Application of Medical Statistics

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What is Statistics ?

- The discipline concerned with the treatment of numerical data derived from groups of individuals (P. Armitage).
- The science and art of dealing with variation in data through collection, classification and analysis in such a way as to obtain reliable results (JM Last).
- The science of learning from data

Medical Statistics

- The data analyzed are derived from the medicine or application of mathematical statistics in the field of medicine

Medical Statistics

1. Why we need medical statistics?
2. What are the basics of statistics?
   - Design of a study
   - Data collection
   - Shorting of data
   - Analysing of data
3. What are the sources of data?

Statistical software

- SPSS
- Minitab
- Statica
- SAS
- Excel

Unit 1. Presenting data

Data is the raw material of the statistics.

A result from the counting or measuring

Ex :-

- Haemoglobin concentration of pregnant mothers in state Maternity clinic (measurement)
- Number of Dengue NS1 Ag positive samples in Jan 2015 (count)

Session 1 : Data types and scales of measurements

Learning Outcome

- To describe the different types of variables

1.1 Variables

- Any measured characteristic or attribute that differs for different subjects, persons, places or things

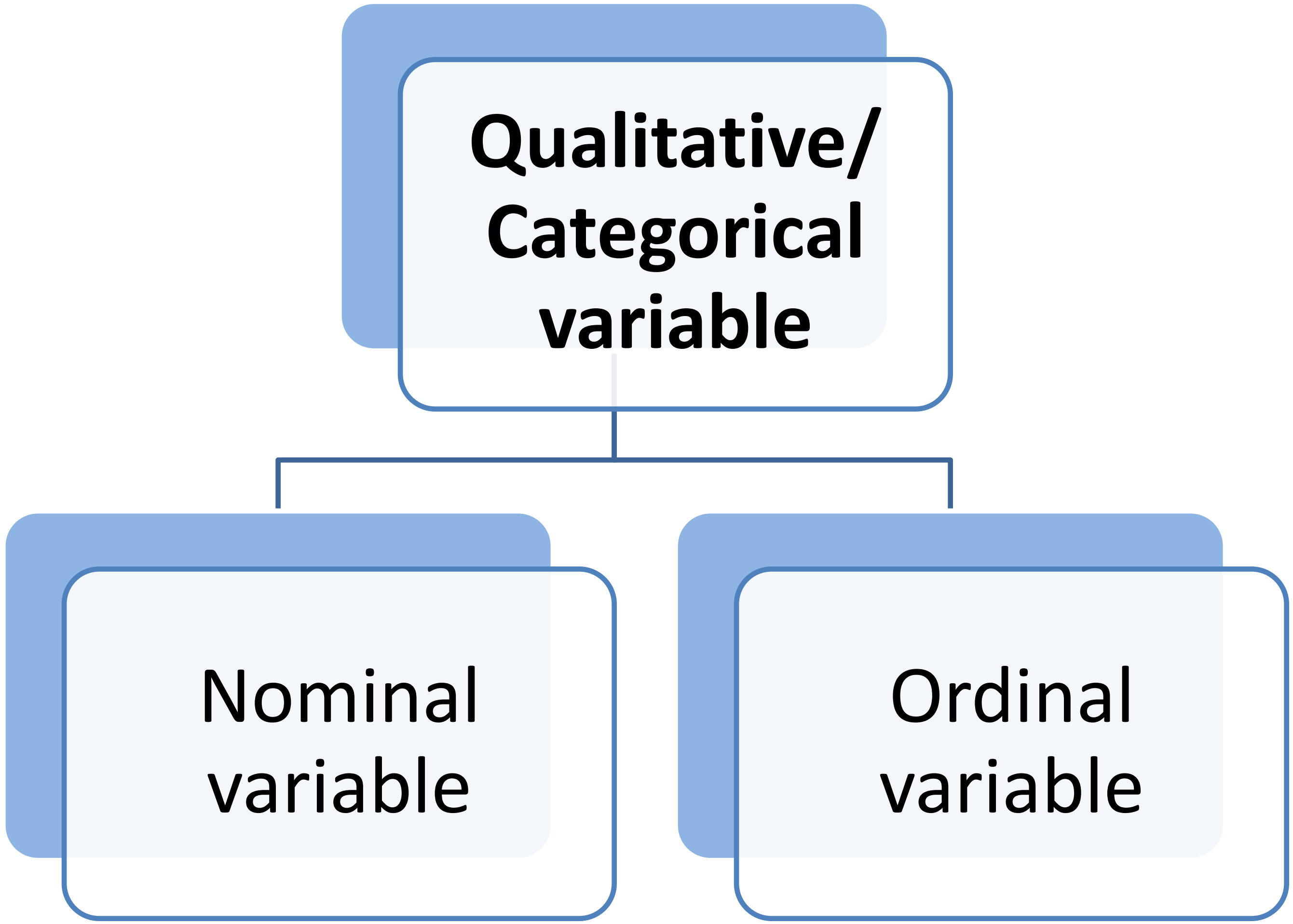
Examples : Age, Sex, Blood type, Heart rate, Weight of pre school children

