

# *Lectures of Stat -145* *(Biostatistics)*

Text book

Biostatistics

Basic Concepts and Methodology for the Health Sciences

By

Wayne W. Daniel

# *Chapter 1*

## *Introduction To Biostatistics*

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Methodology for the Health  
Sciences

- **Key words :**

- *Statistics , data , Biostatistics,*

- *Variable ,Population ,Sample*

- *After studying this chapter, the student will be able to:*

- 1- understand the basic concepts and terminology of biostatistics.*

- 2-select random sample and the processes involved in scientific and design of experiments .*

- 3- organize summarize and presentation of data*

# Introduction

## Some Basic concepts

**Statistics** is a **field of study** concerned with

- 1- collection, organization, summarization and analysis of data.**
- 2- drawing of inferences about a body of data when only a part of the data is observed.**

**Statisticians** try to **interpret** and **communicate** the results to others.

# Statistics:

Statistics is that area of study which is interested in learning how to collect, organize, and summarize information, and how to answer research questions and draw conclusions.

- In other word: a set of tools for collection, organizing, presentation and analyzing of numerical facts or observations.

# \* Biostatistics:

The tools of **statistics** are employed in many **fields**:

**business, education, psychology, agriculture, economics, ... etc.**

When the data analyzed are derived from the **biological science** and **medicine**,

we use the term **biostatistics** to distinguish this particular application of statistical tools and concepts.

# Biostatistics:

If the information is obtained from biological and medical sciences, then we use the term biostatistics.

- i.e. the application of statistical methods to solution of biological problems.

# Data:

- The raw material of **Statistics** is data.
- We may define data as **figures**. Figures result from the process of **counting** or from taking a **measurement**.
- *For example:*
  - - When a hospital administrator counts the number of patients (**counting**).
  - - When a nurse weighs a patient (**measurement**)



# \* Sources of Data:

We search for **suitable data** to serve as the **raw material** for our investigation. Such data are available from one or more of the following **sources**:

## 1- Routinely kept records.

*For example:*

- **Hospital** medical records contain immense amounts of information on **patients**.
- **Hospital** accounting records contain a wealth of data on the **facility's business**
- **activities**.

# Sources of Data:

## 2- Surveys:

The **source** may be a survey, if the data needed is about **answering certain questions**.

*For example:*

If the **administrator of a clinic** wishes to obtain information regarding the mode of transportation used by **patients** to visit the clinic, then a **survey** may be conducted among **patients to obtain this information**.

# Sources of Data:

## 3- Experiments.

Frequently the data needed to answer a question are available only as the result of an **experiment**.

*For example:*

If a **nurse** wishes to know which of several **strategies** is best for maximizing **patient** compliance,

she might conduct an **experiment** in which the different strategies of motivating compliance are tried with **different patients**.

## Sources of Data:

### 4- External sources.

The data needed to answer a question may already exist in the form of published reports, commercially available data banks, or the research literature, i.e. someone else has already asked the same question.

- In other word we can view the sources of data as Historical and Field data, for example Past information (record) about a company, patient used to help forecast the future; for example, historical price.
- While the field data can be collect as instantenouns , like patient temperature during inspection, blood pressure and

## \* A variable:

It is a **characteristic** that takes on different **values** in different persons, places, or things.

*For example:*

- heart rate,
- the heights of adult males,
- the weights of preschool children,
- the ages of patients seen in a dental clinic.

# Types of variables

Quantitative

Qualitative

## Quantitative Variables

It can be measured in the usual sense.

*For example:*

- the heights of adult males,
- the weights of preschool children,
- the ages of patients seen in a dental clinic.

## Qualitative Variables

Many characteristics are not capable of being measured. Some of them can be ordered (called ordinal) and some of them can't be ordered (called nominal).

*For example:*

- classification of people into socio-economic groups (ordinal),

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- hair color (nominal)

# Types of quantitative variables

Discrete

Continuous

A discrete variable is characterized by gaps or interruptions in the values that it can assume.

*For example:*

- The number of daily admissions to a general hospital,
- The number of decayed, missing or filled teeth per child
- in an
- elementary
- school.

A continuous variable can assume any value within a specified relevant interval of values assumed by the variable.

*For example:*

- Height,
- weight,
- skull circumference.

No matter how close together the observed heights of two people, we can find another person whose height falls somewhere in between.



## Discrete Variables:

A discrete variable can have only countable number of values

### Examples:

1. **Family size** ( $x = 0, 1, 2, 3, \dots$ )
2. **Number of patients** ( $x = 0, 1, 2, 3, \dots$ )
3. **Number of rats in animal house** ( $0, 1, 2, 3, \dots$ )

## Continuous Variables:

A continuous variable can have any value within a certain interval of values.

