Vital statistics (जीवन संबंधी आँकड़े)

Vital statistics is defined as that branch of biometry (जीवमापन) which deals with data and the laws of human mortality (मृत्यु-संख्या), morbidity (रुग्णता) and demography (जनसांख्यिकी). The term vital statistics refers to the numerical data or the techniques used in the analysis of the data pertaining (सम्बद्ध) to vital events occurring in the given section of the population. By vital events we mean such events of human life as fertility and mortality (births and deaths), marriage, divorce, separation, adoptions, legitimations, etc.

The following definition due to **Benjamin** explain the utility of vital statistics to planners, various operating agencies, medical sciences, policy makers etc.

"Vital statistics are conventional numerical records of marriages, births, sickness and deaths by which the health and growth of a community may be studied."

"Vital statistics forms perhaps the most important branch of statistics as it deals with mankind in the aggregate. It is the science of numbers applied to the life history of communities and Nations."

Uses of vital statistics. Vital statistics are being extensively used in almost all the squares of human activity. We outline below some of the important application of vital statistics.

1.**Study of population trend**. The study of births (fertility) and deaths (motility) gives us an idea of the population trend of any region, community or country.

If 'Birth Rate > Death Rate', there is an increasing trend.

If 'Birth Rate < Death Rate', there is a decreasing trend.

The division of the population of different regions (or races) by birth and death rates enables us to form some idea about the population trend of the regions for countries and the general standard of living and virility (हिम्मत) of the races.

2. **Use in public administration**. The study of population movement, i.e., Population estimation, population projections and other allied studies together with birth and death statistics according to age and sex distributions provides any administration with fundamental tools which are indispensable (परम आवश्यक) for the overall planning and evaluation of economic and social development programmes.

3. Mortality and natality (जन्म-दर) statistics also provide guide spots for use by the researchers in medical and pharmaceutical profession.

4. **Use to operating agencies**. The facts and figures relating to births, deaths and marriages are of extreme importance to various official agencies for a variety of administrative purposes. Mortality statistics serve as a guide to the health authorities for sanitary improvements, improved medical facilities and public cleanliness. The data on the incidence of disease, together with the number of deaths by age and nature of diseases are of paramount importance to the health authorities in taking appropriate remedial action to prevent or control the spread of the disease. For example, to control the spread of an epidemic, arrangements can be made for inoculation or vaccination through municipal and district local board agencies.

Methods of obtaining vital statistics method. The vital statistics data are usually obtained by the following methods.

1. **Registration method**. The most important source of obtaining vital statistics data is the registration method which consists in continuous and permanent recording of vital events pertaining to births, deaths, marriages, migration, etc. These data, in addition to their statistical utility, also have their value as legal documents. Registration of births provide information on place of birth, sex, age and religion of the parents, legitimacy, number of previous issues and their sexes, father's occupation and birth place of parents. Similarly, death registration furnishes information on the place ace of death, sex, age marital status, number of issues, birthplace, occupation and cause of death. Similar information is also obtained with respect to marriage and migrants.

Many countries require compulsory registration of births and deaths under the law. For example, every new birth has to be reported to the authorities along with the information as giving about. Similarly, the death of a person is automatically recorded since the disposal of the body requires an appropriate death certificate from the authorities.

2. **Census method**. Almost in all the countries, all over the world, population census is conducted at regular intervals of time, usually ten years. Census consists of complete enumeration of the population of the particular area understudy and collecting information from individuals regarding age, sex, marital status, occupation, religion and other economic and social characteristics.

The main drawback of census method is that it provides vital statistics only for the census year and fails to give any information about the vital events in the intercensal period.

Measurement of mortality

The following are the principal rates used in measuring mortality.

Crude death rate. This is the simplest of all the indices of mortality and is defined as the number of deaths (from all-cause) per k person in the population of any given region or community during a given period. Thus, in particular the annual crude death rate (C.D.R.) denoted by m for any given region or community is given by:

$$m = \frac{Annunal\ deaths}{Annual\ mean\ population} \times k \quad \ldots\ldots (1)$$

$$m = \frac{D^a}{P^a} \times k$$

where $k = 1000$, usually.