1.2 Classification of variables

- The different types of classifications are

1. according to the inherent nature of the variable - **qualitative and quantitative variables**
2. on a scale of measurement - **nominal scale, ordinal scale, Interval scale, ratio scale**
3. according to the relationship between two variables - **independent and dependent variables**

Qualitative variable/ Categorical variable



Nominal variable

- The data do not have any units of measurement
- The categories cannot be ordered in any meaningful way

Examples : Blood type (polytomous), Sex (dichotomous), Gender, Occupation, Patients outcome (dead or alive)

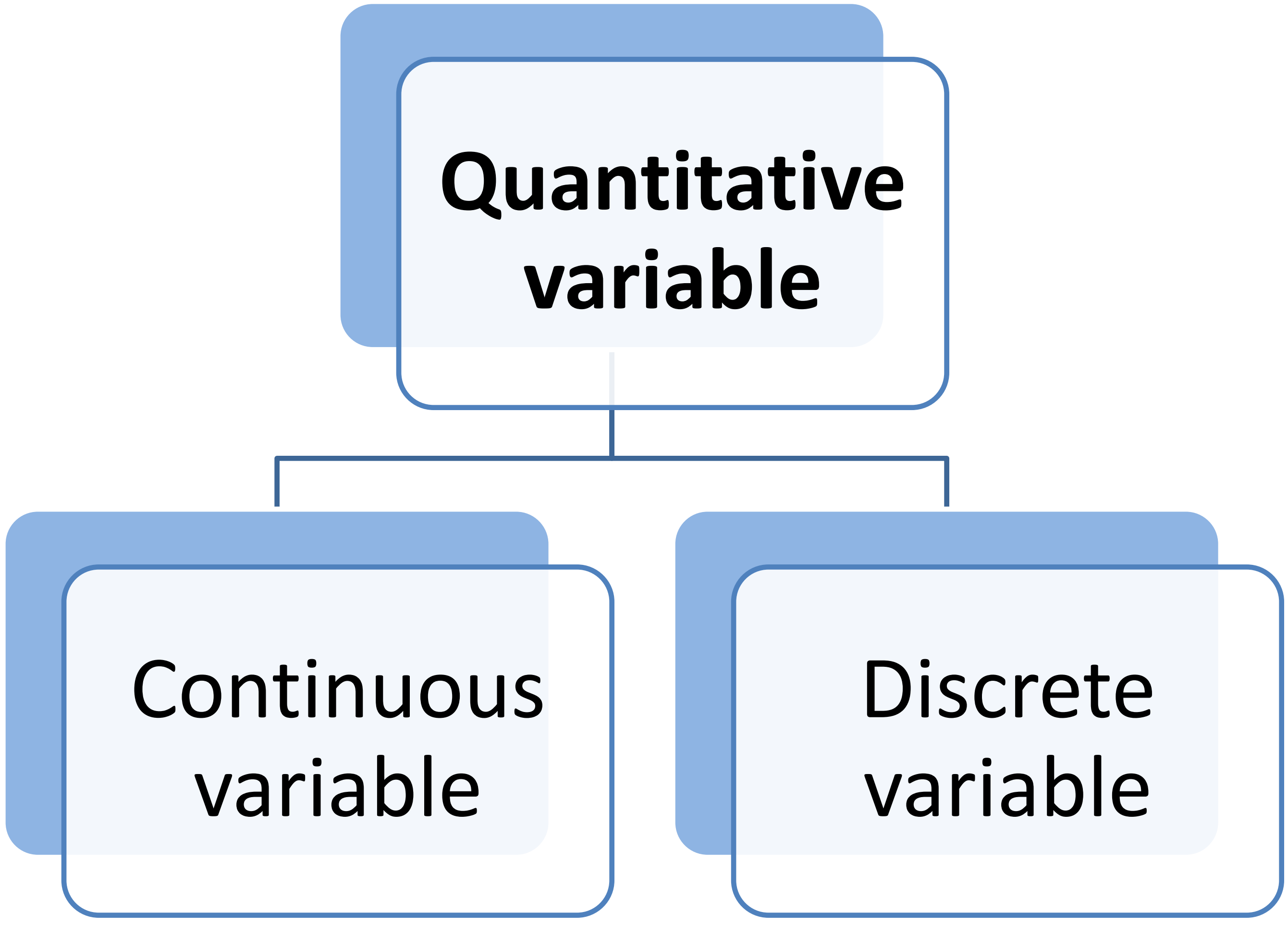
Ordinal variable

- The data do not have any units of measurement (so the same as for nominal variables).
- Possible to order the categories in a meaningful way.

Examples : Social class (lower class, middle class, upper class), Categories of BMI (underweight, Normal, Overweight, Obese), Stage of a cancer

- The difference between any pair of adjacent scores/catogary is *not necessarily the same* as the difference between any other pair of adjacent scores.
- Ordinal values can not add, subtract, multiply or divide.

Quantitative/ Numerical variables



Quantitative variables cont…

- Quantitative variables can be measured.

Continuous variable

- Continuous variables can be properly *measured* and have units of measurement.
- Continuous variables produce data that are real numbers (located on the number line -either a fractional value or a whole number).
- Examples : birth weight (g), blood pressure (mmHg), blood cholesterol (μg/ml), waiting time (minutes), body mass index (kg/m^2)

Discrete variables

- Metric variables can be properly *counted* and have units of measurement – ‘numbers of things’.
- They produce data which are real numbers located on the number line (Whole number).
