



# Variables

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# What is variable

- **Variables** are **properties or characteristics** of people or things that **vary**  
(in quality or magnitude from person to person or object to object)
- A variable is a characteristic of a **person, object, or phenomenon** (that can take on different values) that is studied/ measured in research to achieve “objectives”

# Variables and Data

- ✎ Variables are the characteristics you're studying
- ✎ Data are the values of those characteristics that you measure and record
- ✎ Some of the variables may have produced numerical data, while other variables produced categorical data

## Variables

## Data

Hb level

9.9, 10.5, 10.9, 11.5,

Household member

3, 4, 5, 7, 8

Blood Group

A, B, O, AB

Nutritional status

Low, Medium, High

# Types of Variables

- From the viewpoint of **the unit of measurement**
  - ✍ **Numerical Variables** (can be measured)
    - ❖ Discrete variables
    - ❖ Continuous variables
  - ✍ **Categorical Variables** (cannot be measured but count)
    - ❖ Nominal variables
    - ❖ Ordinal variables
- From the viewpoint of **causal relationship**
  - ✍ **Dependent variables**
  - ✍ **Independent variables**
  - ✍ **Cofounding variables**

# Numerical Variables

❖ which can be measured and always numeric

## 1. Discrete variables

✎ Can be counted

✎ numbers can only have full values

e.g. number of visits to a clinic (0, 1, 2, 3, 4)

number of sexual partners (0, 1, 2)

## 2. Continuous variables

✎ Measurements made by the measuring instrument

e.g. height in centimetres (2.5 cm or 2.546 cm)

temperature in degrees Celsius (37.2°C or 37.19°C)

# Categorical Variables

## 1. Nominal variables

The groups in these variables do not have an order or ranking – just name

e.g. **Blood Group**: A, B, O, AB

**Sex**: male, female

Categorical variable with only 2 levels – **Dichotomous** (or) **binary variable**

e.g. **age**: under 65 group /65 and over group

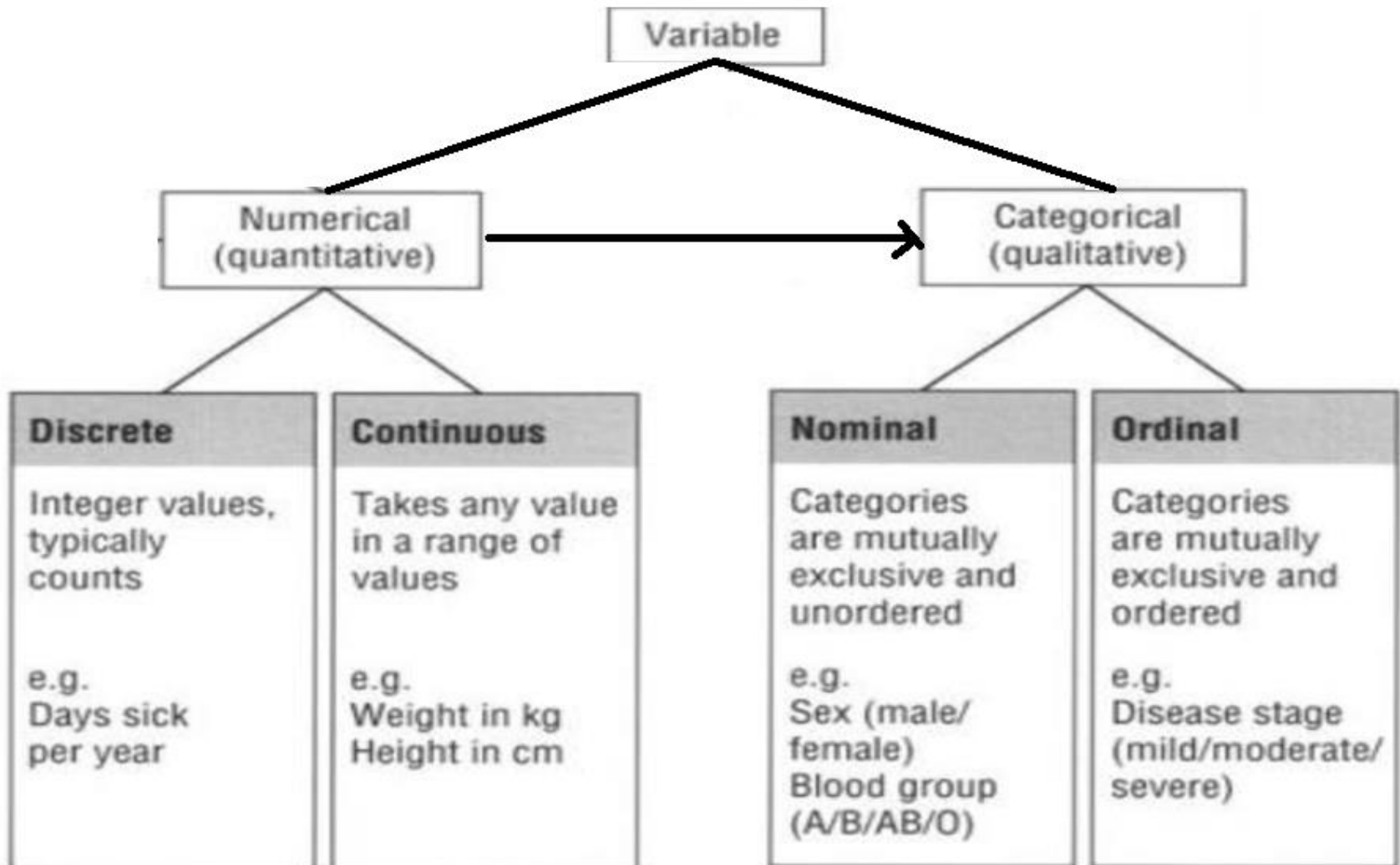
**gender**: male/ female)