The crude death rate for any period gives the rate at which the population is depleted through death over the course of the period.

Merits

1. It is simple to understand and calculate.
2. C.D.R. is perhaps the most widely used of any vital statistics rates. As an index of mortality, it is used in numerous demographic and public health problems.
3. Since the entire population of the region is exposed to the risk of mortality, C.D.R. defined in (1) is a probability rate giving the probability that a person belonging to the given population will die in the given period.

Demerits

most serious drawback of crude death rate is that it completely ignores the age and sex distribution of the population. Experience shows that mortality is different in different segments of the population. Children in the early ages of their life, and the older generation are exposed to higher risk of mortality as compared to younger people. Moreover, mortality rate is also different for females irrespective of age groups, than their male counterparts. C.D.R. is not

suitable for comparing the mortality in two places or same place in two periods unless

(i) The populations of the places are being compared have more or less the same age and sex distribution, or
(ii) Two periods are not too distant, since in a stable large community, age-sex structure of the population shows very little change.

Specific Death Rate: Death rate computed for a particular specified section of the population is termed as specific death rate (S.D.R.). S.D.R. for given geographical region during a given period is defined as:

$$S.D.R. = \left[\frac{\begin{matrix}total\ number\ of\ deaths\ in\ the\ specified\ section \\ of\ the\ population\ in\ the\ given\ peroiod\end{matrix}}{\begin{matrix}total\ population\ of\ the\ specified\ section \\ in\ the\ same\ period\end{matrix}}\right] \times k$$

Where $k = 1000$, usually. Generally, S.D.R. is computed specified to (i) age and (ii) sex.

Age Specific Death Rate (Age S.D.R.). number of deaths per k persons of the population of a particular age group is called Age Specific Death Rate. To formulate mathematically, let

$$\Rightarrow \qquad {}_nD_x = Number\ of\ deaths\ in\ the\ age\ group\ (x, x+n)$$

i.e. number of deaths among persons with age x or more but less than $x+n$, in a given region during a given period, t (say).

$$and \qquad {}_nP_x = Total\ population\ of\ the\ age\ group\ (x, x+n).$$

Then the age specific death rate for the age group x to $x+n$, usually denoted $by\ {}_nm_x$ is given by:

$${}_nm_x = \frac{{}_nD_x}{{}_nP_x} \times 1000$$

Taking $n = 1$, we get the annual age specific death rate, given by:

$$m_x = \frac{D_x}{P_x} \times 1000$$

Merits:

1. The death rates specific to age and sex overcome the drawback of C.D.R. since they are computed by taking into consideration the age and sex

composition of the population. By eliminating the variation in the death rates due to age sex distribution of the population SDR provide more appropriate measure of the relative mortality situation in the regions.

2. For general analytical purposes, the death rate specific for age and sex is one of the most important and widely applicable type of death rates. It also supplies one of the essential components required for computation of net reproduction rate and construction of life table.

Demerits:

1. However, S.D.R. are not of much utility for overall comparison of mortality conditions prevailing in two different regions, say, A and B. For example, it might happen that for certain age groups the mortality pattern for region A is greater than that for B but for the others the case may be opposite. Hence it will not be possible to draw general conclusion regarding the overall mortality pattern in the region A as compared to the region B. In order to draw some valid conclusions, the different age or/and sex specific death rates must be combined to give a single figure, reflecting the true picture of mortality in the region.
2. Moreover, in addition to age and sex distribution of the population social, occupational and topographical factors come into operation causing what is called different mortality. S.D.R. completely ignore these factors. In order to eliminate such superior effects standardised death rates are computed.

Infant Mortality Rate (I.M.R). The infant mortality rate is defined as the chance of dying of a newly born infant within a year of its life, under the given mortality conditions.

Notations:

$D_0^Z =$ Number of deaths (excluding foetal deaths) among the children between the age group 0 – 1.