- Examples: number of deaths, number of angina attacks, number of hospital admission, number of children in a family

- The continuous variables can be converted into categorical variables.
- Example : Body mass index (kg/m^2)
  - Under weight (< 18.4)
  - Normal weight (18.5 – 22.9)
  - Over weight (23 – 27.4)
  - Obese (27.5 above)

Scales of measurement

- There are four level of measurments

Nominal scale

The designation of an observation with a value which is just a name or label.

Ex: Marital status, Sex, Religion, Blood group

- This is the weakest level of measurement
- No priorities
- Calculate only percentages

Ordinal measurements

- Ordered categories, can not magnitude
- Represent the rank order (a scale, the objects in different classes bear some relation to one another : express by the greater than- >)

Ex : Quality of reagent types (Excellent, Good, Fair, Poor)

Agreement with statement (Agree, No decision, Disagree)

Interval measurement

- Distance between any two numbers on the scale are of known size
- The zero point is arbitrary and does not infer the absence of the property being measured
- Can not multiply or divide

Examples : Years, Temperature, any Likert-scale (VAS)

Ratio measurement

- Ratio scale have a true zero point
- There are meaningful ratios between arbitrary pairs of numbers
- The most detailed and objectively interpretable of the measurement scale
- Ex : Height, weight, money, age, the kelvin scale of temperature, time

Independent and dependent variables

- Categorized according to nature of association

Independent variables

  - **Often manipulated by the researcher**
  - **The treatment or intervention that is used in a study**

Dependent variable

  - **Outcome of a study**
  - **Values depend on the independent variables**

Summary