RELEVANCE OF MENARCHE, MENOPAUSE AND OTHER BIO-EVENTS TO FERTILITY

Menstruation

This is a function of the uterus established at puberty (average age, 12 to 13 years) as a result of ovarian activity and consists of the periodic discharge of blood from its cavity. It occurs on an average of every twenty-eight days until the menopause or climacteric is reached, and lasts for three to five days. The amount of fluid, which consists of blood, mucin and epithelial cells, varies between 90-200 ml (3-7 fl. Oz). Menstruation ceases during pregnancy and is often not re-established until lactation is completed. The purpose of the monthly cycle is to prepare the mucous membrane of the uterus (endometrium) to receive a fertilized ovum. The endometrium undergoes constant changes between one menstrual period and another and these changes are made in preparation to receive the fertilized ovum. They are largely brought about by the Follicle-Stimulating (FSH) and the Luteinizing (LH) hormones secreted by the pituitary gland, and by oestrogen and progesterone secreted by the ovary. Menstruation is really a clearing up of these changes in the endometrium when no fertilized ovum has arrived, and therefore in this sense it gives the endometrium an opportunity to make a fresh preparation.

These changes are described as the menstrual cycle and may be conveniently divided in the following way:

1) The secretory (pre-menstrual) phase, lasting for about 14 days before the period, during which the endometrium becomes thickened and congested and is in a state of preparedness to receive a fertilized ovum.

2) The menstruation period (three to five days) in which some of the epithelium of the uterine mucosa is shed and is accompanied by bleeding. In other words, no fertilized ovum has been received and the work of preparation has been useless.

3) The stage of repair begins in the third or fourth days of the menstrual cycle.

4) The growth phase starts on the fourth day and continues up to fourteenth day before the next secretory phase

MENARCHE

Menarche is the first menstrual cycle, or first menstrual bleeding, in female humans. From both social and medical perspectives, it is often considered the central event of female puberty, as it signals the possibility of fertility.

Girls experience menarche at different ages. The timing of menarche is influenced by female biology, as well as genetic and environmental factors, especially nutritional factors. The mean age of menarche has declined over the last century, but the magnitude of the decline and the factors responsible remain subjects of contention. The worldwide average age of menarche is very difficult to estimate accurately, and it varies significantly by geographical region, race, ethnicity and other characteristics. Various estimates have placed it at 13. Some estimates suggest that the median age of menarche worldwide is 14, and that there is a later age of onset in Asian populations compared to

the West. The average age of menarche is about 12.5 years in the United States, 12.72 in Canada, and 12.9 in the UK.

A.M. Tripathi in his study of age of menarche of girls of various Indian states found that lowest age is in the girls of Delhi (11.20) followed by Calcutta (12.50) and UP (12.80). the highest age of menarche was found to be in Gujarat (14.80).

Menarche is the culmination of series of physiological and anatomic process of puberty.

- Attainment of a sufficient body mass (typically 17% body fat).
- Secretion of Oestrogen and progesterone by ovaries in response to pituitary hormones.
- Growth of uterus and vascularization.
- They cause certain changes to pelvic girdle.
- Oestrogen stimulates height growth, breast growth, increase regional adipose tissues.
- Oestrogen stimulates growth and vascularity of endometrium lining of uterus.

Menstruum or flow consists of a combination of fresh and clotted blood with endometrial tissue.

Relation to fertility

- Doesn't signal that ovulation has occurred.
- In post menarchial girls about 80% of cycles were anovulatory in first year after menarche.
- Regular ovulation is indicated by predictable and consistent interval between menses and pattern of flow.
- Continuing ovulation typically requires a body fat content at least 22%. An anthropologist term for this state of potential fertility is Nubility.

Isolated/Premature Menarche

Menarche at unusually early age, preceding thelarche and other signs of puberty.

Reasons for early menarche/effects of stress, social environment, nutrition, health

1) Child obesity
2) Absence of father from home since childhood. It increases stress which affect hypothalamus.
3) High conflict family relations.
4) Girls with low birth weight and thereby taken extra care.
5) Singleton babies – leading to stress of 'only child syndrome'
6) Experience preeclampsia or fits in womb
7) Girls exposed to smoking
8) Girls who are not breast fed
9) Girls who lack exercise in childhood
10) Being exposed to sex hormones. Coming in contact with an oestrogen ointment, or other substances that contain these hormones (such as an adult's medication or dietary supplements), can increase child's risk of developing early menarche
11) Precocious puberty appears to affect African-Americans more often than children of other races.

Complications

Early onset of puberty can cause several problems. Possible complications of early menarche include:

Short height. Children with precocious puberty may grow quickly at first and be tall, compared with their peers. But, because their bones mature more quickly than normal, they often stop growing earlier than usual. This can cause them to be shorter than average as adults. Early treatment of precocious puberty, especially when it occurs in very young children, can help them grow taller than they would without treatment.

Social and emotional problems. Girls and boys who begin puberty long before their peers may be extremely self-conscious about the changes occurring in their bodies. This may affect self-esteem and increase the risk of depression or substance abuse.

Later Menarche

1) Larger Family size
2) Warmer, closer or more positive relationship with biological father
3) Low stress family environment
4) Have a number of elder siblings

Primary amenorrhea

Amenorrhea is the absence of menstrual bleeding. Primary amenorrhea is the failure of menses to occur by age 16 years, in the presence of normal growth and secondary sexual characteristics.

