Measures and scale

Science, Statistics

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Introduction Correlation coefficient measures the linear association between two variables (Ott & Longnecker, 2010). Values of the correlation coefficient are range between -1 and +1. When the correlation coefficient is +1, this means that two variables are perfectly related in a positive linear sense. A correlation coefficient of -1 indicates that the two variables are perfectly related in a negative linear sense. 0 correlation coefficient indicates that no linear relationship between the two variables. Regression analysis identifies the relationship between a dependent variable and independent variables. Various tests have been employed to determine if the regression model is satisfactory. The model is said to be satisfactory, if the estimated regression equation can predict the value of the dependent variable given values for the independent variables. The relationship between these two measures is that they analyze the extent to which variables are related. However, these two do not assess cause and effect.

Exploring the relationship between stress and blood pressure

Stress is part of normal life though too much stress can cause emotional, psychological and physical problems such as heart disease, irregular heart, chest pains and high blood pressure (Quinn & Keough, 2002). Our main concern is to study the relationship between stress and high blood pressure. We want to ascertain whether medical researchers are right with regard to stress causing high blood pressure. Let us determine the relationship of these two by using a sample of 20 patients who had their stress test score and blood readings taken. Regression and correlation is used in ascertaining the relationship as shown below:

Patient

stress score (x)

Blood pressure score (y)

(x-x1)

(Y-Y1)

(x-x1)2

(Y-Y1)2

(xi - x)(yi - y)

ŷ = 25. 1 + 0. 58x

1

20

40

-95

(51. 80)

9, 025. 00

2, 662. 52

4, 921. 00

36. 7

2

30

50

-85

(41. 80)

7, 225. 00

1, 747. 24

3, 553. 00

42. 5

3

40

60

-75

(31. 80)

5, 625. 00

1, 011. 24

2, 385. 00

48. 3

4

50

70

-65

(21. 80)

4, 225. 00

475. 24

1, 417. 00

54. 1

5

60

75

-55

(16. 80)

55*55

282. 24

924. 00

59. 9

6

70

85

-45

(6. 80)

2, 025. 00

46. 24

306. 00

65. 7

7

80

65

-35

(26. 80)

1, 225. 00

718. 24

938. 00

71. 5

8

90

90

-25

(1. 80)

625. 00

3. 24

45. 00

77. 3

9

100

70

-15

(21. 80)

225. 00

475. 24

327. 00

83. 1

10

110

80

-5

(11. 80)

25. 00

139. 24

59. 00

88. 9

11

120

83

5

(8. 80)

25. 00

77. 44

(44. 00)

94. 7

12

130

85

15

(6. 80)

225. 00

46. 24

(102. 00)

100. 5

13

140

87

25

(4. 80)

625. 00

23. 04

(120. 00)

106. 3

14

150

90

35

(1. 80)

1, 225. 00

3. 24

(63. 00)

112. 1

15

160

92

45

0. 20

2, 025. 00

0. 04

9. 00

117. 9

16

170

94

55

2. 20

3, 025. 00

4. 84

121. 00

123. 7

17

180

100

65

8. 20

4, 225. 00

67. 24

533. 00

129. 5

18

190

140

75

48. 20

5, 625. 00

2, 323. 24

3, 615. 00

135. 3

19

200

160

85

68. 20

7, 225. 00

4, 651. 24

5, 797. 00

141. 1

20

210

220

95

128. 20

9, 025. 00

16, 435. 24

12, 179. 00

146. 9

Total

2300

1836

0

-

63, 475

31, 192. 5

36, 800

1, 836. 00

Mean (x1)

115

91. 8

Correlation

1

Regression

$\hat{y} = b0 + b1x$

b1 = Σ [(xi - x)(yi - y)] / Σ [(xi - x)2]

b1=

0. 58

b0 = y - b1 * x

25. 1

$\hat{y} = 25.1 + 0.58x$.

From the above workings in the table, the correlation coefficient is one. Therefore, the relationship between stress and blood pressure is a linear one. This simply means that when stress levels increase, the blood pressure also increases. The regression model is determined is fit as we were able to predict the values of blood pressure at given levels of stress.

Relationship between BMI (Kg/m2) of pregnant mothers and the birth-weight (BW in Kg) of their newborn

The following data set provide information on 6 pregnant mothers who were contacted for this study

BMI

Birth weight

(x-x1)

(Y-Y1)

(x-x1)2

(Y-Y1)2

(xi - x)(yi - y)

1

20

2. 7

-10. 83

-0. 2

117. 2889

0. 04

4. 691556

2

30

2. 9

-0. 83

0

0. 6889

0

0

3

50

3. 5

19. 17

0. 6

367. 4889

0. 36

132. 296

4

45

3

14. 17

0. 1

200. 7889

0. 01

2. 007889

5

10

2. 2

-20. 83

-0. 7

433. 8889

0. 49

212. 60556

6

30

3. 1

-0. 83

0. 2

0. 6889

0. 04

0. 027556

185

17. 4

0. 02

8. 882E-16

1120. 833

0. 94

351. 62857

mean

30. 83

2. 9

coefficient of correlation

1

b1 = Σ [(xi - x)(yi - y)] / Σ [(xi - x)2]

1. 776E-17

b1=

0. 0000

0

b0 = 2. 9 - 0 * 30. 83

0

$\hat{y} = 2.9$

The correlation is +1, therefore a relationship which is linear exists between BMI and birth weight. Using regression analysis, it will be not possible to predict the birth weight given the BMI because the model is $\hat{y} = 2.9$.

References

Ott, Lyman R. & Longnecker, Micheal T. (2010). An Introduction to Statistical Methods And Data Analysis. Cengage learning

Quinn, Gerry P. & Keough, Michael J. (2002). Experimental Design and Data Analysis for Biologists. Cambridge university press