$B_0^Z =$ Total number of live births reported in the same region within the same calendar year.

The infant mortality rate during the calendar year z, usually denoted by i_m^Z, is given by:

$$I.M.R. = \ i_m^Z = \frac{D_0^Z}{B_0^Z}$$

Standardised Death Rates. The crude death rates in terms of age – specific death rates for two regions A and B are given respectively by:

$$m^a = \frac{D^a}{P^a} \times k, \qquad m^b = \frac{D^b}{P^b} \times k \qquad (crude\ death\ rate)$$

And annual age specific death rate for any given age x

$$m_x^a = \frac{D_x^a}{P_x^a} \times k, \qquad and \qquad m_x^b = \frac{D_x^b}{P_x^b} \times k$$

$$D_x^a = \frac{m_x^a\ P_x^a}{k}, \qquad and \qquad D_x^b = \frac{m_x^b\ P_x^b}{k}$$

The annual age specific death rate for all ages is obtained by summing over x

$$\sum D_x^a = \frac{\sum m_x^a\ P_x^a}{k}, \qquad and \qquad \sum D_x^b = \frac{\sum m_x^b\ P_x^b}{k}$$

$$D^a = \frac{\sum m_x^a\ P_x^a}{k}, \qquad and \qquad D^b = \frac{\sum m_x^b\ P_x^b}{k}$$

Substituting these values in C.D.R.

$$m^a = \frac{\sum m_x^a\ P_x^a}{P^a}, \qquad and \qquad m^b = \frac{\sum m_x^b\ P_x^b}{P^b}$$

$$m^a = \frac{\sum m_x^a\ P_x^a}{\sum P_x^a}, \qquad and \qquad m^b = \frac{\sum m_x^b\ P_x^b}{\sum P_x^b}$$

Standardisation: This method Consists in weighting the age specific death rates not by the corresponding population of the area to which they refer but by the population distribution of another region chosen as a standard. Thus, if P_x^s is the number of persons in the age group x to x+1 in the standard population, then the standardised death rates for the regions A and B are given by:

$$(STDR)_A = \frac{\sum m_x^a\ P_x^s}{\sum P_x^s} \qquad and \qquad (STDR)_B = \frac{\sum m_x^b\ P_x^s}{\sum P_x^s}$$

Merits:

1. Standardised Death rates are readily comprehensible and easy to calculate.
2. These are comparable since they eliminate the difference caused by the different distributions of age – specific population for regions A and B. the

difference in these death rates gives a true picture of the difference in mortality in two regions.

Demerits:

1. The main drawback is the choice of standard population. The choice of this 'standard' is bound to affect the magnitude of the rate and may change their relative positions with respect to each other.

Que 1. Compute the crude and standardised death rates of the two populations A and B, regarding A as standard population, from the given data

Age group (Years)	A		B	
	Population	Deaths	Population	Deaths
Under 10	20000	600	12000	372
10 – 20	12000	240	30000	660
20 – 40	50000	1250	62000	1612
40 – 60	30000	1050	15000	525
Above 60	10000	500	3000	180

Solu:

Age Group (Years)	Population A			Population B			$m_x^b P_x^a$
	Population P_x^a	Deaths D_x^a	Death rate / 1000 m_x^a	Population P_x^b	Death D_x^b	Death rate / 1000 m_x^b	
Under 10	20000	600	30	12000	372	31	620000
10 – 20	12000	240	20	30000	660	22	264000
20 – 40	50000	1250	25	62000	1612	26	1300000
40 – 60	30000	1050	35	15000	525	35	1050000
Above 60	10000	500	50	3000	180	60	600000
Total	**122000**	**3640**		**122000**	**3349**		**3834000**

Crude Death Rate:

C.D.R. for population A $= \frac{\sum D_x^a}{\sum P_x^a} \times 1000 = \frac{3640}{122000} \times 1000 = 29.83$

C.D.R. for population B $= \frac{\sum D_x^b}{\sum P_x^b} \times 1000 = \frac{3349}{122000} \times 1000 = 27.45$

Standard Death Rate:

Since population A is taken as standard population,

STDR for A = C.D.R. for A = 29.83

$$STDR\ for\ B = \frac{\sum m_x^b P_x^a}{\sum P_x^a} = \frac{3834000}{122000} = 31.42$$

We, conclude that death rate in population B is greater than in population A.