Possible causes of primary amenorrhea (when a woman never gets her first period) include:

- Problems with the ovaries
- Problems in the central nervous system (brain and spinal cord) or the pituitary gland (a gland in the brain that makes the hormones involved in menstruation)
- Problems with reproductive organs
- Females with a family history of this condition are at a greater risk of developing it
- Girls with eating disorders such as anorexia or bulimia nervosa
- Some female athletes are also at higher risk of developing this condition

MENOPAUSE

Menopause, also known as the climacteric, is the time in most women's lives when menstrual periods stop permanently, and they are no longer able to bear children. Menopause typically occurs between 49 and 52 years of age. Medical professionals often define menopause as having occurred when a woman has not had any vaginal bleeding for a year.

In the years before menopause, a woman's periods typically become irregular, which means that periods may be longer or shorter in duration or be lighter or heavier in the amount of flow. During this time, women often experience hot flashes; these typically last from 30 seconds to ten minutes and may be associated with shivering, sweating, and reddening of the skin. Hot flashes often stop occurring after a year or two. Other symptoms may include vaginal dryness, trouble sleeping, and mood changes. The severity of symptoms varies between women. In some women, problems that were present like endometriosis or painful periods will improve after menopause.

Menopause is usually a natural change. It can occur earlier in those who smoke tobacco. Other causes include surgery that removes both ovaries or some types of chemotherapy. At the physiological level, menopause happens because of a decrease in the ovaries' production of the hormones oestrogen and progesterone.

Perimenopause is the term used to describe menopause transition i.e. years before and after the final period. Medically it is the time from which menses become irregular and FSH levels have increased, until the time when it is known that periods have ceased completely.

During this time women may occur considerable changes both physically as well as psychologically. Moreover, there is also a change of role and status in culture.

It has two phases – premenopause is the year leading upto last menses; postmenopause- for women who had no periods since last 12 months assuming they still have uterus and are not lactating.

Effects

Skeletal

a) Development of Back pain, joint pain, muscle pain.
b) Osteopenia and the risk of osteoporosis gradually developing over time

Skin and soft tissues

a) Breast atrophy
b) Breast tenderness, decreased elasticity of skin
c) Skin thinning and becoming drier

Psychological

a) Depression and anxiety
b) Fatigue
c) Irritability
d) Memory loss
e) Mood disturbance
f) Insomnia
g) Sense of loss of fertility
h) Empty nest syndrome- Empty nest syndrome is a feeling of grief and loneliness parents may feel when their children leave home for the first time, such as to live on their own or to attend a college or university.
i) Role change – from aren't to grandparent

Sexual

a) Painful intercourse due to vaginal dryness
b) Decreases libido
c) Problems reaching orgasm

Menopause and culture

Class notes

Causes of Menopause/ Evolutionary rationale

At the time of menarche all the eggs have been produced, matured and stored in ovaries. So risk of genetic disorders in the baby increase with the increase in mother's age at pregnancy. But no such correlation with father's age as in female reproductive system all eggs are produced and matured before menarche and are kept in store. Therefore, higher the age more will be the duration of storage and there are more chances that eggs are exposed to X-rays, UV rays and other pollutants.

Various theories have been suggested that attempt to suggest evolutionary benefits to the human species stemming from the cessation of women's reproductive capability before the end of their natural lifespan. Explanations can be categorized as adaptive and non-adaptive:

Non-adaptive hypotheses

The high cost of female investment in offspring may lead to physiological deteriorations that amplify susceptibility to becoming infertile. This hypothesis suggests the reproductive lifespan in humans has been optimized, but it has proven more difficult in females and thus their reproductive span is shorter. If this hypothesis were true, however, age at menopause should be negatively correlated with reproductive effort and the available data do not support this.

Adaptive hypotheses

Mother hypothesis

The mother hypothesis suggests that menopause was selected for humans because of the extended development period of human offspring and high costs of reproduction so that mothers gain an advantage in reproductive fitness by redirecting their effort from new offspring with a low survival chance to existing children with a higher survival chance.

Grandmother hypothesis

The grandmother hypothesis suggests that menopause was selected for humans because it promotes the survival of grandchildren. According to this hypothesis, post-reproductive women feed and care for children, adult nursing daughters, and grandchildren whose mothers have weaned them. Human babies require large and steady supplies of glucose to feed the growing brain. In infants in the first year of life, the brain consumes 60% of all calories, so both babies and their mothers require a dependable food supply. Some evidence suggests that hunters contribute less than half the total food budget of most hunter-gatherer societies, and often much less than half, so that foraging grandmothers can contribute substantially to the survival of grandchildren at times when mothers and fathers are unable to gather enough food for all of their children. In general, selection operates most powerfully during times of famine or other privation.

Fertility, Fecundity, Mortality and Natality

Fertility and Fecundity

According to **Thompson and Lewis**, "Fertility is used to indicate the actual reproductive performance of a woman or groups of women. The crude birth rate (number of births per thousand population per year) is only one measure of fertility".

