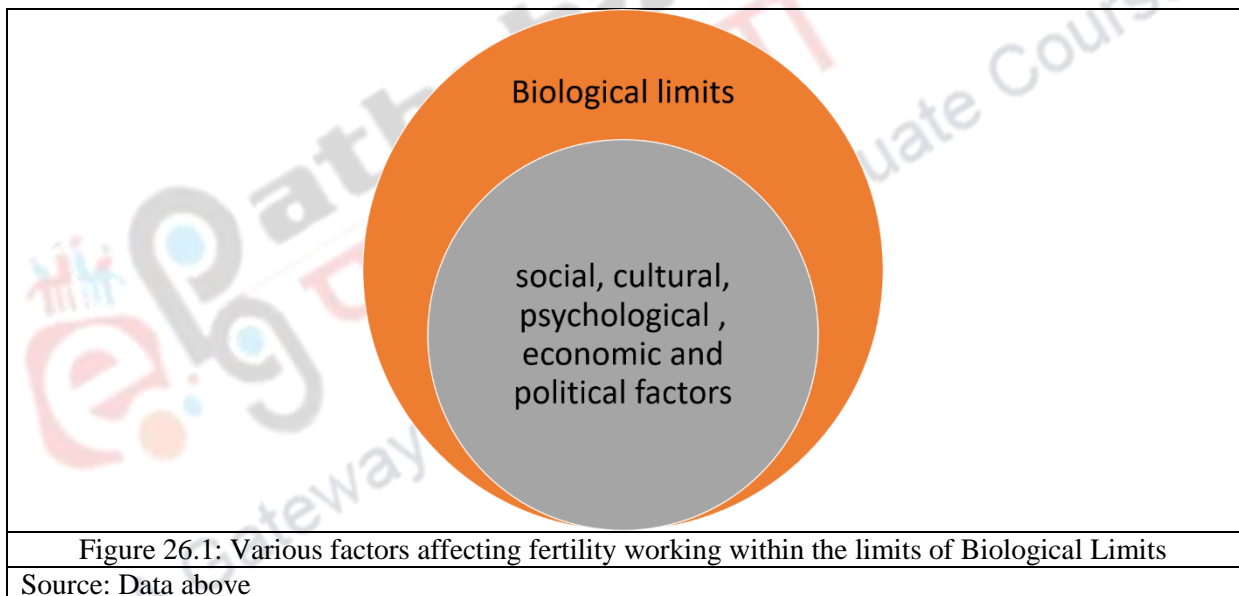## Module -26

Fertility- Population Change

26.1 Introduction:

Human fertility is a complex process responsible for the biological maintenance of society and constitutes an essential component in demographic studies. In population dynamics fertility is a positive force through which the population expands counteracting the force of attrition caused by mortality. Fertility refers to the number of live births per woman in the population. It represents the actual performance and should not be confused with the ability to reproduce, which is termed as fecundity. The inability to reproduce is called sterility. The scope of this chapter is to provide the importance of the study of fertility in Population dynamics.

Natality is the study of total process of fertility and the way it affects population change. Any society replenishes itself through the process of human fertility. Thus in population dynamics fertility is a positive force through which the population expands counteracting the force of attrition caused by mortality. The process of replacement a group through fertility is a complicated process. Within this biological limits of human fertility, several social, cultural, psychological as well as economics and political factors are found to operate, and these are responsible for determining the levels and determinants of fertility.

Figure 26.1: Various factors affecting fertility working within the limits of Biological Limits

Source: Data above

Measurement of fertility is not as direct as in the case of mortality. Only a section of the population, namely the women in the reproductive age group which is biologically identified as between menarche and menopause and for purpose of demographic analysis, as between 15 and 50, is capable of childbearing and even among them fecundity is a varying factor. Apart from the biological aspects, there is an additional behavioural component to fertility. Fertility can be controlled by conscious adoption of contraception or other means to prevent births and therefore, we have "controlled fertility" as distinct from "natural fertility", the latter meaning fertility in the absence of any form of voluntary control. For these and several other reasons it becomes difficult to identify the group of women exposed to the childbearing.

The dynamic character of fertility was realised when after the Great Depression of the early 1930's, the birth rates in North-west Europe and North America which were quite low till then and which had consistently registered a declining trend, started rising stabilised themselves at higher levels and then declined. Till that time demographers had expected a steadily declined trend and ultimately stabilized lower level in the birth rate. With the upsurge in the birth rates following economic development a

phenomenon popularly known as the "baby boom" occurred and all the population projections based on the assumption of declining birth rates went haywire. Though this "baby boom" was not anticipated and caused never to be forgotten embarrassment, to demographers it brought about a realisation among social scientists in general and demographers in particular that fertility had to be studied in a broader perspective, with due importance given to social, economic, cultural as well as political factors.