Que 2. Estimate the standardised death rates for the two countries from the data given below,

Age group (in Years)	Death Rate per 1000		Standardised Population (in lakhs)
	Country A	Country B	
0 – 4	20	5	100
5 – 14	1	0.5	200
15 – 24	1.4	1	190
25 – 34	2	1	180
35 – 44	3.3	2	120
45 – 54	7	5	100
55 – 64	15	12	70
65 – 74	40	35	30
75 and above	120	110	10

Answer: Standardised death rate for country A = 7.372

Standardised death rate for country B = 4.7

MORTALITY TABLE OR LIFE TABLE

The life table gives the life history of a hypothetical group or cohort as it is gradually diminished by deaths. It is a conventional method of expressing the most fundamental and essential facts about the age distribution of mortality in a tabular form and is a powerful tool for measuring the probability of life and death of various age sectors. A life table provides answer to the following questions:

1. How will a group of infants all born at the same time and experiencing unchanging mortality conditions throughout the life, gradually die out?
2. When in the course of time all these infants die, what would be the average longevity per person?
3. What is the probability that persons of specified age will survive a specified number of years?

4. How many persons, out of selected number of persons living at some initial age, survive on the average to each attained age?

The life table the gives a summary of the mortality experience of any population group during a given period and is a very effective and comprehensive method for providing concise measures of the longevity of that population.

The data for construction a life table are the census data and death registration data. Life tables are generally constructed for various sections of the people which, as experience shows, have sharply different patterns of mortality. Thus, there are life tables constructed for different races, occupational groups and sex. Life tables are as well constructed on regional basis and other factors accounting differential mortality.

Uses of life tables. Although the basic objective of life tables is to give a clear picture of the age distribution of mortality in a given population group, it has been used widely in large number of spheres. Today life table is widely accepted as important basic material in demographic and public health studies. We enumerate below some of important applications of life tables.

1. **For use by Actuaries (रजिस्ट्री) in Insurance.** Life tables are indispensable for the solution of all questions concerning the duration of human life. These tables, based on the scientific use of statistical methods, are the keystone or the pivot (प्रधान आधार) on which the whole science of life insurance hinges. Life tables form the basis for determining the rates of premiums to be paid by person of different age groups, for various amount of Life assurance.

2. **For Population Projections**. Life tables are used by demographic to device measures such as 'Net Reproduction Rate' to study the rate of growth of population. They have also been used in preparation of population projections by age and sex, ie, in estimating what the size of the population will be at some future date.

3. **For Comparison of Different Populations.** Life tables for two or more different groups of population may be used for the relative comparison of various measures of mortality such as death rate, expectation of life at various ages etc.

4. Life tables are as well used by the government and the private establishments for determining the rates of retirement benefits to be given to its employees or for formulating various programs for retired persons.

5. Since a life table depicts the distribution of the people according to age and sex it is extremely useful in planning in respect of education and for predicting the school going population in connection with school building programs.

6. Life tables are also used:

- for making policies and programmes relating to public health, by the government and public administration.
- to stop the impact of family welfare programme on the population growth.
- for estimating the probable number of future widows and orphans in a community. and
- for computing the approximate size of future labour force and military force etc.

Components of Life Table (Notations and Terminology):

1. l_x is the number of persons living at any specified age x in any year out of an assumed number of births, say l_0 usually called cohort or radix of the life table.
2. d_x is the number of persons among the l_x persons who die before reaching the age $(x+1)$. Obviously

$$d_x = l_x - l_{x+1}$$

3. ${}_np_x$ is the probability that a person aged x survives up to age $x+n$ in any year, then

$${}_np_x = \frac{l_{x+n}}{l_x} \qquad \Rightarrow \quad l_{x+n} = l_x \cdot {}_np_x$$

In particular if we take $n = 1$, we have

$$p_x = \frac{l_{x+1}}{l_x}$$

Is the probability that a person aged x will survive till his next birthday.