According to **Bernard Benjamin**, "Fertility measures the rate at which a population adds to itself by births and is normally assessed by relating the number of births to the size of some section of the population, such as the number of married couples, or the number of women of child bearing age i.e., an appropriate yardstick of potential fertility."

According to **Barclay** the fundamental level of fertility is an actual level of performance in a population based on the number of live births that occur.

Fecundity means the capacity of a man, a woman or a couple to participate in reproduction. While fertility means the actual reproductive performance whether applied to an individual or a group. The **fecundity is biological** whereas the term **fertility is determined by social, cultural, psychological as well as economic factors.**

Natural and Controlled Fertility:

Natural fertility is the fertility which exists in the absence of deliberate birth control, while controlled fertility is the fertility which involves a deliberate use of birth-control.

Contraception:

Contraception refers to measure which are taken in order to prevent sexual intercourse resulting in conception or if conception has taken place not allowing it to continue to be transformed into a live birth.

Birth Intervals:

A birth interval defined as the length of time between two successive live births, indicates the pace of child bearing. Short birth intervals may adversely affect a mother's health and her children's chances of survival.

Age at First Birth:

The age at which women start child bearing is an important demographic determinant of fertility. A higher median age at first birth is an indicator of lower fertility.

Crude Birth Rate:

It is the ratio of the total number of births during a given year to the average or mid year population in that year.

Its formula is CBR = (B/P) x 1000

Where,

CBR = Crude Birth Rate

B = Total number of births occurring in a given year.

P = Total average or mid year population in that year

The crude birth rate is calculated by ignoring all differences in the composition of population. All factors which affect the differential fertility, can affect the CBR, for example, income, employment, military population and their mode of family life, urbanity, diet, occupation, migration, cultural changes, composition of population and even death rate

General Fertility Rate:

It is an improvement over CBR with regard to the population exposed to the chance of conception. It differs from CBR in defining the denominator population which in this case is the number of women in fertile age group (in the age range 15-49 or 15-44) and not the total population.

Its formula is GFR = (B/W) x 1000

Where, GFR = General Fertility Rate

B = Total number of births occurring in a given year.

W = Total number of women between the age group of 15- 49 years.

Age Specific Fertility Rate:

For any year, it is obtained by dividing the number of births to mother of each age in that year by the number of women of this age in the population at that date and multiplying the figure by 1000. Women of different fertility periods are grouped according to age 15-19, 20-24, 25- 29, 30-34, 40-44, 45-49 age groups.

Its formula is ASFR = (Bx/Wx) x 1000

Where, ASFR = Age Specific Fertility Rate

Bx = Number of live children born to women of the specific age

Wx = Number of women of the specific age group i.e. 20-24 age group

Total Fertility Rate:

For all women ages 15-49, it may be calculated by adding the age specific fertility rate of five year age group and multiplying this total by five. This rate explains the possible number of children per 1000 fertile women on the assumption that no death occurs among the women.

Its formula is TFR = ASFR x i /1000

Where TFR = Total Fertility Rate

ASFR= Age Specific Fertility Rate

i = Magnitude of the Age Group

Factors of Differential Fertility

1) **Biological factors:**

According to **Davis and Blake** there are 8 important biological factors:

a) **Proportion Married**- higher the number of married women in a population, higher will be its fertility compared to a group with less number of married women. (doesn't affects fecundity)

b) **Contraception**- measures which prevents fertility such as use of contraceptive pills or surgical prevention of fertilization. (surgical removal of uterus will affect the fecundity)

c) **Induced Abortion**- Measures which causes termination of pregnancy (doesn't affects fecundity)

d) **Lactational Infecundability**- Breastfeeding delays the resumption of normal ovarian cycles by disrupting the pattern of pulsatile release of GnRH from the hypothalamus and hence LH from the pituitary.

Suckling intensity directly correlates with the duration of the amenorrheal period following birth. Suckling intensity has several dynamic components: frequency of suckling, duration of the suckling bout, and duration of suckling in a 24-hour period. It is not clear which of these plays the most critical role in maintaining amenorrhea. Suckling intensity is highly variable across populations. Studies of U.S. and Scottish women show that at least six bouts per day and 60 minutes of suckling in a 24-hour period will typically sustain amenorrhea. Concurrent studies of !Kung women in Botswana and Gainj women in Papua New Guinea have shown that very frequent, very short suckling bouts of about 3 minutes, 40 to 50 times per day correlate with typical amenorrhea of up to two years postpartum.

Suckling as proxy indicator of infecundity rather than a direct, hormonal causal factor is supported in studies contrasting the nursing intensity hypothesis, which says that more intense (prolonged, frequent) breastfeeding will result in a longer period of lactational amenorrhea.

e) **Frequency of sexual intercourse**

f) Sterility- Both sexes are affected- Males- azoospermia, low sperm count, non-motility of sperm

Females- amenorrhea, constriction of oviducal funnel and fallopian tube

g) **Spontaneous Intrauterine mortality**- May occur due to reason such as blood group incompatibilities, chromosomal changes, maternal medication etc. (affects fecundity)

h) **Duration of Fertile Period-** (15-49 years generally)

Economic Factors

i) **Theory of Leibenstein (Benefit-cost ratio)** – There is high infant mortality in poor societies hence there is desire to compensate the loss because children are viewed as having high benefit-cost ratio. In rich societies children are viewed as having low- benefit cost ratio because high expenditure involved in upbringing of the child.

ii) **Distress from unemployment-inflation:** Population explosion has resulted into more and more unemployment. Scarcity of commodities has led to inflation. Most of the amenities, including education, health, housing, clothing, food and drinks have become costlier. Two-child norms have given way to one-child norm or no child norm in some countries.

iii) **Rising socio-economic status of women:** With the rise in literacy of women and their rising economic status, they assert that they have greater control over their body and it is he who generally decides whether to go in for long gestation periods. In underdeveloped societies, because of poor socio-economic conditions of women, there is crime of repeated pregnancies committed on them.

