Introduction to Descriptive Statistics

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Course: **RESEARCH METHODOLOGY/BIOSTATISTICS** (MA 322)

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Outline

- What is Statistics.
- Types of Statistics.
- Differentiate between the two approaches.
- Common Tools used Descriptive Statistics.

Objectives

❖ By the end of this lecture, students should be able to:

1. Define descriptive statistics and explain its importance in research.
2. Differentiate between descriptive and inferential statistics.
3. Key Components of Descriptive Statistics.

❑ What is Statistics?

- Statistics is the science of **collecting**, **organizing**, **analyzing**, and **interpreting data** in order to make informed decisions.

- It is broadly divided into:

❖ **Descriptive Statistics:**→ Summarizes data.

❖ **Inferential Statistics:**→ Makes predictions or generalizations from data.

❑ Definition of Descriptive Statistics:

❖ Refers to methods of summarizing and organizing data so it can be easily understood.

- **Purpose:** To describe the main features of a dataset without drawing conclusions beyond it.

- **Example:** If we measure the exam scores of 50 students, descriptive statistics helps us summarize:

- The average score
- The highest and lowest score
- How spread out the scores are

❖ Common Tools used Descriptive Statistics:

- **Measures of Central Tendency**: Mean, Median, Mode.
- **Measures of Dispersion**: Range, Variance, Standard Deviation.
- **Data Presentation**: Tables, Bar charts, Pie charts, Histograms.

❑ Importance of Descriptive Statistics

1. Simplifies complex data into understandable form.

2. Helps researchers see patterns and trends.

3. Provides a foundation for inferential statistics.

4. Widely used in education, health sciences, business, and social sciences.

❖ Definition of Inferential Statistics:

- Inferential statistics uses sample data to make **conclusions**, **predictions**, or **generalizations** about a larger population.

- **Purpose:** To use sample data to make estimates and test hypotheses about a larger population.

- It involves a degree of uncertainty, which is measured by probability.

- **When to Use:**

✓ When it is impractical or impossible to collect data from every member of a population (due to cost, time, or size), so you use a sample.

❖ Common Tools used in Inferential Statistics:

1. Estimation:– Confidence intervals

2. Hypothesis Testing:– t-test, Chi-square test, ANOVA.

3. Correlation & Regression:– To study relationships between variables.

❖ Example:

- From a sample of 100 students, we find the average age is 21 years.
- Using inferential statistics, we estimate that the average age of all university students is between 20.5 and 21.5 years (95% confidence interval).
- We may also test whether male and female students differ significantly in GPA using a t-test.

❖ Applications:

- Predicting election results from a sample poll.

- Testing effectiveness of a new drug in a clinical trial.

❖ Key Differences between Descriptive & Inferential Statisti

Aspect	Descriptive Statistics	Inferential Statistics
Definition	Summarizes and describes data	Makes predictions or inferences about population
Purpose	To present data clearly	To test hypotheses and generalize findings
Methods	Mean, median, mode, charts, SD	t-test, chi-square, regression, ANOVA
Scope	Deals only with sample data	Extends sample results to population
Example	"Average class height = 165 cm"	"Average height of all students in the university ≈ 165 cm ± 3 cm"

References

1. National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research. (1979). The Belmont Report.
2. World Medical Association. (2013). Declaration of Helsinki.
3. Council for International Organizations of Medical Sciences (CIOMS). (2016). International Ethical Guidelines for Health-related Research Involving Humans.

Thanks