Evidences are many to show that fluctuations in this fertility rates of country might take place in response to political, social and economic condition. For instance, in Romania, as a result of legalised abortions this birth rate declined from the level of 24.2 per thousand population in 1956to 14.3 per thousand population in 1966. When in 1966, this abortion facilities were withdrawn, this birth rate shot up to 27.4 in one year, that is in 1971- perhaps this most rapid rise in birth rate ever witnessed in one year. According to Ronard Freedman, "this experience in Romanian demography is a dramatic example of the kinds of 'natural experiments', occurring in human fertility most of which are not studied systematically in order to observe causes and consequences".

In 1960s it was increasingly realised that the greatest concern for any country, both developed and developing was the birth rate. The growth rates of several countries at present depend on the levels of fertility and mortality, and are not much affected by international migration. In the developing countries mortality has declined considerably, and is expected to decline further. But birth rates in these countries however have not declined correspondingly, with the result that these countries were experienced rapid population growth which pose a threat to social and economic development of these countries. Latter in 1980s and 1990s, the fertility has started to decline in most of the developing countries but still the birth rates are high in some developing and underdeveloped countries. Hence the efforts at bringing down fertility rate would be successful only if the knowledge of fertility behaviour in the context of the culture, social, economic and political settings. As a result of these developments, there has been a great spurt in fertility studies in developing countries, especially after 1960. The other reason for growing interest in the study of fertility are also worth considering. One of these is the age structure of any population is primarily determined by fertility and that the bulges and gaps and this age structure can have serious repercussions, with social, economic and political overtones.

26.2 Population Change: Population Pyramids

The age-sex structure of a country can be studied through population pyramids which are also an important tool to gauge into the changing population structure of any country. The overall shape of the pyramid indicates the potential for future growth. The representations of population age-sex structure given in figure 26.1 provide an overall example of what a pyramid for different levels of population growth would look like — rapid growth, slow growth, and negative growth. The horizontal bars show the percentage (or in some cases the actual numbers) of males and females in each age group.
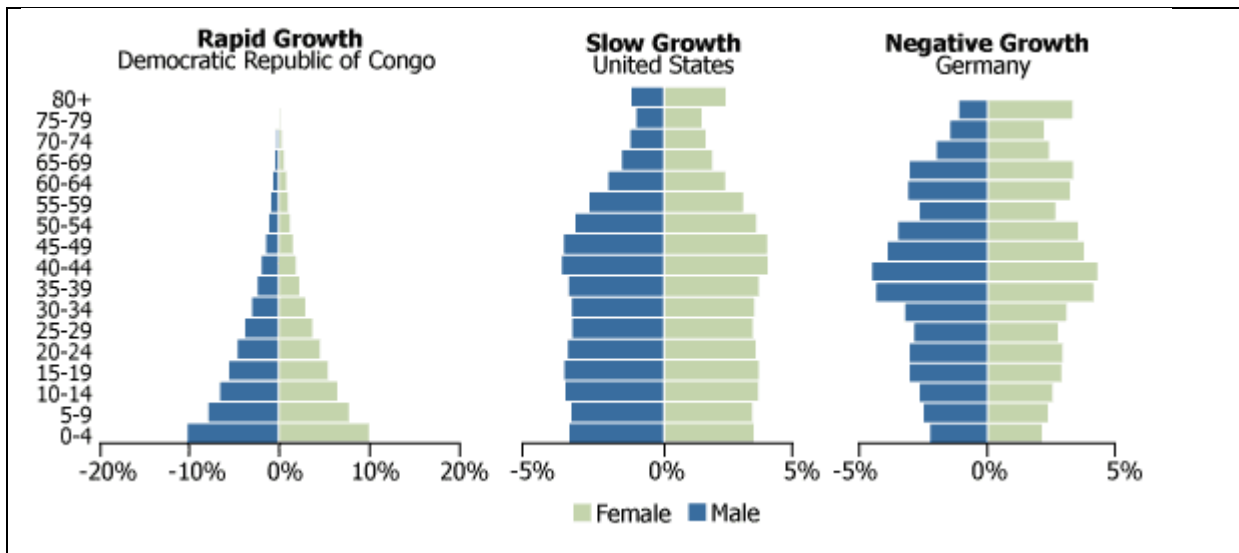
Figure 26.2: Three patterns of Population Change
Source: United Nations, World Population Prospects, The 2006 Revision.