Socio-economic Factors affecting fertility

a) Age at marriage- if marriage is at later years the overall fertility is very less.

b) **Widowhood, separation and divorce**- may affect fertility due to absence of a partner

c) **Post-Partum absistence**- Husband and wife are separate for a long period after the birth of a child. It is practiced among some tribes of north east.

d) **Celebacy** – Many women either donot marry or have intercourse, thus affecting fertility.

e) **Frequency of Coitus** – in developed societies there are many means of recreation; hence frequency of coitus is reduced. In underdeveloped countries coitus is only means of recreation.

f) **Family systems** – In joint families, fertility is high because there is sufficient number of persons who van look after 2 or more children at a time.

g) **Superstition**- Children are viewed as gift of God, hence many neither use contraceptive nor opt of termination of Pregnancy.

h**) Desire for Children**- Among the social attitudes affecting fertility in India the desire for children is of no less importance than any other relevant social attitude.

i) **The Desire for a Son**- In a country where the death rate, until recently, has been very high, the prompt arrival of a son after marriage is eagerly welcomed, so as to ensure the future of the parents in the other world and to perpetuate their name in this one.

j) **The Concern for Care in Old Age**- The wish to be cared for in old age by one's children is a very powerful one among average Indians. This is particularly so in a society in which the average parents can hardly save anything for a retired life because of the low level of their incomes and the absence of institutions that help saving. Nor has this motive been affected by the welfare activities of the State because, except in the case of civil servants, no old age pensions or allowances worth mentioning have been started in India. The Mysore Study shows that 82-86 per cent of the rural couples and 68 per cent of the urban couples considered this an important reason for having a large family.

k**) The Need to Follow the Community Pattern-** Public approval or disapproval is one of the means of social control in a traditional society in which the average individual or family finds it difficult to go against the pattern of social behaviour set and dictated by the society. Such individuals or families are goaded back to the set pattern of behaviour by community criticism, or the fear of it.

In a modern type of society, on the other hand, these social controls do not apply and, therefore, such motives are necessarily weak. In the urbanized sector of Indian society, which is relatively modernized as well, this form of social control is becoming ineffective, thereby weakening the motive under discussion.

l) **Urbanisation**-reduces the fertility rate.

Urbanization not had the effect of lowering fertility in India. Evidence on differential fertility, according to residence, was collected in the 1951 census for Travancore, Cochin and Madhya Pradesh which demonstrated that in the former State and in areas excluding Eastern Madhya Pradhesh in the latter, the number of children ever born to women of forty-five and over, still married, was 6-6 in rural and 6&4 in urban areas-a difference which is not very significant. However, in 2011 census it was found that the rural TFR was higher than urban TFR.

m) **Literacy**- Regarding differential fertility according to literacy, Kingsley Davis 10 observed a negative correlation between general literacy and fertility which has been supported by later investigations. In

Central India, fertility of wives was found to decline with education. Mean fertility of illiterate wives was 4-7, with primary education 4 3 and with high school education or above 3 2

n) **The Status of Women** - Among the social attitudes that have a bearing on fertility, directly or indirectly, is the status accorded to women in the society. Though it is believed, on good evidence, that the women of India in the very early days (Vedic period towards the close of the B.C. era) and in places where the matriarchal system of kinship existed, had a relatively high status, Indian society in later years had not bestowed on its women a status comparable to that enjoyed by the women in developed countries. The women were assigned a submissive and secondary role in society and it was considered that women do not deserve independence. Lower status of women increases fertility as women are looked upon as producer of children.

o) **Religion**- Almost every religion is pronatalist in nature. Minority group may tend to have more fertility. Similarly, 'lower' caste people are found to have more fertility and fecundity. In multiracial societies, black are more fertile.

p) **Economic Status**- Generally people who are economically well off tend to have lower fertility. People of labour class usually see children as an extra labour and have more fertility rate.

MORTALITY

Mortality is the state of being mortal, or susceptible to death. Mortality, in demographic usage, the frequency of death in a population. Mortality or death rate, is a measure of the number of deaths in a particular population, scaled to the size of population per unit of time. Mortality rate is typically expressed in units of deaths per 1,000 individuals per year;

Mortality is considered to be an important index in population studies. Although the association between mortality and health may not be very explicit, yet decline in the mortality generally suggests an improvement in living standards and medical facilities. Structure of a population is mainly determined by four main component of population dynamics namely Birth, morality, immigration and emigration. Immigration and emigration depends on social, economical and environmental factors they do not have direct relation with biological component of population like genetic factors, pathogenicity, physiological factors. But birth and death are directly affected by genetic, physiological and physical factors prevailing in population.

