SAWA UNIVERSITY

SPSS - الاحصاء

المحاضرة العاشرة

Sawa University

College of health and medical techniques

Department of Medical Laboratories

. 2nd Stage

جامعـــــــة ســـــــــاوة الاهلية

كليــــــة التقنيـــات الصحيـة والطبيـة

قسم تقنيات المختبرات الطبية

المرحلـــــــــــــــة الثانية.

تدريسي المادة : م.م سلام النجيب

محاضرة رقم ١٠

الجانب النظري

Lecture No. 10

Theoretical

Introduction to Simple Linear Regression:

Simple linear regression is a statistical method used to analyze the relationship between two variables: one is called the **independent variable** (which causes changes in the other), and the other is called the **dependent variable** (which changes based on the independent variable).

The goal is to find a mathematical relationship between the two variables that can be used for prediction.

The equation for simple linear regression is:

PRESENTATION TITLE

$$y = \beta_0 + \beta_1 x$$

Introduction to Simple Linear Regression:

Where:

y= Dependent variable (the one we are trying to predict).

x = Independent variable.

$\beta 0$= Intercept (the value of y when x=0).

$\beta 1$ = Slope (the change in y for a one-unit change in x).

Benefits of Using Regression Equations in Medicine with Exercises, Solutions, and Applications:

1. **Predicting Health Indicators Based on Specific Factors**

Using regression equations in medicine helps in predicting health indicators such as blood pressure, blood sugar levels, or heart rate based on other factors like weight or age.

This can help doctors provide better recommendations to patients based on previous data.

Benefits of Using Regression Equations in Medicine with Exercises, Solutions, and Applications:

2. Assessing the Impact of Different Factors on Patients

Regression equations help in assessing the impact of various factors on patients, such as the influence of genetic factors or lifestyle on a certain disease. Through this equation, doctors can identify which factors have the most impact on health.

3. **Predicting Treatment Response Based on Other Factors**

Regression also helps doctors predict how patients will respond to treatments based on other factors like age or weight. With these predictions, treatment can be tailored to individual patients.

Simple Correlation Coefficients

The correlation coefficient is a statistical measure that quantifies the strength and direction of a linear relationship between two variables.

It is widely used in data analysis to determine **how strongly two variables are related.**

Key Points about Correlation Coefficient

Symbol: Usually denoted by r.

Range: The value of r lies between -1 and 1.

$r=1$: Perfect positive linear relationship.

$r=-1$: Perfect negative linear relationship.

$r=0$: No linear relationship.

Formula

The correlation coefficient is calculated using:

$$r = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum(x_i - \bar{x})^2 \cdot \sum(y_i - \bar{y})^2}}$$

Where:

- x_i and y_i: The individual data points for variables x and y.
- $\bar{x}$ and $\bar{y}$: The means of x and y, respectively.

Steps to Calculate Correlation Coefficient

1. Compute the mean ($\bar{x}$, $\bar{y}$) for both variables.
2. Subtract the mean from each data point to get deviations.
3. Multiply the deviations of x and y, then sum the results ($\sum(x_i - \bar{x})(y_i - \bar{y})$).
4. Compute the squared deviations for x ($\sum(x_i - \bar{x})^2$) and y ($\sum(y_i - \bar{y})^2$).
5. Divide the sum of products by the square root of the product of the squared deviations.

Example:

Dataset:

- Variable x: [2, 4, 6, 8, 10]
- Variable y: [1, 3, 5, 7, 9]

Step 1: Compute Means

$$\bar{x} = \frac{2+4+6+8+10}{5} = 6$$

$$\bar{y} = \frac{1+3+5+7+9}{5} = 5$$

Step 2: Compute Deviations and Products

x_i	y_i	$x_i - \bar{x}$	$y_i - \bar{y}$	$(x_i - \bar{x})(y_i - \bar{y})$	$(x_i - \bar{x})^2$	$(y_i - \bar{y})^2$
2	1	-4	-4	16	16	16
4	3	-2	-2	4	4	4
6	5	0	0	0	0	0
8	7	2	2	4	4	4
10	9	4	4	16	16	16

Step 3: Summations

$$\sum(x_i - \bar{x})(y_i - \bar{y}) = 40$$

$$\sum(x_i - \bar{x})^2 = 40, \quad \sum(y_i - \bar{y})^2 = 40$$

Step 4: Compute Correlation Coefficient

$$r = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum(x_i - \bar{x})^2 \cdot \sum(y_i - \bar{y})^2}}$$

$$r = \frac{40}{\sqrt{40 \cdot 40}} = \frac{40}{40} = 1$$

Result: $r = 1$, indicating a perfect positive linear relationship.

Applications in Medicine

1. **Patient Data Analysis:**
   1. Correlation between weight and blood pressure to identify potential health risks.
2. **Drug Efficacy Studies:**
   1. Correlation between medication dosage and reduction in symptoms.
3. **Epidemiology:**
   1. Correlation between environmental factors (e.g., pollution levels) and disease incidence.