



OVERVIEW & BASIC STATISTICS

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RESEARCH

Gathering of data, information and facts for the advancement of knowledge.



Research provides answers to questions like

What, Where, When, How and Why.



SCIENTIFIC RESEARCH

Scientific research relies on the application of the scientific method.

Systematic and methodical investigation

- ❖ To establish facts or collect information on a subject.
- ❖ Follows a series of steps and rigid protocol.



OBJECTIVES OF RESEARCH

- ❖ Contributes to theory and generalizations.
- ❖ Verifies existing theories and facts.
- ❖ Enables to predict events.
- ❖ Helps to establish interrelationships and derive explanations.
- ❖ Helps to develop new tools, concepts and theories to study phenomenon.



REASONS FOR UNDERTAKING RESEARCH

- 0 Academic requirements
- 0 Participating in a scientific meet
- 0 Career prospects
- 0 Peer pressure



Generating “evidence” for improving clinical and public health outcomes should be the goal of research.

- 0 Doing research is imperative.
- 0 Doing **good research** is a choice.

Performing *valid and useful research* is not easy, but you can choose to do it.

- 0 Doing **beneficial research** with sound methods is a possibility.



CHARACTERISTICS OF RESEARCH

- It adopts **scientific method**.
- It demands a clear statement of the problem.
- It is objective and logical.
- It is based on observable experience.
- It requires clear objectives and a plan.
 - not aimlessly looking for something in the hope that you will come across a solution.
- It builds on existing data, using both positive & negative findings.
- *Systematically* collected data are analyzed to answer the original research objectives.



RESEARCH PROCESS . . .

- Identification of the problem
- Objectives of the study, hypothesis
- Operational definition of the concepts
- Methodology of research
- Methods of data collection, sampling design
- Tools for collection of data, plan of analysis
- Collection of data: preparing sample frame, drawing samples, interviewing and follow up.
- Processing data : editing, coding, tabulation.
- Analysis of data - interpretation of findings - Report writing.



HOW COULD STATISTICS BE HELPFUL IN THE RESEARCH PROCESS ?

- ④ **Measurement and classification**
- ④ Powerful, cost effective research designs
- ④ Appropriate statistical analysis
- ④ Presentation of results

STATISTICS . . . MEASUREMENT

Statistics provides a way of organizing data to get information on a formal basis (objective) than relying on personal experience (subjective).

Measurements yield data.

Without measurements there would be no statistics and no need for statistical methods.

Statistical methods extract significant conclusions from the data.



“ When you can measure what you are speaking about and express it in numbers, you know something about it; but when you cannot express it in numbers, your knowledge about it is of meager and unsatisfactory kind, it may be the beginning of knowledge, but you have scarcely in your thoughts advanced to the state of science, whatever the matter may be”

Lord Kelvin



MEASUREMENT

Process of assigning numbers to various aspects of objects / events according to a rule.

The aim of measurement is to provide accurate, objective, sensitive, and communicable descriptions of events.



PRINCIPLES OF MEASUREMENT

✿ Difference

Different numerals mean different instances the variable can take.

Age: 10,11... 18,19...25, 26

✿ Magnitude

This indicates that something is more or less than the other.

● Equal Appearing Interval

Different numerals have equal distances with preceding and succeeding numbers.

● True Zero

Zero has an absolute meaning.



LEVELS OF MEASUREMENT & HIERARCHY

S S Stevens (1946) proposed that all measurement in science can be classified into four different types of scales.

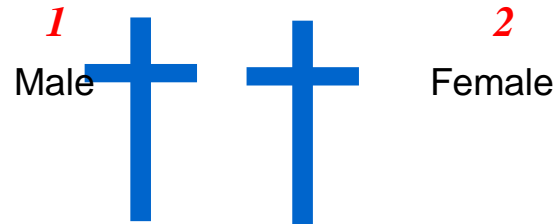
Nominal – Ordinal – Interval – Ratio

Weaker < _____ > Stronger



Nominal measure:

Example: Gender



Ordinal measure:

Example: Pain



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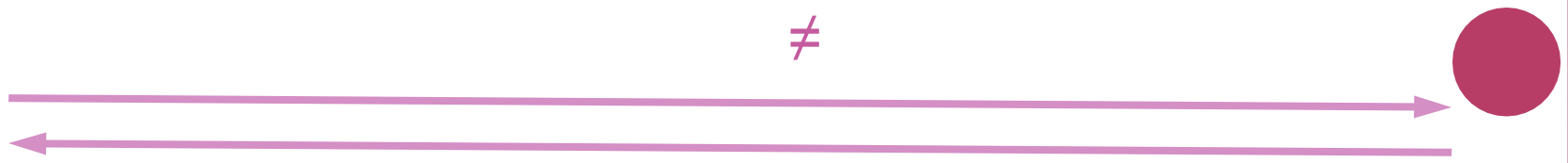