Mortality and Morbidity are considered as an Indicators of Health Status of a Population. Death is a unique, universal and final event, therefore Mortality is clearly defined as State of being subjected to death. Age at death and cause/reason provide an instant depiction of health status. In high mortality settings, information on trends of death (by causes) substantiate the progress of health programs. But anthropologist and demographist give more importance to the rate of mortality or death rate and the reason of mortality which is of great concern for anthropologist.

Measures of Mortality

These different type of mortality rates are as follows:

1) Crude Death Rates;

2) Age-Specific Death Rates;

3) Life Table Estimates – 3(a). Life expectancy – 3(b). Survivorship (by age);

4) Cause-Specific Death Rates;

5) Special Indicators – 5(a)Infant and 5(b) maternal mortality rates;

6) Prenatal mortality rate;

7) Child mortality rate

1). **The crude Death rate (CDR):** is a very general indicator of the health status of a geographic area or population. It can be defined as the number of deaths per 1000 estimated mid -year population.

CDR= Total deaths during a year x 1000/ total mid-year population during that year

2). **Age specific mortality rate:** Total number of death per year per 1000 people of a particular age is called age specific mortality rate. This expression of mortality rate is of great use for insurance companies. They use this expression to calculate premium of life insurance for an individual of a population.

3). Life Table: This records matters of life and death for a population. According to this the organisms in a population will live, die, and/or reproduce at different stages of their lives.

3(a). **Life expectancy at birth**: It is defined by the United Nations Human Development Report as “the years a newborn infant would live if prevailing patterns of age-specific mortality rates at the time of birth were to stay the same throughout the child’s life”.

3 (b). **A survivorship (by age) curve:** This is defined by what fraction of a starting group is still alive at each successive age.

4). **Cause specific Mortality Rate**: The death rate due to specific cause of death is take as cause specific mortality rate. this expression is very useful to understand the trend of mortality due to an epidemic or an disease prevailing in an population.

5). Special Indicators

5(a**). Infant Mortality rate:-**It is defined as number of death of children of less than one year i.e. the infants in one year per 1000 live births.

5(b). **Maternal mortality**: According to WHO maternal mortality is defined as "the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes.". Maternal Mortality Ratio (MMR) is the ratio of the number of maternal deaths per 100,000 live births. It is one of the indicator in assessing the quality of a health care system. First, aside from the WHO definition, other definitions exist and some include accidental and incidental causes. "Incidental causes" include deaths secondary to violence against women that may be related to the pregnancy and be affected by the socioeconomic and cultural environment. Maternal mortality numbers are unreported, as the major causes of maternal death are bacterial infection, variants of gestational hypertension including pre-eclampsia, obstetrical hemorrhage, ectopic pregnancy, amniotic fluid embolism, and complications of abortions. Indirect causes can be malaria, anemia, HIV/AIDS and cardiovascular disease, complicated pregnancy, among others.

6). **Prenatal mortality:** The sum of neonatal death and foetal deaths per 1000 births in a year is called prenatal mortality. It can be useful to understand condition of child and mother before and after birth of child like sufficient supplements and health care facilities etc.

7). **Child Mortality rate:** The number of death of children less than five years per 1000 live births in one year is called child mortality rate. There are two other type of mortality rate which are used in medical studies to assess the success or failure of a treatment procedure.

1. Early mortality rate: - Death rate in early stage of ongoing treatment.

2. Late mortality rate: - Death rate during later stage of ongoing treatment

USE OF MORTALITY STUDIES

1) POPULATION FORECASTING

2) PUBLIC HEALTH INFRASTRUCTURE: Public health infrastructure are for communities, states, and the Nation. It provides the capacity to these to prevent from disease, uphold better health, and prepare to respond to crisis/ disastrous situation and to the health challenges in progress. A country with weak health infrastructure has high mortality rate.

3) **POLICY MAKING**: Information of mortality helps policy makers to plan, design, and implement for the benefit of the population, as it can assess country's trajectory through epidemiological transition.

4) **SOCIAL DESCRIPTIONS**: On a shorter time-scale, mortality statistics provide an important indicator of the health and well-being of a population. Mortality statistics are required to estimate summary measures of population health among sub-groups in the population, for example the life expectancy at birth, and infant mortality are included to understand the quality of life.

5) **EPIDEMIOLOGICAL STUDIES**: Information on definite cause of death is also significant in various epidemiological studies. Epidemiology uses observed mortality differentials so as to suggest links between risk factors and disease. Mortality by occupation, place of residence, personal habits, or diet, details disaggregation by cause is required.

6**) USES FOR DETERMINING PAYMENT COST BY LIFE INSURANCE COMPANY**: The premium rate for a life insurance policy is determined by two underlying concepts: mortality and interest. There is also a third variable i.e the expense factor. This factor equals to the amount the company adds to the cost of the policy to cover operating costs of investing the premiums, selling insurance, and paying claims. Life insurance is based on the sharing of the risk of death by a large group of people, i.e. trend of mortality of that population and age specific mortality. To predict the cost to each member of the group the amount at risk must be known. Estimation of cost of death claims is a question of great importance for the life insurance companies and Mortality tables are used to give the company a basic of this estimate. By using a mortality table, a life insurer can determine the average life expectancy for each age group.