Also, q_x is the complementary probability of survival, i.e. q_x is the probability that a person of exact age x will die within one year following the attainment of that age. Thus, we have

$$q_x = \frac{d_x}{l_x}$$

Remark:

$$d_x = l_x - l_{x+1}$$
$$q_x l_x = l_x - l_{x+1}$$
$$l_{x+1} = l_x - q_x l_x$$

$$l_{x+1} = l_x(1 - q_x)$$
$$l_{x+1} = l_x p_x$$

4. L_x is the number of years lived in the aggregate by the cohort of l_0 persons between age x and $(x+1)$ or L_x may be interpreted as the average size of the cohort between ages x and $(x+1)$.
   Thus, deaths are assumed to be uniformly distributed over the whole year or equivalently, if we assume the linearity of l_{x+t} for $t \in [0,1]$, then we get

$$\begin{aligned} L_x &= \int_0^1 l_{x+t}\, dt \\ &= \int_0^1 (l_x - t d_x)\, dt \qquad \{l_{x+t} = l_x + t d_x\} \\ &= l_x\, |t|_0^1 - d_x \left|\frac{t^2}{2}\right|_0^1 \\ &= l_x - \frac{d_x}{2} \\ &= l_x - \frac{1}{2}(l_x - l_{x+1}) \\ &= l_x - \frac{1}{2} l_x + \frac{1}{2} l_{x+1} \\ &= \frac{1}{2}(l_x + l_{x+1}) \end{aligned}$$

5. T_x is the total number of years lived by the cohort l_0 after attaining the age x , i.e. T_x is the total future life time of the l_x persons to reach age x. thus, we have

$$T_x = L_x + L_{x+1} + L_{x+2} + \ldots\ldots$$

6. **Expectation of life**: The current expectation of life, usually denoted by e_x gives the average number of complete years of life lived by the cohort l_0 after age x by each of l_x persons attaining that age.

   The complete Expectation of life, denoted by e_x^0 measures the average number of years a person of given age x can be expected to live under the prevailing mortality conditions. It gives the number of years of life entirely completed and includes the fraction of the year survived in the year in which death occurs, which on the average can be taken to be $\frac{1}{2}$ year.

$$e_x^0 = e_x + \frac{1}{2}$$

Since the total number of years lived by l_x persons of age x is given by:

$$T_x = \int_0^{\infty} l_{x+t}\, dt$$

The complete expectation of life of a person attaining age x is obtained from the following relation:

$$e_x^0 = \frac{T_x}{l_x}$$

e_0^0 is the expectation of life at age 0. It is the average age at death or the average longevity of a person belonging to a given community.

Table 3. Abridged Life Table and ASDRs for Male Population of Bangladesh

Age Group x	l_x	${}_nd_x$	${}_nq_x$	${}_np_x$	${}_nL_x$	T_x	e_x
0	100000	16581	0.16581	0.83419	88393	4342518	43.42518
1	83419	5606	0.067203	0.932797	80055	4254125	50.99708
2	77813	2841	0.036511	0.963489	76393	4174070	53.64232
3	74972	1691	0.022555	0.977445	74127	4097677	54.6561
4	73281	1099	0.014997	0.985003	72732	4023550	54.90577
5	72182	2245	0.031102	0.968898	355298	3950818	54.73412
10	69937	904	0.012926	0.987074	347425	3595520	51.41084
15	69033	1036	0.015007	0.984993	342575	3248095	47.05134
20	67997	1202	0.017677	0.982323	336980	2905520	42.73012
25	66795	1428	0.021379	0.978621	330405	2568540	38.45408
30	65367	1734	0.026527	0.973473	322500	2238135	34.23952
35	63633	2233	0.035092	0.964908	312583	1915635	30.10443
40	61400	2984	0.048599	0.951401	299540	1603052	26.10834
45	58416	3986	0.068235	0.931765	282115	1303512	22.3143
50	54430	5402	0.099247	0.900753	258645	1021397	18.76533
55	49028	6731	0.137289	0.862711	228313	762752	15.55748
60	42297	8413	0.198903	0.801097	190453	534439	12.63539
65	33884	9313	0.274849	0.725151	146138	343986	10.15187
70	24571	9132	0.371658	0.628342	100025	197848	8.052094
75	15439	3594	0.232787	0.767213	68210	97823	6.336097
80+	11845	11845	1	0	29613	29613	2.500042

