

# RESEARCH FUNDAMENTALS

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1. Define Measurement
2. Measurement Framework
3. Scales of Measurement
4. Pilot Study
5. Types of variables
6. Reliability & Validity
7. Drawing Tables, Graphs, Master chart etc

# 1. DEFINE MEASUREMENT

- Measurement is a **process of mapping** aspects of a domain onto other aspects of a range according to some rule of correspondence

“Process of assigning numerals to variables to represent quantities of characteristics according to certain rules”

- Measurement in research refers to the **process of systematically assigning numbers** or labels to variables or events according to specific rules
- This process allows researchers to **quantify and analyze variables**, facilitating the comparison, analysis, and interpretation of data

- ◉ **Hemoglobin Concentration:** measured in grams per deciliter (g/dL), helps assess conditions like anemia
- ◉ **Body Mass Index (BMI):** using a person's weight and height ( $\text{kg}/\text{m}^2$ ). Classify individuals based on weight categories
- ◉ **Muscle Strength:** using a dynamometer, quantified in terms of the force exerted by specific muscle groups

## 2. MEASUREMENT FRAMEWORK

- ◉ Refers to a structured system used to **identify**, **define**, and **quantify** variables, ensuring consistent and reliable data collection
- ◉ **Systematically** plan and **implement** measurement processes
- ◉ Accurate analysis and interpretation of data
- ◉ Ex; **Automated hematology analyzers**, **food frequency questionnaires**, **Dynamometer**

- Measurement is a relatively complex and demanding task, specially so when it concerns qualitative or abstract phenomena
- level of measurement being a function of the rules under which the numbers are assigned
- Used to describe the quality or quantity of an existing variable, such as the measurement of intelligence, attitude, range of motion or muscle strength

- ⦿ Measurement to make absolute decisions based on a criterion or standard of performance, such as the requirement that a student achieve at least a grade of C to pass a course or that a certain degree of spinal curvature be present to indicate a diagnosis of scoliosis
- ⦿ Measurement as a basis for choosing between two courses of action



- Clinicians use measurement as a means of evaluating a patient's condition and response to treatment; that is, we measure change or progress
- Measurements to compare and discriminate between individuals or groups

# 3. MEASUREMENT SCALES

- ◉ scales of measurement can be considered in terms of their mathematical properties
- ◉ Four main types:
  - Nominal
  - Ordinal
  - Interval
  - Ratio

# NOMINAL SCALE

- ◉ Lowest, simplest & least powerful level of measurement
- ◉ Assigning number symbols to events in order to label them
- ◉ Counted data
- ◉ Eg. Assignment of numbers of players in order to identify them
- ◉ Numbers are just convenient labels for the particular class of events and as such have no quantitative value

- ◉ Counting of members in each group is the only possible arithmetic operation when a nominal scale is employed
- ◉ restricted to use mode as the measure of central tendency
- ◉ Chi-square test is the most common test of statistical significance

# EXAMPLES

- Examples of nominal categories:
  - male/female
  - dead/alive
  - single/married/divorced/separated/widowed
  - English/Irish/Scottish/Welsh/other

# ORDINAL SCALE

- ‘Represent the most primitive level of numerical measurement’
- Indicates a rank order in which things are arranged from the greatest to the least, the best to the worst

- In such a scale, 3 is greater, or better, than 1, but it is impossible to claim that the difference between 3 and 1 is the same as the difference between 3 and 5
- Easy to tell the order of the observations in relation to one another but no information is available on actual values

- ◉ Ordinal measures have no absolute values, and the real differences between adjacent ranks may not be equal
- ◉ All that can be said is that one person is higher or lower on the scale than another, but more precise comparisons cannot be made



# EXAMPLES

- If you were given an ordinal scale of the weights of a group of people, you could tell the heaviest from the lightest but you would have no idea of the actual weight of each person
- People could be placed in rank order on the basis of attributes such as:
  - Height: arranged from tallest to shortest
  - Examination results: arranged from best to worst

# INTERVAL SCALES

- ◉ Usually shown as beginning with a zero point but there can be no real zero
- ◉ Does not have the capacity to measure the complete absence of a trait or characteristic
- ◉ Rank-order demonstrates known and characteristics of an ordinal scale, but also equal distances or intervals between the units of measurement

- ◉ Negative values may represent lesser amount of an attribute
- ◉ Measures of temperature using Fahrenheit and Celsius scales are also at the interval level
- ◉ Both have an artificial zero points they do not represent a total absence of heat
- ◉ can indicate a temperature in negative degrees

# EXAMPLES

- ◉ rank-order demonstrates known and characteristics of an ordinal scale, but also equal distances or intervals between the units of measurement

# RATIO SCALES

- Ratio scales have an absolute or true zero of measurement
- For example, it is possible to have no shoulder flexion, no blood pressure and no pulse
- A ratio scale therefore provides the most precise information of all the measurement scales

- ⦿ Represents the actual amounts of variables
- ⦿ Measures of physical dimensions such as weight, height, distance, etc
- ⦿ Scale with an absolute zero point that has empirical, rather than arbitrary, meaning
- ⦿ A score of zero at the ratio level represents a total absence of whatever property is being measured.

# THE FOUR LEVELS OF MEASUREMENT:

	Nominal	Ordinal	Interval	Ratio
Categorizes and labels variables	✓	✓	✓	✓
Ranks categories in order		✓	✓	✓
Has known, equal intervals			✓	✓
Has a true or meaningful zero				✓

TO BE CONTINUED...