## 2. Ordinal variables

These are grouped variables - ordered or ranked in increasing or decreasing order

e.g. **High income, Middle income and Low income**

# Types of Variables



Depending on **relationship** between variables,

variables can be identified into:

 Dependent variables

 Independent variables

 Confounding variables



## Dependent variables

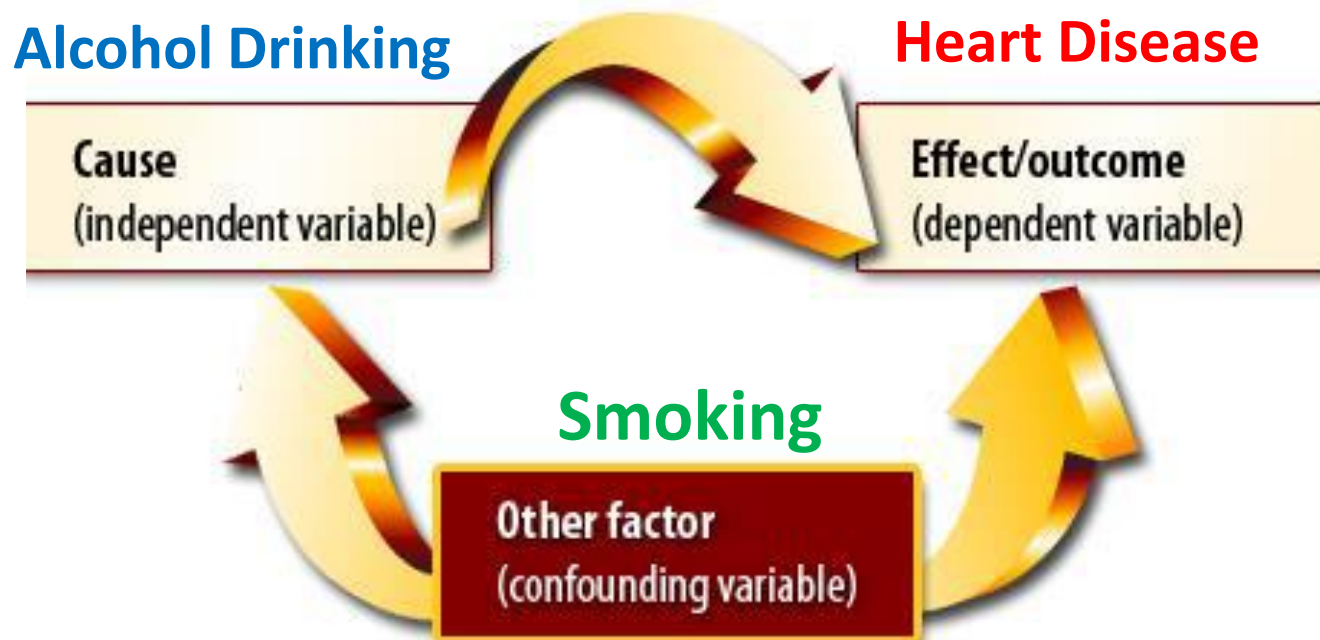
- ✍ the **response** variable
- ✍ What is measured as an **outcome** in a study
- ✍ the variable a researcher is interested in