7) **USE IN CHILD HEALTH CARE**

FACTORS AFFECTING MORTALITY

1) Medical Facilities and health
2) Nutritional levels

3) Living standard
4) Access to clean drinking water
5) Hygiene levels
6) Levels of infectious disease
7) Prevalence of violence or crime or war
8) Inbreeding and genetic load
9) Poverty

DEMOGRAPHIC THEORY

Demography is the science of populations. Demographers seek to understand population dynamics by investigating three main demographic processes: birth, migration, and aging (including death). All three of these processes contribute to changes in populations, including how people inhabit the earth, form nations and societies, and develop culture.

Pointing out the importance of demography, Kingsley Davis (1949) said, 'demography' is the essential basis for understanding the human society.

Functions:

He has demarcated the following functions of demography:

(a) To know the population of a particular area;

(b) To ascertain as to which factors are influencing the population of that particular area;

(c) To explain the factors relating to changes in population; and

(d) To study the population trends on the basis of the above three factors.

MALTHUSIAN THEORY OF POPULATION GROWTH

Thomas Robert Malthus (1766-1834 was the first economist to propose a systematic theory of population. He articulated his views regarding population in his famous book, Essay on the Principle of Population (1798), for which he collected empirical data to support his theory. His expression on population was a landmark in the history of population theories, where he generalized the relationship among population factors and social change.

Malthus proposes the principle that human populations grow exponentially (i.e., doubling with each cycle) while food production grows at an arithmetic rate (i.e. by the repeated addition of a uniform increment in each uniform interval of time) in Essay on the Principle of Population. Thus, while food output was likely to increase in a series of twenty-five year intervals in the arithmetic progression 1, 2, 3, 4, 5, 6, 7, 8, 9, and so on, population was capable of increasing in the geometric progression 1, 2, 4, 8, 16, 32, 64, 128, 256, and so forth. This scenario of arithmetic food growth with simultaneous geometric human population growth predicted a future when humans would have no resources to survive on. Malthus urged controls on population growth to avoid such a catastrophe.

On the basis of a hypothetical world population scenario which was of one billion in the early nineteenth century along with an adequate means of subsistence at that time, Malthus proposed that there was a potential for a population to increase to 256 billion within 200 years whereas the means of subsistence were only capable of being increased enough for nine billion to be fed at the level prevailing at the beginning of the period. He therefore considered that the population increase should be kept down to the level at which it could be supported by the operation of various checks on population growth, which he categorized as "preventive" and "positive" checks.

Preventive Checks

Preventive checks exercise their influence on the growth of population by bringing down the birth rate. Preventive checks are those checks which are applied by man. Late marriage and self-restraint during married life are the examples of preventive checks applied by man to limit the family

Positive Checks

Positive checks are applied by nature, which exert their influence on the growth of population by increasing the death rate. There are various positive checks to population which include every cause, whether arising from vice or misery, which in any degree contributes to shorten the natural duration of human life. Insubstantial occupations, hard labour, exposure to the seasons, extreme poverty, bad nursing of children, common diseases, wars, plagues and famines ire some of the examples of positive checks. They all shorten human life and increase the death rate.

Criticism of Malthusian Theory:

The theory proposed by Malthus has been a subject of keen controversy. It was criticized on the following grounds:

(i) It is pointed out that Malthus's pessimistic conclusions have not been borne out by the history of Western European countries. Population has not increased as rapidly as predicted by Malthus; on the other hand, production has increased tremendously because of the rapid advances in technology. As a result, living standards of the people have risen instead of falling as was predicted by Malthus.

(ii) It was Malthus asserted that food production would not keep pace with population growth owing to the operation of the law of diminishing returns in agriculture. But by making rapid advances in technology and accumulating capital in larger quantity, advanced countries have been able to postpone the stage of diminishing returns.

(iii) Malthus did not visualize role of preventive checks like contraceptives and family planning.

(iv) Karl Marx argued that starvation was caused by unequal distribution of wealth and its accumulation by capitalists. It has nothing to do with population growth.

Despite criticism, Malthusian thesis gained widespread currency. His ideas had profound effect on public policies, economists. His principle of population has been successful in highlighting the urgency to maintain a balanced relationship between population growth and means of subsistence. Another main contribution of Malthus was to give a new line of thinking whereby dynamics of population growth were viewed in context of man's welfare.

THOMAS DOUBLEDAY'S DIET THEORY

Thomas Doubleday, a social philosopher and an English economist, expressed his views on various natural laws which govern population. According to him, population increase will be less when the quantity of food supply is greater.

Doubleday divides society into three groups:

(1) The first group includes those who are in a state of affluence and are well supplied with luxuries. Their number is on constant decrease.

(2) The second group consists of the poor people who have less supply of food. Their number is increasing rapidly. In other words, the constant increase in population is found in the group where people are worst supplied with food. This happens in all societies.

(3) The third group has those people who form the mean and median between two opposite states and who fall under the average income group and those who are tolerably well supplied with good food or who get a normal diet and do not overwork and yet are not idle. Their number is stationary.

Doubleday is also of the view that, "The rich produce less children as the fertility would be less amongst them and therefore, the transfer of their wealth will be distributed among a few people. Over a period of time, it may happen that there is no one as an heir to that property and therefore this wealth will pass to the children of the poor. Again when the children become rich, they will restrict their families and their wealth will be gained once again by the poor. Thus socialism comes on its own through the automatic distribution of wealth by nature."

