HEALTH STATISTICS –TREND AND CHALLENGES IN 21st CENTURY

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ABSTRACT *Health statistics are a foundation-stone of our health system. They provide us with critical data to assess the health of our population and to make informed decisions about how to best direct our health related resources and activities. Health statistics and data on health are important because they measure a wide range of health indicators for a community means a region, country, states or city. Information is at the root of everything we do which public health and health policy is built. Yet the role of health information is poorly articulated and the processes and mechanisms through which our nation manages and programs are also poorly understood. This paper focused on the results of the visioning process, a definition of health statistics, models of the factors that influence the health of population, an ideal health statistics cycle, methods of estimation of health and demographic measures and also vision for the health statistics enterprises in 21st century.*

Keywords: *Critical data, Demographic data, Enterprises, Health Statistics, Indicators, Statistics, Trend, Vision,*

Introduction:

'Health Statistics' is taken as the branch of official statistics which is mainly provided to the needs of statisticians, professional and institutional users of official statistics. Apart from administrative data on health related parameters, it also covers measures, estimates and counts derived from survey and census results. Health statistics are crucial for decision making at all levels of health care systems. It facilitates better decisions in policy design, health planning, management, monitoring and evaluation of programmes and services including patient care and facilitate improvements in overall health services performance and outcome. Health management information incorporates all the data needed by policy makers, clinicians and health service users to improve and protect population health. Few countries in the world today have effective and comprehensive systems in place to gather this data.

Objectives:

Describe the concepts and definition of health statistics.

1. Defining rates, ratios, prevalence, incidence rates, Kaplan-Meir and life tables, their types and also construction of life tables.
2. Defining the concept and definition of basic measures of health statistics, demography like attack rate, secondary attack rate, case fatality rate, duration of illness or sickness and other measures like relative risk, attributable risk and odds ratio are described.
3. Methods of estimation of health and demographic measures are also described.
4. Basic measures of fertility and indicators of National Aids Control Programme are also included.

Concepts and Definitions of Major Terms:

Rates:

A rate is used to compare two quantities with different units. If "a" and "b" are two different quantities, K is a multiplicative factor which may be 100,1000,10000 etc. It is denoted as **a/b * K** For example 5 persons died with HIV in 5000 population in a city during year 1990,then HIV death rate is 5/5000 * 1000 = 1 per 1000 population during 1990 in that city.

Infant mortality rate:

$$\frac{\text{Number of children in the age group 0-1 died during x year in a given area}}{\text{Number of births occurred during that year in that area}} \times 1000$$

Death rate:

$$\frac{\text{Number of deaths occurred in a place in a year x}}{\text{Total number of persons living in that place in the year x}} \times 1000$$

Ratio:

A ratio is a comparison of two quantities with the same units. For example if we require to comparing the Male and female ratio in a community consisting of 5000 male and 2000 female then: **Sex**

Ratio: (M/F).per 1000= 5000/2000 *1000= 2500.Hence in that case we can say per each 1000 females there are2500 males in that community or for each one female there are 2.5 males in that community.

Incidence (I):

Incidence is nothing but the occurrence of new cases of disease that develop in a population over a specific time period.

Incidence rate (I) = (Number of **new cases** of a particular disease in a fixed time period / Number of people at risk.)

Usually the period of study is chosen to be one year, in which case it would be called as the ***annual incidence*.**

Prevalence (P): prevalence measures the *frequency of existing disease*.

Prevalence (P) = (Number of people **with the disease at a given time** / Number of people at risk). There are two types of prevalence measures-point prevalence and period prevalence. *Point prevalence* refers to the proportion of the population that is diseased at a single point in time. The point can be either a particular calendar date. *Period prevalence* refers to the proportion of the population that is diseased during specified duration of time.

$$\text{Point Prevalence} = \frac{\text{Number of existing cases of disease at a point of time}}{\text{Number of total population at the same point of time}}$$

$$\text{Period Prevalence} = \frac{\text{Number of existing cases of disease during a period of time}}{\text{Number of total population}}$$

Relationship between Prevalence and Incidence:

The relationship between prevalence and incidence is as follows: **P/ (1-P) = I x D**, where P=Proportion of the total population with the disease and I is incidence rate and 1-P is the proportion of the total population without the disease. A population, in which the numbers of people with and without the disease remain stable, is known as a steady-state population. In such (theoretical) circumstances, the point prevalence of disease is approximately equal to the product of the incidence rate and the mean duration of disease. That is **P=I x D.**

Life tables:

Life expectancy is calculated by using life tables. Life table is a mathematical table which shows, for a person at each age, what the probability (chances) is that they die before their next birthday. The hypothetical group or cohort of people loses a predetermined proportion at each age, and thus represents a situation that is artificially contrived. Taking this a number of statistics can be derived which included in the table is:

the probability of survival age
the remaining life expectancy for people at different ages
the proportion of the original birth cohort still alive

Life tables are usually constructed separately for men and for women because of their substantially different mortality rates. Life tables are used by epidemiologist, physicians, zoologists, manufacturers and other scientists.

Types of Life Tables:

I) Current Life Table and Cohort Life Table
   a) Current Life Table is based upon the mortality experience of a community for a short period of time viz: One year, three years etc for which the mortality of community has not changed substantially.
   b) Cohort or generation life table is based on the mortality experience of a birth cohort (Persons born during one particular year).Cohort life table would observe the mortality experience of that particular birth cohort from its beginning till the death of all the cohort members.

II) Complete and Abridge Life Table: In complete life table information is given for every single year of age from birth until the lass applicable age In abridged life tables Information is give only for broader age interval such as x to x+5 years.

III) Single Decrement and Multiple Decrement Life Table: The Life Table which describes the attrition caused by a given single factor (e.g.: mortality) is called a single decrement life table. On the other hand the life table that considers attrition to the size of a group from two or more causes is called multiple decrement life tables.

Construction of life tables:

Age specific mortality rates are applied to a notional (hypothetical) population, typically of 100,000 (Radix). 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 include (using standard notations)

Age	Age interval x to x+n
nqx	Probability of dying in the age interval x and x+n for those alive at the beginning of the interval
lx	Number of survivors (alive) at age x (Radix)
nDx	Number of deaths between age x and x+n
nLx	Number of person years lived between age x and x+n
Tx	Total number of person years lived after age x
ex	Life expectancy at age x

This sort of life table is based on current age-specific death rates for each age or age interval and is called period life tables. In contrast, actual life expectancy of a particular birth cohort can only be calculated when everyone in this cohort is dead. This approach uses a cohort life table.

Assumptions Involved in Construction of Life Tables:

1. The death of people is fixed at each age according to a schedule that is fixed in advance and does not change.
2. The deaths are evenly distributed between one birthday and the next excepting first few years of life.
3. The cohort originates from a fixed number of births (radix i.e. 1000, 10000 etc births).
This facilitates for comparison between different life tables.
4. The age specific death rates (ASDR) in the life table population are the same as the age specific death rates in the actual population during a specific period.

Life Table for Clinical Data:

Life table gives mortality rates experienced by hypothetical cohort here expectation of life is calculated. In clinical setup data the expectation of life cannot be approximated, because the onset of a disease (incidence) and person dying. Therefore it is necessary to construct a life table by considering number of persons surviving with the disease, likely to die (out of cohort) within certain time. Hence it is possible to estimate the chances of surviving with the disease through survival analysis. Survival analysis known as the time-to-event analysis includes similar concepts to both the incidence risk and the incidence rate.

Survival analysis analyse the chance of survival after being diagnosed with the disease or after beginning the treatment. The event can be any other health event not only just death. Survival analysis analyse the variable time of entry and variable time of withdrawal of individuals from population. It also calculates cumulative event-free probabilities which generates in a survival curve.