## Independent variables

- ✍ The independent variable is the **predictor** variable that is hypothesized to **influence** our dependent variable.
- ✍ variable that can be **manipulated** or controlled by the researcher; usually affecting the dependent variable

# Confounding variables

- ✍ Also known as intervening variables
- ✍ Variable which have associated both with disease and exposure being studied



# Measurement of data

- ✍ To establish relationship between variables →  
observe the variables and record their observations
- ✍ This requires that the variables be measured
- ✍ The quantitative data - have different levels of measurement
- ✍ four **levels of measurement**:  
**nominal, ordinal, interval, and ratio**

# Scale of Measurements

 **Nominal Scale**

 **Ordinal Scale**

 **Interval Scale**

 **Ratio Scale**

# 1. Nominal Scale

- ✎ The attribute (**unique quality or feature**) regarded as a characteristic of the variable  
e.g. the variable of **gender** has the unique attributes of **male** and **female**
- ✎ There is **no ordering or ranking** of the attributes
- ✎ A nominal scale simply describes differences between things (by assigning them to categories)
- ✎ Nominal data are, thus, counted data

# 1. Nominal Scale

✏ classifies data into **mutually exclusive** (non-overlapping)

E.g.

- ☐ Gender (male, female)
- ☐ Eye color (blue, brown, green, hazel)
- ☐ Surgical outcome (dead, alive)
- ☐ Blood group (A, B, AB, O)
- ☐ Religious status

## 2. Ordinal Scale

- ✎ similar to nominal because the measurements involve categories (names)
- ✎ can be rank-ordered, but the distances between the attributes are not the same (have no meaning)
- ✎ the use of an ordinal scale implies a statement of 'greater than' or 'less than' (an equality statement is also acceptable) without being able to state how much greater or less

E.g. ☐ Likert-type scales, Net Promoter Score (NPS)

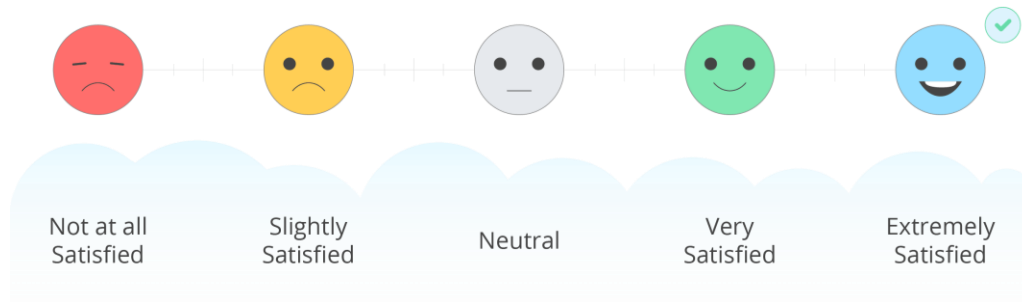
☐ Stage of cancer (stage I, II, III, IV)

☐ Education level (elementary, secondary, college)

☐ Satisfaction level (very dissatisfied, dissatisfied, neutral, satisfied, very satisfied)

# 2. Ordinal Scale

## Likert scale



**Customer satisfaction is key to organizational growth.**

- ☐ 1- Completely agree
- ☐ 2- Somewhat agree
- ☐ 3- Neutral
- ☐ 4- Somewhat disagree
- ☐ 5- Completely disagree