### Examples:

- **height** ( $140 < x < 190$ )
- **blood sugar level** ( $10 < x < 15$ )
- **Age of animal (in year)** ( $7 < x < 10$ )

## \* A population:

It is the largest collection of **values** of a **random variable** for which we have an interest at a particular time.

*For example:*

The weights of all the children enrolled in a certain elementary school.

Populations may be **finite** or **infinite**.

# \* A sample:

It is a part of a population.

*For example:*

The weights of only a fraction of these children.

- Sample Size:

- The number of elements in the sample is called the sample size and is denoted by  $n$ .

- The following data represent the number of children of 16 Egyptian Family:

- 3, 5, 2, 4, 0, 1, 3, 5, 2, 3, 2, 3, 3, 2, 4, 1

- 

- - Variable =  $X$  = no. of children (discrete, quantitative)

- - Sample size =  $n = 16$

## Exercise(1)

### Q1

- In a study, 500 students of KSU were selected. Each one was asked
- whether or not he smokes. 20 students said they smoke. Based on this information we can say that :-
- population is .....
- sample size is .....
- variable is ..... and it is ..... (qualitative, quantitative).

### Q2

- 1) Number of admissions of patients in a clinic on a given day is
- (a) discrete (b) continuous (c) qualitative (d) otherwise
- 2) Which of the following are continuous random variables?
- (a) height (b) weight (c) pressure (d) all of them.
- 3) A sample may be defined as:
- (a) large group for which we have an interest
- (b) a part of population,
- (c) large group for which we do not have an interest,
- (d) none of these
-

### Q.3

Against each statement, put a tick mark (✓) if it is true and a cross (×) if it is false. [Half mark for each]

(i) A measure obtained from the sample is called a statistic ( )

(ii) The variable representing nationality is a quantitative variable ( )

Q.4 State which of the following variables are: •

(a) continuous, (b) discrete, (c) quantitative, (d) qualitative, •

(iii) Mass (ii) Marital status, (i) Place of Birth, •

(v) Family name (iv) Temperature in  $C^{\circ}$ , •

(viii) Occupation (vii) Number of hospital beds, •

### Q.4

A sample is defined as:

A) the entire population of values •

B) a measure of reliability of the population •

C) a subset of data selected from a population •

D) inferential statistics •

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Q.5

We measure the number of visits to certain club made by a random sample of 10 person during a year as follow 10, 11, 4, 14, 4, 12, 5, 13, 12, and 3. Then the type of variable is

- (a) Number of visits                      (b) qualitative                      (c) discrete  
(d) Continuous                              (e) none of these

Q.6

For a sample of 100 cancer patients in Saudi Arabia, we measure how long the patient lives after diagnosis, then in this experiment:

1. The population is :

- [A] Saudi Arabia [B] all cancer patients in S.A. [C] 100 Saudi patients [D] all Saudi patients

2- The Variable is:

- [A] number of patients [B] cancer [C] length of life after diagnosis [D] all Saudi patients

3-And the type of the variable is:

- [A] Qualitative [B] Quantitative and discrete [C] Quantitative and continuous [D] none of these

4- The sample size is:

- [A] Saudi Arabia [B] Saudi patients [C] Saudi adults [D] 100 cancer patients

No	Variables	Types
i	Place of Birth	Qualitative and nominal
ii	Marital status	Qualitative and nominal
iii	Mass	Quantitative and continuous
iv	Temperature in C °	Quantitative and continuous
v	Family name	Qualitative and nominal
vi	Number of hospital beds	Quantitative and Discrete
vii	Occupation	Qualitative and Ordinal

# Exercises

- Question 3,(a-c),(g-L)
  - Question (6) – Page 17
  - Question (7) – Page 17
- “ Situation A , Situation B “



5. List, describe, and compare the four measurement scales.
6. For each of the following variables, indicate whether it is quantitative or qualitative and specify the measurement scale that is employed when taking measurements on each:
  - (a) Class standing of the members of this class relative to each other
  - (b) Admitting diagnosis of patients admitted to a mental health clinic
  - (c) Weights of babies born in a hospital during a year
  - (d) Gender of babies born in a hospital during a year
  - (e) Range of motion of elbow joint of students enrolled in a university health sciences curriculum
  - (f) Under-arm temperature of day-old infants born in a hospital
7. For each of the following situations, answer questions a through e:
  - (a) What is the sample in the study?
  - (b) What is the population?
  - (c) What is the variable of interest?
  - (d) How many measurements were used in calculating the reported results?
  - (e) What measurement scale was used?

Situation A. A study of 300 households in a small southern town revealed that 20 percent had at least one school-age child present.

Situation B. A study of 250 patients admitted to a hospital during the past year revealed that, on the average, the patients lived 15 miles from the hospital.