Main Sources of Demographic Data

1. Population Census
2. Registration
3. Sample Surveys.

1.Population Census. The most important source of demographic data is the census. The New International Webster's Dictionary defines it thus – "An official count of the people of a country or district including age, sex, employment, etc."

A United Nations Study defines the population census as the "total process of collecting, compiling and publishing demographic, economic and social data pertaining, at a specified time or times to all persons in a country or delimited territory."

Thus, a population census is an official enumeration of the inhabitants of a country with statistics relating to their location, age, sex, marital status, literacy status, language, educational level, economic activity, number of children, migration, etc. Population census is a regular feature of all progressive countries, whatever be their size and political set up. It is conducted at regular intervals, usually every 10 years, for fulfilling well-defined objectives.

A census has the following features:

1. A census is usually conducted after an interval of 10 years.
2. The census covers the entire country or a part of it.
3. The census operations are completed within specified dates.
4. It is organised and conducted by the Government through the Census Commission of the country.
5. For conducting the census a reference period is determined by the Census Commission at that point of time.
6. Before starting the census operations, some preliminary steps are taken by the Census Commission such as preparation of schedules, lists of households in each area, training of enumerators, etc.
7. The filled up census schedules are collected, examined and analysed statistically by the Census Commission.
8. The census data are published for circulation.
9. The census operations involve collection of information from households from door to door by enumerators. In some countries, schedules are sent by post and the required information is collected.
10. A census is a process whereby information is collected relating to age, sex, marital status, occupation, education etc. from people residing in a country.
11. Every country is legally bound to undertake a census after an interval of 10 years and people are bound to cooperate and provide the required information.

Uses of Census: Population census is very useful for researchers, administrators, social organisations, etc. We highlight its uses as under:

1. It provides primary population data relating to age, sex, marital status, economic activities, occupations, migration, literacy, etc.

2. Population data throw light on the socio-economic problems of the country such as the status of women, male-female sex ratio, population density, literacy level, urbanisation, living standards, etc.
3. These data help researchers, administrators, planners and social organisations to suggest and adopt measures to solve the various problems.
4. Census data are used for constructing life tables by insurance companies.
5. They are highly useful for making population projections.
6. Census data are used for carrying out sample surveys.
7. They are used by the Election Commission of the country for demarcation of constituencies and allocation of seats for municipal corporations, state legislatures and parliament of the country.
8. Population data are one of the bases of allocation of resources between the centre and states in a federal country.
9. They guide the city planners in planning measures for the future growth of cities regarding their future needs relating to housing, transport, flyovers, sanitation, pollution, water, educational institutions, etc.
10. Population projections and age-sex structure of the population help the government in estimating for the future military personnel of the country.

Some Problems of Census: Census operations are costly in terms of men, materials and money. They require huge manpower, piles of forms containing schedules and lot of money on them and on processing, preparing and publishing population data. The entire census work is also very time consuming. Besides, there are some other problems listed below:

1. Census is not a continuous process and is usually conducted after 10 years. So this is an ad hoc work which requires the training of census staff before each census. Thus experienced staff is not available.
2. The enumerators often interpret the terms used in the schedules in their own way despite the guidelines supplied to them by the Census Commission.
3. In the census operations, the enumerators are required to go from door to door to collect information. This work is not only time consuming but also monotonous. Some enumerators who shirk work and are dishonest fill up the schedules with cooked up figures sitting at home.
4. Often many persons are reluctant to provide correct information for fear that it may be used for some other purposes. This happens if the household is illiterate or the enumerator is not able to convince the former that the entire information is kept secret by law.