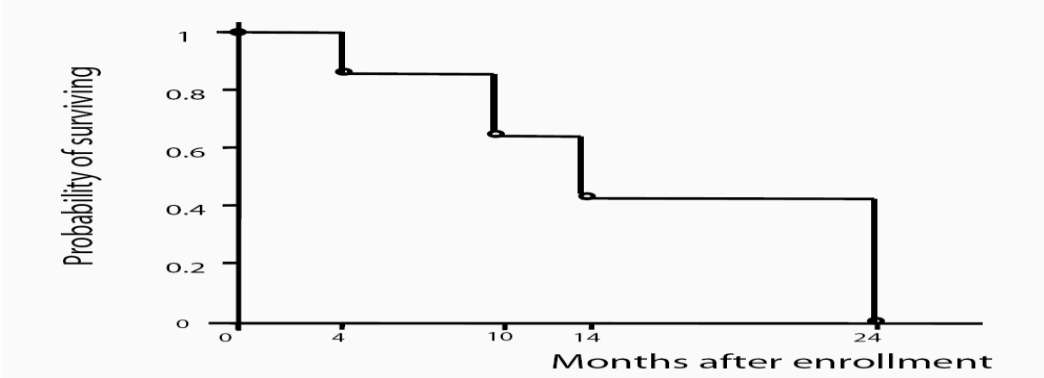
Kaplan-Meier Method of Life Table Construction:

Kaplan-Meier is also a survival analysis method. It is as similar as clinical life table method but it uses the **exact times that event occurred**, rather than the intervals of follow-up. In this method the probability of the event is equal to the number of events at that time divided by the number at risk at the point in time. Further if there are withdrawals before the time event, they are subtracted from the number at risk.

Use of Kaplan-Meier Method:

1. K-M method is useful for small sample size which takes the advantage of all information available in the calculation.
2. Clinical research using K-M plots to display prognosis over time and K-M estimates. It can be used for comparison purpose in clinical trials when groups are similar and adjustment is not needed.

Kaplan- Meier Plot:



Basic Measures of health statistics:

1. Health: According to WHO, Health is defined as "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity".

2. Morbidity: A "Morbid condition" appears due to any attack of one or more "diseases" or "injury".

'Health' does not merely means obscene of disease or provision of diagnostic, curative and preventive services. The state of positive health implies "perfect functioning" of the body and mind.

Measures:

Disease, illness or sickness measured by calculating:

1. Incidence rate,
2. Prevalence rate: Period Prevalence Rate, Point Prevalence Rate.
3. Attack Rate, Secondary Attack Rate.
4. Case fatality Rate
5. Attack Rate
6. Case Fatality Rate
7. Duration of illness or sickness
8. Other measures: Relative Risk, Attributable Risk and odds ratio

$$\text{Attack rate} = \frac{\text{Number of new cases of specified disease during its specified time interval}}{\text{Total population at risk during the same interval}} \times 100$$

Case fatality rate:

Number of new cases of illness or injury (Ii) for a specific cause, during a specified period and Di is the deaths due to that specific cause in the same period and community:

Case Fatality Rate= (Di/Ii) x1000

Duration of Illness:

a) Average duration of illness Per **person** $= \frac{\text{Total days of illness of all sick persons}}{\text{Total Population Exposed}}$

Other measures:

1. Relative Risk (risk ratio)
2. Attributable Risk
3. Odds Ratio (cross product ratio)

These above measures depend on study design; in a cohort study Relative risk and Attributable risk can be calculated. In Case Control study Odds ratio can be calculated.

Mortality Rates:

1. Crude death rate
2. Specific death rate
3. Method of Indirect Estimation of Infant Mortality
4. Maternal Mortality rate
5. Proportional mortality rate (ratio)

6. Expectation of life at birth
7. Survival rate

Basic Measures of Fertility:
1. Crude Birth Rate
2. General fertility Rate
3. Age specific fertility rate
4. Total Fertility Rate
5. Gross reproduction rate (GRR)
6. Net reproduction rate (NRR)

Measures of Reproduction---
(I)The gross reproduction rate (GRR):
It is the average number of daughters that would be born to a woman (or a group of women) if she passed through her child-bearing years and conformed to the age-specific fertility rate of a given year.
(II)Net reproduction rate (NRR):
The net reproduction rate (NRR) indicates the experience of a hypothetical cohort of females which undergo the current schedule of fertility and mortality. It is the average number of daughters that would be born to a female (or a group of females) if she passed through her lifetime conforming to the age-specific fertility and mortality rates of a given year.

Conclusion

Analysing the above paper we form a rough idea about health statistics scenario for the 21st century. It is expected to help various stakeholders associated with health care and those working at the international level for global action and also provides valuable inputs for the formulation of new health policies and programmes for the 21st century. It tries to explain about health statistics, its sources and indicators for the 21st century.

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