### 3. Interval scale

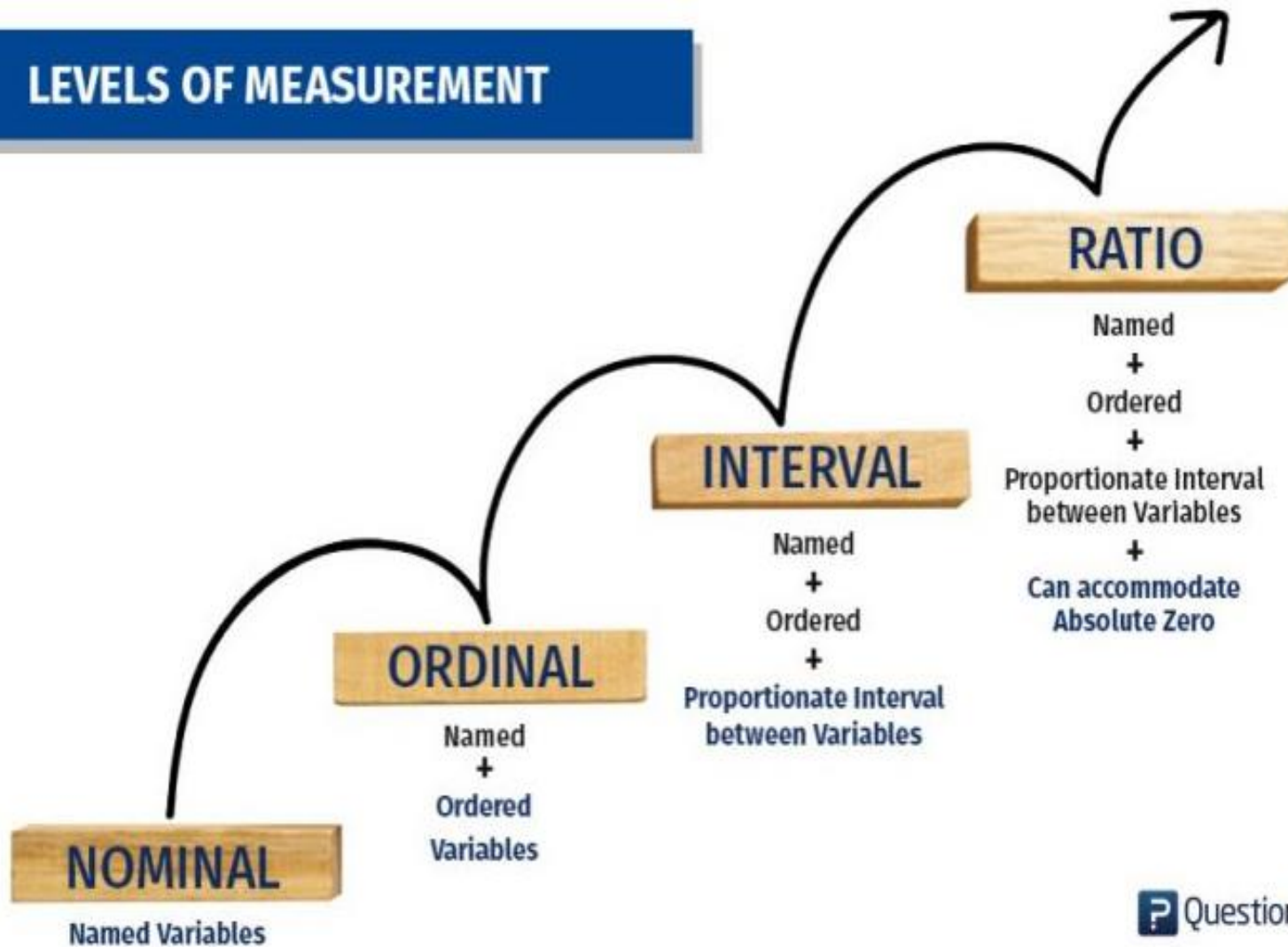
- ✎ Always numeric with **equal intervals**
- ✎ The **distance between the attributes are the same** so they can be interpreted (the difference)
- ✎ Does not have a true zero (zero does not mean for absence/ nothing in this scale) - does not have the capacity to measure the complete absence  
E.g. The Fahrenheit scale, where  $0^{\circ}$  does not correspond to an absence of heat
- ✎ provide more powerful measurement than ordinal scales - incorporates the **concept of equality of interval** - more powerful statistical measures can be used

## 4. Ratio scale

- ✍ Also numeric
- ✍ Measurements have equal intervals
- ✍ There is a true zero (zero stands for negative existent)  
Eg . distance, height, weight, and time
- ✍ Ratio is the most advanced level of measurement
- ✍ have significant **comparison** which is not possible in case of an interval scale (how many times more of less...)
- ✍ all statistical techniques are usable with ratio scales and all manipulations that can carry out with real numbers can also be carried out with ratio scale values

Eg. Multiplication and division can be used with this scale but not with other scales

## LEVELS OF MEASUREMENT



- proceeding from the nominal scale (the least precise type of scale) to ratio scale (the most precise), relevant information is obtained increasingly

# Example of Defining Variables

## Conceptual Definition

## Operational Definition

## Scale of Measurement

**Sex**

Male/Female

Nominal

**Nutritional Status**

Weight in relation to age  
compared to standard  
growth curve

Ordinal  
(Low, Medium, High)

**Temperature**

Fahrenheit scale

Interval  
(degree F)

**Haemoglobin level**

Hb conc. In  
capillary blood  
measured by  
hemoglobinometer

Ratio  
(g/dl)

# References

- Dr Win Maw Tun's ppt, Research Methodology Workshop, 2019
- DMR (2017). Lecture guide on Research Methodology

**THANK YOU!**