5. In many developing countries, the column in the household schedule relating to age is based on age groups 1-5, 6-10, etc. thereby leaving a wide gap of 5 years. This creates a problem for the enumerator to fill up the age column which becomes a mere guess work.

2. **Registration:** Another source of population data is the registration of life or vital statistics. Every person is required by law to register with a specified authority such demographic events as birth, death, marriage, divorce, etc. Unlike the census, registration of vital events is a continuous process throughout the year. It is an important source of information about citizenship, marital status, succession rights and settlement of disputes regarding birth and death. Registration is a secondary source of demographic data which is available from four sources:
(1) Vital Registration
(2) Population Register
(3) Other Records, and
(4) International Publications.

Limitations:

1. Very few people want to register marriages with the Registrar of Marriages in developing countries like India. Bangladesh, Pakistan and Sri Lanka.
2. In almost all the developing countries where the majority of people are illiterate and reside in rural areas, births and deaths are not reported to the registration authorities. Thus, the registration records remain incomplete and are imperfect source of demographic data.

3.Sample Surveys: Sample survey is another source of collecting population data. In a sample survey, information is collected from a sample of individuals rather than from the entire population. A sample consists of only a fraction of the total population. Several different population samples can be drawn on the basis of sample surveys such as the number of abortions, contraceptives used, etc. for the study of fertility.

Some countries conduct national sample surveys based on Random Sampling or Stratified Random Sampling. Whatever method is adopted, care should be taken to select a representative sample of the total population. The survey of the sample requires a small trained staff and small questionnaires relating to one aspect of the population. The data so collected are tabulated, analysed and published.

So this method takes less time and is less costly. Sample survey can be used to supplement the census data and to carry out further the trends in population growth in between two census operations. Sampling is also used to check the accuracy of the census data where there is doubt in census results. This method yields good results if the sample is properly chosen.

Limitations: The sampling method has certain limitations.

1. It is highly subjective and it is possible to arrive at different data with different samples of the same population.
2. There are bound to be errors in coverage, classification and sampling of population data.
3. As the survey requires many surveyors who may not be efficient and sincere, it is subject to large errors.
4. If the informants in the sample do not cooperate with the surveyors, the survey will not give accurate results. To conclude with Stephen, "Samples are like medicines. They can be harmful when they are taken carelessly or without adequate knowledge of their effects."

Que 3. Calculate the crude and standardised death rates for the local population from the following data and compare them with crude death rate of the standard population.

Age Group	Standard Population	Deaths	Local Population	Deaths
0 – 10	**600**	**18**	**400**	**16**
10 – 20	**1000**	**5**	**1500**	**6**
20 – 60	**3000**	**24**	**2400**	**24**
60 – 100	**400**	**20**	**700**	**21**

Solution:

Age Group (Years)	Standard Population A			Local Population B			$m_x^b P_x^a$
	Population P_x^a	Deaths D_x^a	Death rate / 1000 m_x^a	Population P_x^b	Death D_x^b	Death rate / 1000 m_x^b	
0 – 10	600	18	30	400	16	40	24000
10 – 20	1000	5	5	1500	6	4	4000
20 – 60	3000	24	8	2400	24	10	30000
60 – 100	400	20	50	700	21	30	12000
Total	**5000**	**67**		**5000**	**67**		**70000**

Crude death rate for Standard population $= \frac{\sum D_x^a}{\sum P_x^a} \times 1000 = \frac{67}{5000} \times 1000$

$$= 13.4$$

Crude death rate for Local population $= \frac{\sum D_x^a}{\sum P_x^a} \times 1000 = \frac{67}{5000} \times 1000$

$$= 13.4$$

Standardised death rate for Local population

$$= \frac{\sum m_x^b P_x^a}{\sum P_x^a} = \frac{70000}{5000} = 14$$