The country pyramids shown in "Three Patterns of Population Change" also represent different stages of population growth going on today. The first pyramid, representing the population of the Democratic Republic of Congo, with its wide base and narrow top, is typical of a young population. This shape is the result of high birth rates that feed more and more people into the lowest bars and in turn shrink the relative proportion at the oldest ages. As the death rate declines, more people survive to the reproductive ages and beyond. The births they have further widen the base of the pyramid. This shape is common in many less developed countries that have experienced improvements in life expectancy but continue to have high birth rates. It reflects both a history of rapid population growth and the potential for future rapid growth.

The second age-sex pyramid is typical of a slowly growing population. The United States is an example of a country in slow growth. The United States has had declining fertility and mortality rates for most of this century. With lower fertility, fewer people have entered the lowest bars of the pyramid, and as life expectancy has increased, a greater percentage of the "births" have survived until old age. As a result, the population has been aging, meaning that the proportion of older persons in the population has been growing. This trend was interrupted by the postwar baby boom, 1946-1964, when birth rates climbed again. (The bulge of the baby-boom generation can be seen in the pyramid for ages 40-59 in 2005.) After 1964, birth rates continued their downward trend until the late 1970s. As the last members of the baby boom approached their childbearing years during the 1980s, the number of births rose again, peaking in 1990. These children, the youngest generation, are represented by the slightly widening base of the pyramid. Even though the number of births per woman is lower than ever before, the population continues to grow because of the children and grandchildren of the huge baby-boom generation.

A few countries have reached zero population growth or are experiencing negative growth because of low birth rates and an old age structure coupled with minimal net migration. While Germany's death rate exceeds its birth rate, its population continues to grow because of net migration. Pyramids in which the proportions of the population are fairly evenly distributed among all age groups are representative of many highly industrialized societies. Germany's old population reflects an extended period of low birth and death rates. While fewer children have been born, most of those born survive through to old age. The net effect is zero growth or no natural increase. Germany's pyramid also shows the effect of higher mortality among males. In an industrialized society, females generally outnumber males after age 40. This trend is particularly evident in Germany's oldest age group.

While birth and death rates usually determine the basic pyramid shape, migration also affects it. Typically, most migrants are in the working ages, and often more males than females migrate across national borders. In some Middle Eastern countries a large number of men migrated to work in the oil fields, which caused a bulge in one side of the pyramid, while it took a "bite" out of the pyramid of some of the countries from which they came.

Short-term fluctuations in birth and death rates that produce unusual bites or bulges in population pyramids, such as the baby boom, often can be traced to such historical events as wars, epidemics, economic booms, or depressions. The decline in the birth rate during the Great Depression caused a small bite in the U.S. pyramid for the group born between 1930 and 1934. World Wars I and II caused a deficit of older men in Germany. The impact of these events emphasizes the interrelationships among population change and economic, social, political, and health factors.

(www.prb.org)

Even though childbearing is basically a biological phenomenon, it is generally argued that variations in the level of fertility are not primarily due the differences in physiological capacity but are more often produced by responses of individuals and couples to the social systems in which they live. The biological and behavioural factors which directly influence fertility are called *Proximate Determinants of Fertility.* Various social, economic and other factors influence childbearing through these proximate determinants. The distinguishing feature of proximate determinants is their direct effect on fertility.

26.3 Fecundity and Fertility
Fecundity refers to "the capacity of a man or woman or a couple to participate in reproduction (*i.e.* the production of a live child)". Fertility is the actual performance, that is, the number of live births per woman.

26.4 Basic Demographic Equation
The most basic equation that expresses the change in population over time in a simple form is known as the ***basic demographic Equation or the balancing equation.*** It isthe decomposition of the population change into its components.

$P_2 = P_1 + (B - D) + (I - E)$

Where P2 and P1 are population at two different points of time. B-births, D- deaths, I-immigrants, E- emigrants.

$P_2 = P_1 + NI + NM$,

Where NI is natural increase and NM is net migration.

26.5 Population Change
Population change is measured as the difference in Population size between two points of time. It can be expressed in terms of absolute change, percentage, average annual absolute change, geometric or exponential growth rate. It can be refer to changes in size, distribution or composition, or to any combination of the three.

26.6 Measures of Population Change:
Let P_2 = Population at later date, P_1 = Population at the earlier date, and y = number of years between P_2 and P_1, then

Absolute change = $P_2 - P_1$

Percentage change = $\{(P_2 - P_1) / P_1\}$ x 100

Linear growth rate(r) = $[(P_2/P_1) - 1] / y$

Geometric growth rate $r = (P_2/P_1)^{1/y} - 1$

Exponential growth rate r = $[\ln(P_2/P_1)] / y$,

where ln is the natural logarithm.

26.7 Components of Population Change

There are only three components of population change, namely births, deaths and migration. Population grows through the addition of births and in-migrants. Population declines through the subtraction of deaths and out-migrants. These three demographic processes is essential to understand the nature and causes of population change.

