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LEVELS OF MEASUREMENT OF DATA

Data Levels and Measurement All research needs particular data levels and measurement. There are many procedures in statistics which need different types of data levels, and all data contain assumptions for particular procedures.

Broadly, four types of data levels and measurement are used in every type of research:

1. Nominal
2. Ordinal
3. Interval
4. Ratio

Nominal data:

- A nominal scale is one in which numbers are only used as labels.
- For example, if we want to categorize male and female respondents, we could use a nominal scale of 1 for male, and 2 for female, but 1 and 2 in this case do not represent any order or distance. They are simply used as labels.
- We can use a nominal scale to show the categories of a variable as a numeric value. Nominally, scaled variables cannot be used to perform many statistical computations such as mean and standard deviation, because such statistics do not have any meaning when used with nominal scale variables. However, nominal scale variables can be used to do cross tabulations. The chi-square test can be performed on a cross-tabulation of nominal scale data.

Ordinal Data:

- Ordinal scale variables have a meaningful order to them. We can assign order to the variable or respondent.
- For example, we can assign rank 1, which is higher than rank 2, and 2 is higher than 3 etc. Instead of rank 1, 2, 3, we can use any other number which preserves the same order. This is because we do not know for sure what the distance between 1 and 2 is, or what the distance between 2 and 3 is.
- We can use statistics median various percentiles such as the quartile, and the rank correlation on ordinal data. In addition to this statistic, we can use frequency tables and cross tabulations on ordinal data. Arithmetic mean should not be calculated on the ordinal scale variables.

Interval scale:

- An interval scale variable can be used to compute the commonly used statistical measures such as the average standard deviation and the Pearson correlation coefficient
- Most of the behavioral measurement scales are used to measure attitudes of respondents on a scale of 1 to 5, or 1 to 7, or 1 to 10. These can be treated as interval scales. These types of scales are also known as rating scales and they are very commonly used in marketing research. The difference between an interval scale and an ordinal scale variable is that the distance between ordinal data is the same, but in ordinal data the distance is not fixed.

Ratio scale:

- All arithmetic operations are possible on a ratio scaled variable. These include computation of geometric mean, harmonic mean, and all other statistic-like averages such as standard deviation and Pearson correlation. Additionally, the tests such as the t-test, F-test, correlation and regression are also included with ratio-level variables. An example of ratio scale data would be the sales of a company, the expenditure of a company, the income of a company, etc. We can do any mathematical procedure with ratio scale data that is not possible with nominal, ordinal, and interval scale data.

SCOPE OF BIOSTATISTICS IN NURSING

IN PHARMACOLOGY

- To find the action of drug – a drug is given to animals or humans to see whether the changes produced are due to the drug or by chance.
- To compare the action of two different drugs or two successive dosages of the same drug
- To find the relative potency of a new drug with respect to a standard drug.

IN MEDICINE

- To compare the efficacy of a particular drug, operation or line of treatment – for this, the percentage cured, relieved or died in the experiment and control groups, is compared and difference due to chance or otherwise is found by applying statistical techniques

CLINICAL MEDICINE:

- Documentation of medical history of diseases.
- Planning and conduct of clinical studies.
- Evaluating the merits of different procedures.
- In providing methods for definition of ‘normal’ and ‘abnormal’.

PREVENTIVE MEDICINE

- To provide the magnitude of any health problem in the community.
- To find out the basic factors underlying the ill- health.
- To evaluate the health programs which was introduced in the community (success/failure)?
- To introduce and promote health legislation.

ROLE OF BIOSTATISTICS IN HEALTH PLANNING AND EVALUATION

- They arising out of biological sciences, particularly from the fields of Medicine and Public health. The methods used in dealing with statistics in the fields of medicine, biology and public health for planning, conducting and analyzing data which arise in investigations of these branches.

BIOTECHNOLOGY

- Biotechnology can focus on a whole range of topics, from genetic modification of plants and animals to gene therapy, medicine and drug manufacturing, reproductive therapy, and even energy production.
- In all cases, research is carried out by developing something and testing whether or not it has the desired performance.
- Determining performance requires statistical analysis of results.

COMMUNITY MEDICINE AND PUBLIC HEALTH

- To evaluate the efficacy of sera and vaccines in the field.
- In epidemiological studies-the role of causative factors is statistically tested.
- To test whether the difference between two populations is real or a chance occurrence.
- To study the correlation between attributes in the same population.
- To measure the morbidity and mortality.
- To evaluate achievements of public health programs.
- To fix priorities in public health programs.
- To help promote health legislation and create administrative standards for oral health.

GENETICS

- Statistics and Human Genetics are twin subjects, having grown with the century together, and there are many connections between the two.
- Some fundamental aspects in particular the concept of Analysis of Variance, first arose in Human Genetics, while statistical and probabilistic methods are now central to many aspects of analysis of questions is human genetics.

