

Chapter → POPULATION

Demography - The statistical analysis and study of populations is known as demography. It is especially concerned with human beings.

1755 Benjamin Franklin

published his essay Observations concerning the increase of Mankind, Peopling of countries etc. Projecting the exponential growth of British colonies. His work influenced Thomas Robert Malthus, who in end of 18th century feared that, if unchecked, population growth would tend to outstrip growth in food production, leading to ever increasing famine and poverty (Malthusian Catastrophe)

Malthus is seen as intellectual father of ideas of overpopulation and the limits of growth. The period 1860-1910 can be characterised as a period of transition where demography emerged as a separate field of interest. Many demographers like Richard Boeth, Luigi Bodio contributed to the development of demography, and to the toolkit of methods and techniques of demographic analysis.

Methods of demographical Studies -

There are two methods of data collection

① Direct Method → Direct data comes from vital statistics registries that track all births and deaths as well as certain changes in legal status. Such as marriage, divorce and migration

Census is the other common direct method of collecting demographic data. In census collection of information about families or households in addition to individual characteristics such as

age, sex, marital status, literacy, education, employment, geographical location and occupation is collected.

Indirect Methods → The indirect method of data collection includes models of mortality (including life tables, Gompertz models etc), fertility, marriage, population projection and momentum.

Population (Factors influencing Population) - Population can be defined as sum total of organisms of a species in a particular Geographic area. The factors which influence population are

Fertility - Fertility involves the number of offspring that women can have, in contrast to fecundity (means the capacity to produce child)

Mortality - Mortality is the study of the causes, consequences and measurements of processes affecting death to the members of the population. It can be studied by using life tables, a statistical device that provides information about mortality condition or life expectancy in the population.

Migration - Migration refers to the movement of persons from one place to another for livelihood or for other political purposes.

Life Table - It was described as barometer of population by William Farr. John Graunt (1620-1674) made observation on bills of mortality. Edmund Halley (1656-1742) An estimate of the Degree of the mortality of mankind drawn from the curious Table of Births and Funerals at the city of Breslaw.

LIFE TABLES - Definition

A life table is a table which shows, for a person at each age, what the probability is that they die before their next birthday. A number of statistics can be derived from the life table

- ① The Probability of surviving any particular year of age.
- ②, The remaining life expectancy for people at different ages.

Life table and their application - life expectancy is a commonly used by data by calculating the life tables and secondly, the proportion of original people still alive. Life tables are usually constructed separately for men and for women because of their different mortality rates. They are also a biological tool to study population.

Construction of life tables - Age specific mortality rates are applied to a national population, typically of 100,000 starting at birth, the probability of dying in each period is applied to the number of people surviving to the beginning of the period, so that the initial figure slowly reduces to zero. The different elements required for a life table includes.

l_x	No. of survivors at a age x
q_x	probability of dying between age x and $x+n$
nD_x	No. of deaths between age x and $x+n$
nL_x	No. of person years lived between age x and $x+n$

T_x - Total no. of persons years lived after
to age x

e_x - life expectancy of age x

This type of life table is based on current age specific death rates for each age band used and are called period life tables and are the most frequently used life tables

In contrast actual life expectancy of a particular birth cohort can only be calculated when everyone in the cohort is dead. This approach uses a cohort life table and requires data over many years to prepare a single complete cohort life table.

Applications of life table -

- (1) - Summary of mortality provides an overall picture of mortality for the countries are compared.
- (2) Life tables can be used for distinguishing different risk factors for life expectancy such as smoking status, occupation, socioeconomic class and other.
- (3) Assessment of survival in disease that involves comparisons between two populations or population in two points in time.
- 4) Life tables are also used by insurance companies and actuary departments
- 5) In biology it is used for age specific fertility rates and its calculations. It gives an idea in the dynamics of population.
- 6) In poor countries it is used for knowing childhood mortality rate.

Importance of life Tables - It helps in knowing the

- No of survivors
- At 5 years, the of children likely to enter primary school.
- At 15 years number of women entering fertile period at 18 years
- It years no. of eligible voters
- No of persons likely to die after life insurance.

Calculation of expectation of life and comparison of mortality among communities
Population Studies

Survival rate after treatment.
Analysis by causes of death.

Statistical construction of life tables -

1. $q_x = \frac{m_x}{1 + (1 - a_x)m_x}$ Here $P_x =$ midyear population between ages x and $x+1$

2. $P_x = 1 - q_x$ $D_x =$ No of deaths between ages x and $x+1$

3. $L_{x+1} = L_x l_x$ $a_x =$ Average fraction of last year of life by those living between x and $x+1$

4. $d_x = L_x + L_{x+1}$ $m_x =$ Age specific death rate
5. $l_x = L_x - (1 - a_x)d_x$ $q_x =$ Probability of dying b/w age x and $x+1$

6. $P_x = L_x + L_{x+1} + \dots$ $I_x =$ No of people surviving to age out of the life table cohort

7. $e_x = \frac{T_x}{L_x}$ $d_{x+n} =$ No of deaths between age x and $x+n$ out of the life table cohort

$L_x =$ No. of Persons years lived between x and $x+1$ age

$T_x =$ Total no. of Person lived between after age x

$e_x =$ life expectancy at age x

Dr. Pooja Verma
Dept of Zoology