JOUSE DE CASTRO'S PROTEIN CONSUMPTION THEORY:

Castro accepted the findings of R.J. Solankar who conducted experiments on rats in 1920. In these experiments Solankar found that with the increase in protein consumption in diet, the fecundity will decrease and it will increase with low protein content in diet.

Castro came to the conclusion that the fatness is affected by the consumption of protein, it increases with the protein rich diet, which leads to lower fertility. Moreover, this concept of Castro is similar to the Doubleday's diet theory that the food supply influences the rate of population increase.

According to Castro, people or societies are blamed for the high birth rate in the poor countries, which is not proper. For this the people of affluent societies should be blamed, as no steps to improve the standard of living of their people nor have they made attempts to provide good food and provision of good food was made by imperial or colonial powers. Such a vicious cycle of consumption of imbalanced food, less protein intake, leading to the increase in the capacity to produce more children goes on. Castro reflected on the issue with reference to India that out of the total number of children born in India; almost fifty percent suffer from starvation and die before they reach the age of marriage.

MICHAEL THOMAS SADLER'S DESTINY THEORY:

Michael Thomas Sadler, an Economist and a British social reformer, was born in 1780. He was a contemporary of Malthus. He expressed his ideas about population in his book **The Law of Population**. According to Sadler, the law which regulates the growth of animals and plants is primarily the same as the law which regulates the growth of human population.

He was of the opinion that "The fecundity of human beings is in the inverse ratio of the condensation of their numbers." Fertility rate decreases with the increase in the density of population. In the agriculture based or pastoral countries where the density of population is low, the fertility rate of the population becomes high. In such countries, people have the capacity to work hard and hardworking people give birth to more children.

With the passing of time, when there is industrialisation and the population becomes more civilized and literate, the density of population increases. Here people would limit the size of family and in such socio-economic conditions they will be happier and there will be prosperity.

Criticisms of Michael Thomas Sadler's Destiny Theory:

If we compare Sadler's theory to the Malthusian theory of population, it can be said that the theory of Sadler is very optimistic. When Sadler's book was published in 1830, many economists, sociologists and demographers were under the spell of pessimism created by Malthus in his population theory. In such an atmosphere to give optimistic thoughts itself was a great achievement.

1) Sadler failed to distinguish between fecundity and fertility. He said that the fecundity of human beings is in the inverse ratio of the condensation of their numbers. But in fact no biological reason is found to prove the idea that if density brings down 'fertility', it will bring down 'fecundity' also. This is because in slums the density is very high and at the same time fertility is also high among slum dwellers.

2) Moreover, in many countries of the world where the density is high, the fertility rate is also high. Even in India, in some states like Delhi, Kerala and West Bengal where the density is high, the fertility is not low in comparison with the fertility of other states.

3) Sadler's view that with industrialization the population decreases has not been proved true. In a country like India, industrialisation has not led to the decline in the growth of population.

HERBERT SPENCER'S BIOLOGICAL THEORY

Herbert Spencer, a famous English philosopher and sociologist, propounded the biological theory of population in his book The Principles of Biology. Spencer argued that fecundity decreases when the complexity of life increases.

Spencer believed that "there exists antagonism between individuation (survival) and genesis (reproduction)". When any individual does hard work for his personal development at his work place, the desire for reproduction decreases.

In other words, when more energy has been utilised for one's self-development, the energy available for reproduction will be less and consequently the population growth will be less. Thus, with the development of society and for one's success and survival (individuation), life becomes more complex which results in reduction in the capacity of reproduction.

According to him, people can be divided in three groups:

(i) Poor people who live a simple life whose fertility is high;

(ii) Middle class people whose fertility is correspondingly low; and

(iii) People who live developed or complex life whose fertility is fairly low.

According to Spencer, in societies where people, especially woman, are educated and belong to rich families, their reproductive power is low, as compared to the poor who are uneducated and whose reproductive power is high.

Criticisms of Herbert Spencer's Biological Theory:

1) The view of Spencer that fertility decreases due to more complex life has no empirical evidence. There is high fertility rate even in rich families or industrialised societies where people's life is more complex.
2) Spencer's view that educated women whose individuation is high would prove relatively infertile, is not realistic. Even educated women have high reproductive power.

DUMONT'S THEORY OF SOCIAL CAPILLARITY:

Arsene Dumont (1849-1902) has propounded the Theory of Social Capillarity. Dumont studied the growth of population in France in the later part of nineteenth century and found that the reason for low fertility in France was high intellectual and aesthetic development. In the words of Dumont, "The development of number in a nation is in inverse ratio to the development of individual. "According to him, "The direct cause of decline in birth rate was the movement of individual from the lower to the upper class. The individual tends to rise to higher levels in his social environment by process similar to physical capillarity." Further, "what gravity is to the physical world, capillarity is to the social order." According to Dumont, there are three principles of population that are related to the stages of social development:

1. In the preventive stage, the Malthusian theory of population applies where human beings live like animals. On what they can find, they increase in geometrical progression.

2. In the intermediate stage, "Population proportions itself automatically." In such a society, population increases as food supply increases because population can produce food itself. Here positive checks do not become necessary.