ENVIRONMENTAL SCIENCE

- Baseline studies to document the present state of an environment to provide background in case of unknown changes in the future.

NUTRITION

- Nutritionists now have the advanced methodologies for the analysis of DNA, RNA, protein, low- molecular-weight metabolites, as well as access to bioinformatics databases.

APPLICATION AND USES OF BIOSTATISTICS AS FIGURES

- Health and vital statistics are essential tools in demography, public health, medical practice and community services.
- Recording of vital events in birth and death registers and diseases in hospitals is like book keeping of the community, describing the incidence or prevalence of diseases, defects or deaths in a defined population.
- Such events properly recorded form the eyes and ears of a public health or medical administrator.
- ✓ What are the leading causes of death?
- ✓ What are the important causes of sickness?
- ✓ Whether a particular disease is rising or falling in severity and prevalence? etc.

ORGANIZATION AND PRESENTATION OF DATA

This refers to the organization of data into tables, graphs or charts, so that logical and statistical conclusions can be derived from the collected measurements.

Charts often convey the meaning or significance of data more clearly than would a table.

Data may be presented in(3 Methods): -

- ✓ Textual
- ✓ Tabular or
- ✓ Graphical.

TEXTUAL PRESENTATION

The data gathered are presented in paragraph form.

- Data are written and read.
- It is a combination of texts and figures.

Example: Of the 150 sample interviewed, the following complaints were noted: 27 for lack of books in the library, 25 for a dirty playground, 20 for lack of laboratory equipment, 17 for a not well maintained university buildings

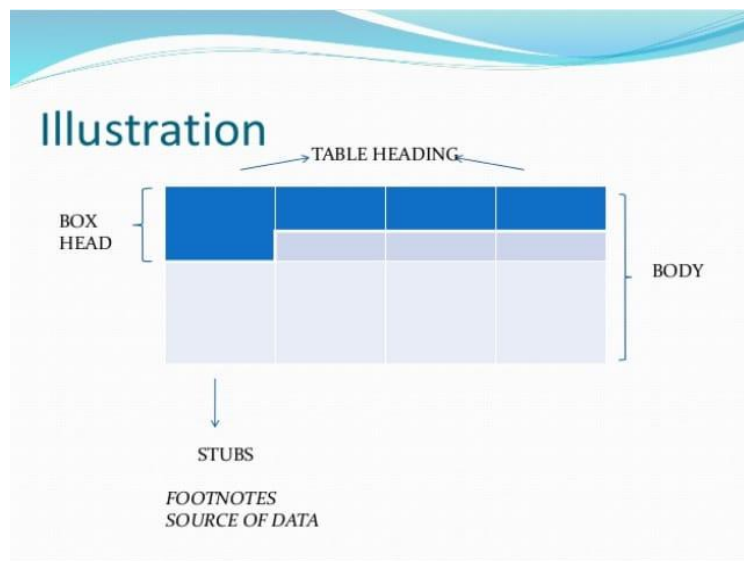
TABULAR PRESENTATION

- Method of presenting data using the statistical table.
- A systematic organization of data in columns and rows

Parts of a statistical table

- ✓ Table heading – consists of table number and title
- ✓ Stubs – classifications or categories which are found at

- ✓ the left side of the body of the table
- ✓ Box head – the top of the column
- ✓ Body – main part of the table
- ✓ Footnotes – any statement or note inserted
- ✓ Source Note – source of the statistics



**Table 1: Total Population
Distribution by Region: 2000**

REGION	POPULATION	PERCENT
NCR	9,932,560	12.98
CAR	1,365,412	1.78
REGION I	4,200,478	5.49
REGION II	2,813,159	3.68
REGION III	8,030,945	10.50
REGION IV	11,793,655	15.42
REGION V	4,686,669	6.13
REGION VI	6,211,038	8.12
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GRAPHICAL PRESENTATION KINDS OF GRAPHS OR DIAGRAMS