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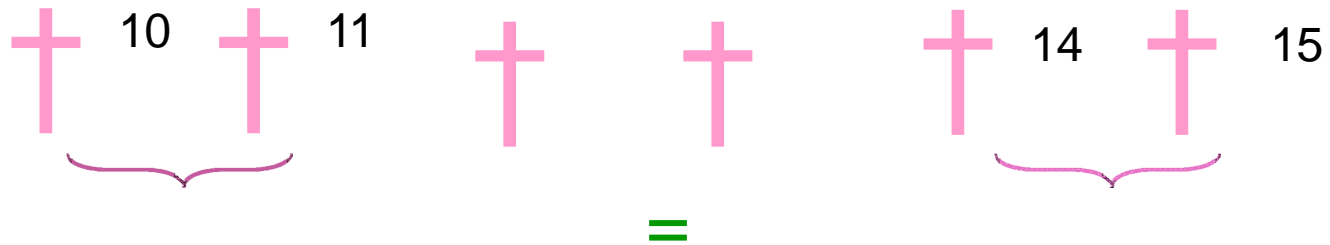
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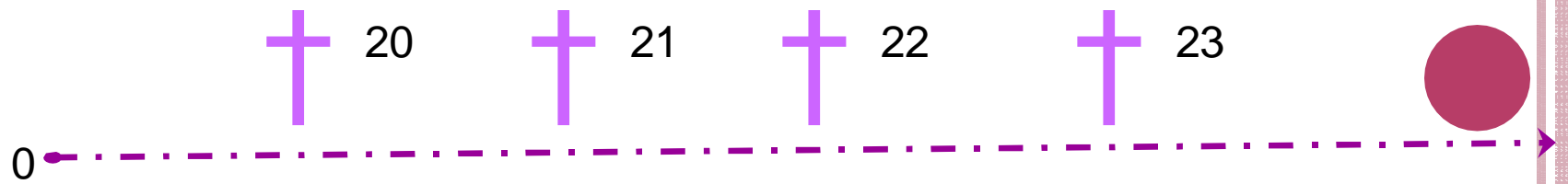
Interval measure:

Example: Time



Ratio measure:

Example: Age



MEASUREMENT OF VARIABLES

- **Nominal:** Categories
Arbitrary labels
 - **Religion,** **Sex,** **Pt status**
(H/ C/ M) (M / F) (alive / dead)

- **Ordinal :** Rankings
 - SES,** **severity,** **improvement**
(I / M/ II) (Mild/ Mod/ Sev) (no/ slight/ remarkable)

- **Interval:** Equal difference between levels, but no true zero
 - **Time, temperature...**

- **Ratio:** Interval with natural zero
 - **Age, height, weight, BP ...**



WHICH LEVEL IS MOST APPROPRIATE?

➤ To categorize subjects into different groups, *Nominal* scale should be used.

➤ To rank order people along some dimension, *Ordinal* scale is best.



To quantify a trait on a scale where the distance between ranks is the same, the *Interval* scale is the way .



To measure something on a scale where there is a true zero point, a *Ratio* scale should be used.

VARIABLES

Variable:

A characteristic which varies from person to person.

Age, sex, height, weight, skin color, LDL,
HDL, depression level, glucose level ...

➤ Qualitative & Quantitative variable

QUANTITATIVE (NUMERICAL) VARIABLE

- o Data that can be expressed in numbers.

Age, height, weight, IQ score, HDL, income, anxiety score,

No. of kids with ADHD, cholesterol, days taken for recovery,

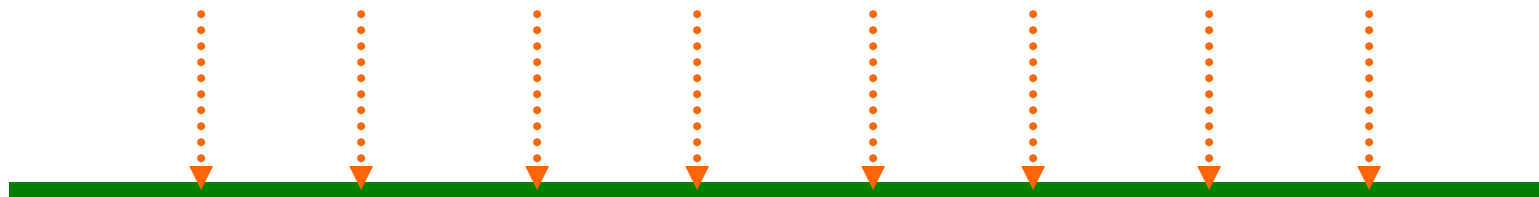
CD₄ count, Time to complete a surgery

* Discrete



DISCRETE VS. CONTINUOUS DATA

Discrete data -- Gaps between possible values



Continuous data -- no gaps between possible values



QUALITATIVE (CATEGORICAL) VARIABLE

- 0 Numbers are used to merely represent labels or categories

Sex (Male, Female)