Figure 26.3 : Components of Population Change
Source: Data above
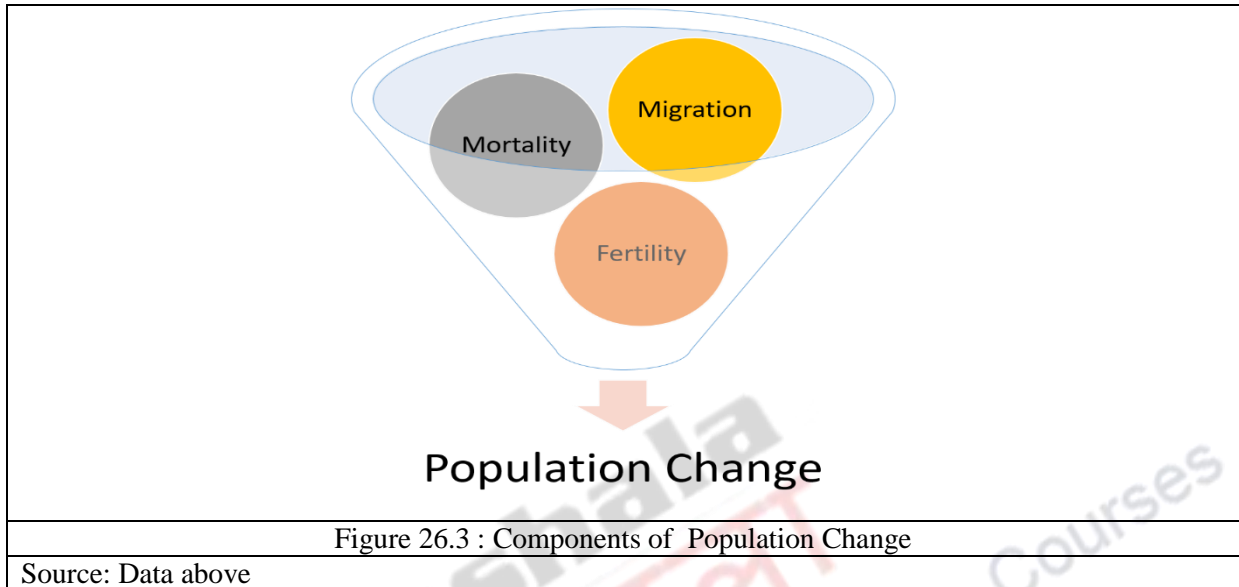
The change in the population can be broken down into the combined effect of natural increase (births less deaths) and net migration (immigration less emigration).

Natural Increase: Natural change is the difference between births and deaths in a population. Oftentimes, natural change is positive, which means that more babies are being born than people are dying. This positive natural change is referred to as natural increase.
The opposite of natural increase is called natural decrease, where more people are dying than babies being born, which can cause a population to shrink. Areas with aging populations often have natural decrease.

Migration: Net migration is the difference between how many people move into and out of an area. When net migration is positive, a population has more people moving in than out. We split migration into domestic migration and international migration.

(www.census.gov)

Demographers often estimate migration as a residual value, by calculating the difference between total population change and natural increase because it is difficult to estimate actual migration.

26.8 Fertility

Fertility refers to the occurrence of a live birth and is determined by a variety of biological, social, economic, psychological and cultural factors. Biological factors determine the physiological capacity to reproduce. Other factors determine perceptions regarding the costs and benefits of children. Contraceptive availability and effectiveness play a role in affecting the ability to control the number and timing of births. Fertility rates have declined over the last two centuries in Europe, North America and other developed countries. Some of the developing countries have also experienced a drastic decline in their fertility rates in the recent past. A detailed discussion on mortality and migration are given in other chapters.
The Age specific Fertility rates(ASFR), Total Fertility Rates(TFR) and Crude Birth Rates(CBR) for India, according to three National Family Health Surveys(NFHS-1,2 and 3) are given in Table I.

Table I

Age-Specific and Total Fertility Rates and CBR from NFHS-3, NFHS-2, NFHS-1: India

	NFHS – 3	NFHS - 2	NFHS – 1
Age	Total	Total	Total
15-19	0.090	0.107	0.116
20-24	0.209	0.210	0.231
25-29	0.139	0.143	0.170
30-34	0.062	0.069	0.097
35-39	0.025	0.028	0.044
40-44	0.007	0.008	0.015
45-49	0.003	0.003	0.005
TFR	2.66	2.85	3.39
CBR	23.1	24.8	28.7

The NFHS-1 was conducted in 1992-93, NFHS-2 was conducted in 1998-99 and NFHS-3 was in 2005-06.

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