1. BAR GRAPH

– used to show relationships/ comparison between groups

2. PIE OR CIRCLE GRAPH

- shows percentages effectively

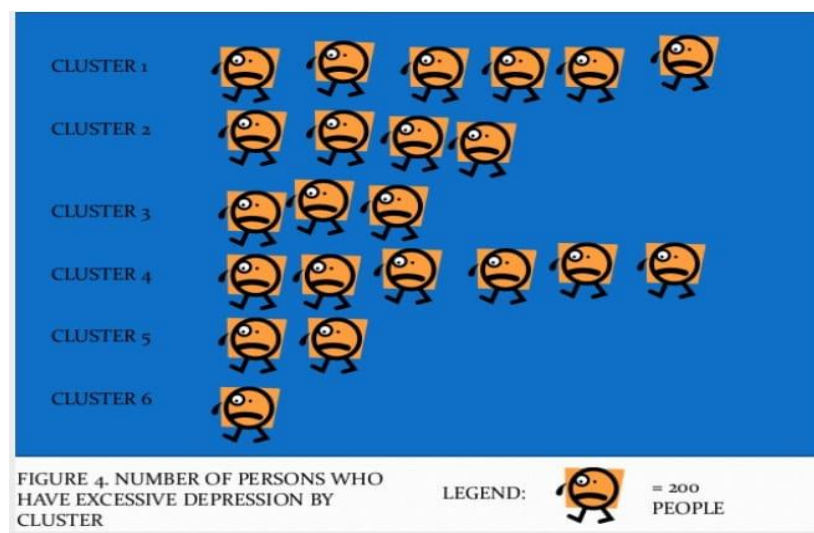
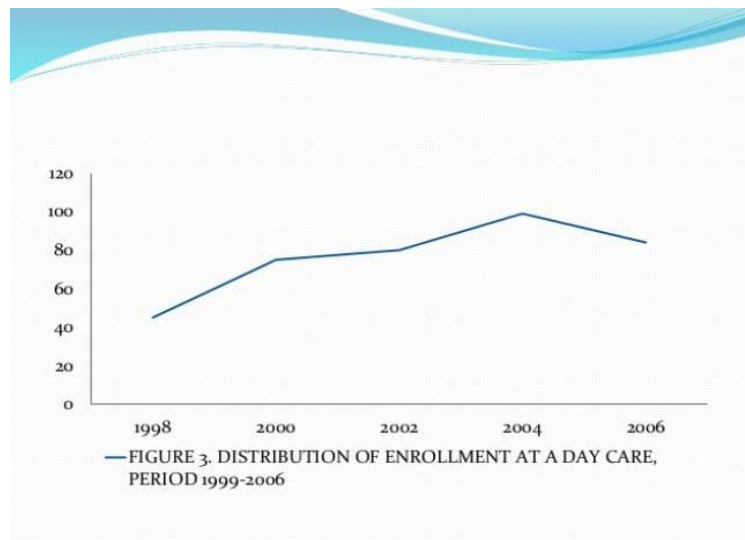
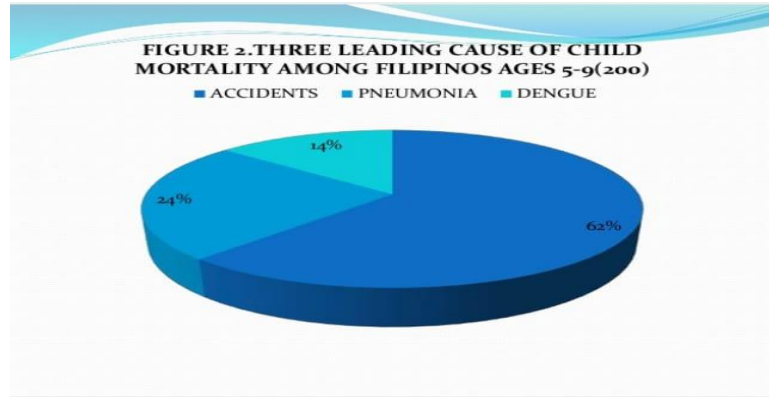
3. LINE GRAPH

– most useful in displaying data that changes continuously over time.

4. PICTOGRAPH

– or pictogram. It uses small identical or figures of objects called isotopes in making comparisons .Each picture represents a definite quantity.





GRAPH

Shows relationships between 2 variables, x and y

2 axes : Horizontal (x), and Vertical (y)

Point where the 2 axes intersect is called the origin

Coordinates of points

it Is one of a set of numbers used to identify the location of a point on a graph.

Coordinate: (x,y)

Bar charts

A method of data presentation in which data are represented by bars of equal width, the height / length of the bar corresponding to the value of the data.

Axes must be labeled and there must be a scale to indicate the magnitude of the data.

Pie charts

A chart which is used to show pictorially the relative size of component elements of a total.
(always be based on percentage values)

A complete 'pie' = $360^\circ = 100\%$ $180^\circ = 50\%$ □ Shading and Colour => distinguishes the segments from each other

Histogram

The area of a bar above a class interval is proportional to the frequency in that class

AREA not HEIGHT

If there is non-equal size of class interval. Find the frequency density
 $\text{Height of block} = \frac{\text{frequency}}{\text{class width}}$

Frequency polygon

In a Frequency Polygon, a line graph is drawn by joining all the midpoints of the top of the bars of a histogram.

gives the idea about the shape of the data distribution