SES (Low, Medium, High)

Skin color (Fair, Wheatish, Dark)

Pain (Mild, Moderate, Severe)

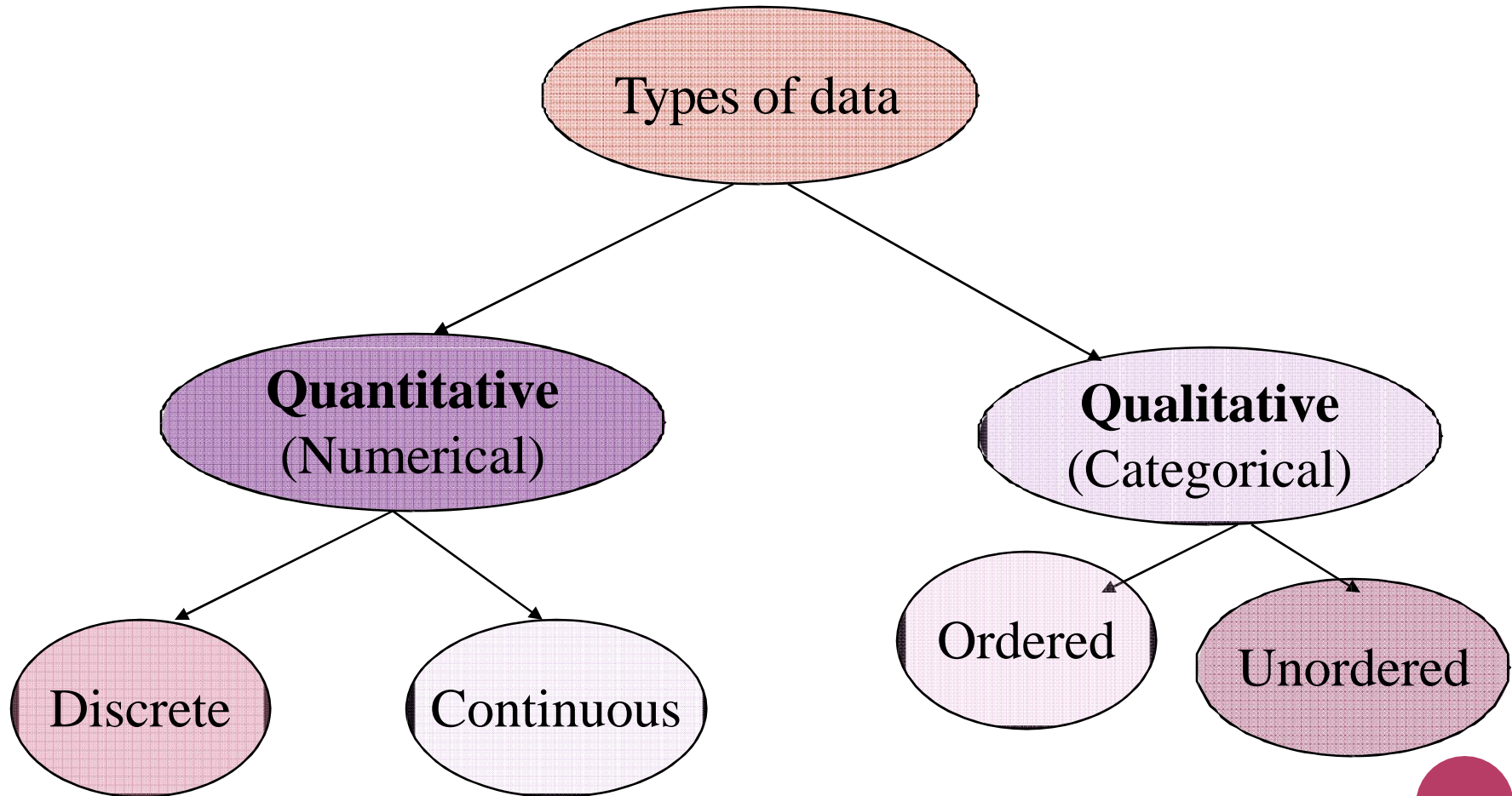
Religion (Hindu, Christian, Muslim)

Improvement (mild, moderate, remarkable)

* ordered categories



DATA (VARIABLE) TYPES



MEAN

Sex
M
M
F
F
M
F
M

\bar{X}_{10}

SES
Low
High
Medium
Medium
High
Medium
Medium

\bar{X}_{20}

Temp
38
37
37
39
36
38
37

37.4

Age
23
17
22
19
24
23
25

21.9



WHY SO MUCH IMPORTANCE?



Qualitative and quantitative data behave differently and therefore are presented and studied differently.

The level of measurement and the type of variable determine the type of statistics that is appropriate for its analysis.

Statistical analysis should be planned along with the data collection procedures so that they match.





Best of Luck
Thank you