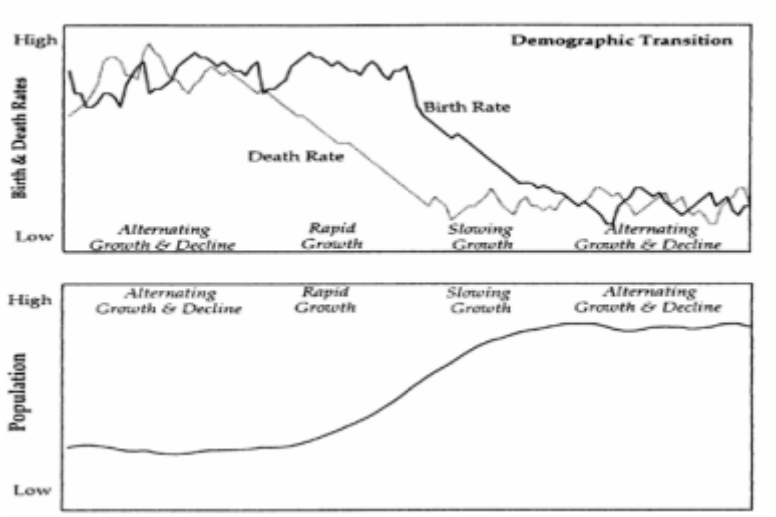
3. In a modern civilized society, Dumont applies his social capillarity principle. In such a society, every individual wants to achieve higher economic and social status. For this, a small family is imperative, because one cannot climb high on the social ladder with the burden of more no of kids in the family. When an individual earns more income and wealth, his ambition for better position and higher social prestige goes up and consequently the number of children decreases. Therefore, in a civilized society due to social capillarity, fertility goes down, it also decreases when people migrate to cities from rural or backward areas.

DEMOGRAPHIC TRANSITION THEORY

Demographic transition theory was foreshadowed by Thompson (1929) but created in its classical form largely by Notestein (1945) and places a broad emphasis on social and economic modernisation. In general, demographic transition theory can be characterised by four phases: an initial phase of high mortality and high fertility; a second phase where mortality falls and fertility remains high, resulting in rapid population growth; a third phase where fertility drops, slowing growth; and a final phase of low mortality and low fertility. Transitions in fertility were explained on the basis of a version of

modernisation theory (Notestein, 1945), multi-phasic response (Davis 1963) and of cultural diffusion (Coale, 1973).

Phases of Demographic Transition Theory



The theory postulates a particular pattern of demographic changes from a high fertility and high mortality to a low fertility and low mortality when a society progresses from a largely rural agrarian and illiterate society to a dominant urban, industrial, literate and modern society.

C.P. Blacker divided population into five types as high, stationary, early expanding, low stationary and diminishing. According to the theory of demographic transition, population growth will have to pass through these different stages during the course of economic development.

First Stage

It is characterised by high and fluctuating birth and death rates which will almost neutralize each other. People mostly live in rural areas and their main occupation is agriculture which is in the stage of backwardness. The tertiary sector consisting of transport, commerce banking and insurance is underdeveloped.

All these factors are responsible for low income and poverty of the masses. Social beliefs and customs play an important role in keeping birth rate high. Death rate is also high because of primitive sanitation and absence of medical facilities. People live in dirty and unhealthy surroundings.

As a result, they are disease ridden and the absence of proper medical care results in large deaths. The mortality rate is highest among the poor. Thus, high birth rates and death rates remain approximately equal over time so that a static equilibrium with zero population growth prevails.

Second Stage:

It is called the stage of Population Explosion. In this stage the death rate is decreasing while the birth rate remains constant at a high level. Agricultural and industrial productivity increases, means of transport and communication develops. There is great mobility of labour. Education expands. Income also increases. People get more and better quality of food products. Medical and health facilities are expanded.

During the stage economic development is speeded up due to individual and government efforts. Increased use of better technology, mechanization and urbanisation takes place. But there is no substantial change in the men, attitude of the people and hence birth rate stays high i.e., economic development has not yet started affecting the birth rate.

Due to the widening gap between the birth and death rates, population grows at an exceptionally high rate and that is why it has been called the population explosion stage. This is an "Expanding" stage in population development where population grows at an increasing rate, as shown in figure, with the decline in death rate and no change in birth rate.

Third Stage:

It is also characterised as a population stage because the population continues to grow at a fast rate. In this stage, birth rate as compared to the death rate declines more rapidly. As a result, population grows at a diminishing rate. This stage witnesses a fall in the birth rate while the death rate stays constant because it has already declined to the lowest minimum. Birth rate declines due to the impact of economic development, changed social attitudes and increased facilities for family planning. Population continues to grow fast because death rate stops falling whereas birth rate though declining but remains higher than death rate.

Fourth Stage:

It is called the stage of stationary population. Birch rate and death rate are both at a low level and they are again near balance. Birth rate is approximately equal to death rate and there is little growth in population. It becomes more or less stationary at a low level.

Criticism:

1) Based merely on experience of Australia, Europe and America

2) It is neither predictive nor its stages are segmental and inevitable.

3) Doesn't provide a timeframe for a country for developing countries of the world.

4) Many countries like Thailand have passed stage 2 and entered directly to stage 3.