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STATISTICAL ANALYSIS OF THE RELATIONSHIP BETWEEN AGE AND HIGH BLOOD PRESSURE OF PATIENTS

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ABSTRACT

This study was intended to investigate and to ascertain whether there exist or not a relationship between age and high blood pressure of patients in Sapele metropolis, Delta State. Data was collected from eighteen (18) patients randomly selected from the records/files and their average blood pressure for three conservative months: March, April and May 2016. A Hypothesis was formulated and tested using the statistic at $\alpha = 0.05$, level of significance, Regression analysis was also employed in the analysis of data collected from the sample to forecast blood pressure of patients. Results from the analysis showed that, there is a significant relationship between age and high blood pressure with a coefficient of 0.729 showing that the blood pressure is dependent on age. Forecasted blood pressures of ages (80, 85, 87 and 90) of would be patients using the regression equation $y = 77.43 + 1.183x$, with corresponding blood pressure of 172, 178, 180 and 183 respectively. It is hereby recommended that people should from the habit of predicting their blood pressure and undergo routine checkup to know their blood pressure status and seek early treatment where necessary.

Keywords: High blood pressure, data, study, decision, regression, age,

INTRODUCTION

Age is a recognized risk factor for high blood pressure and the incidence of this disease increases with age. While a great deal is understood about the contribution of age to overall risk profile, the issue remains complicated and there is a continuous debate about several key points. Increase in blood pressure (BP) has been taken as an inevitable consequence of ageing in industrialized societies, giving rise to hypertension to a large extent in elderly subjects (Franklin, 1991). For instance, while the National Institute of Ageing (NIA, 2011) reports that more than 50% of the over the age 60 have high blood pressure, there is considerable disagreement in the scientific community about what that statistic actually mean. These elements includes maintaining diet (especially salt intake and fats), exercising, limiting one's intake of alcohol and deadly substances, maintaining a healthy weight, developing strategies to cope with stress etc.

Blood pressure is the force of blood against the walls of arteries which rises and falls during the day, when blood pressure or hypertension, Hypertension is the medical term associated with High Blood pressure (WHO, 2015).. A blood level of 140/90mmHg is

considered high. About two-third of people over age 65 have been estimated to have High Blood pressure. If your blood pressure is between 120/80mmHg and 139/89 mmHg, then you have pre-hypertension. This means that you do not have High blood pressure now, but one is likely to develop it in future. If a person develops high blood pressure before the age of 50, his or her risk of heart failure is greatly increased. If untreated, it can reduce life expectancy by 10 or more years.

Research has reported that men often develop high blood pressure within the age of 35 and 55 while women often develop high blood pressure after menopause (WHO, 2015).. Both numbers in a blood pressure test are important for people who are 50 and above. The number at the upper limit of the test is called, the systolic blood pressure, while that at the lower limit of the test is called the diastolic blood pressure. i.e. (140/90)

Systolic blood pressure is the force of blood in the arteries as the heart beats. It is shown at the top number in a blood pressure reading. High blood pressure is 140mmHg and above for systolic pressure. Systolic pressure gives the most accurate diagnosis of high blood pressure. Diastolic blood pressure is the force of blood in the arteries as the heart relaxes between beats. It is shown as the bottom number in a blood pressure reading. This has been, and remains, especially for younger people, an important hypertension number. The higher the diastolic blood pressure, the greater the risk of heart diseases. As people become older, the diastolic pressure will begin to decrease and the systolic pressure beings to rise and becomes more important. Diastolic pressure does not need to be high for you to have high blood pressure.

Clinical studies have proven that treating a high systolic pressure saves life, greatly reduces illness and improves the quality of life. Yet, most people do not have their high blood pressure under control, Holmes and Rahe (1967) stated that "the more stressful the changes that take place in a person's life, the greater the likelihood of illness within the next year or two"'. Even positive change can be stressful.
Livingstone Medical Care, Boston (2015) has found that being overweight or having history of high blood pressure also increases a person's chance of developing this condition. It has stated that "hypertension results in constricted blood vessels and causes the blood supply to organs such as the kidney to drop". Negative emotional state may lead people to think that they are sicker than they really do whereas positive emotional state seems to enhance it (Salovey et al., 2000)". The health consequences of negative emotionally depend on how individuals are able to manage and repair their moods and this may be a function of disposition. Hypertension is an increasingly important concern from middle life. It is

the most common chronic condition among 45 to 64 years old men and second most common (after arthritis) in women in that age group. Hypertension can lead to heart attack or stroke or cognitive impairment in late life Launer et al., (1995).

However, it is not clear on the borderline hypertensive Patient should be treated medically since the side effects of the medications may outweigh any benefits. Activity of the sympathetic nervous system and secretion of epinephrine and no-epinephrine can elevate blood pressure in many ways Kaplan (1986). High blood pressure (Hypertension) is called the silent killer because it is such a serious risk factor. Yet no consistent pattern symptoms reveal itself to allow a patient to identify it reliably. Symptoms such as headache, dizziness, shortness of breath and blurry vision may occur in people quite frequently than those without elevated blood pressure. Pennebaker, (1982) has presented evidence that certain individuals may have their own unique symptoms that go with high blood pressure, but these do not generalize from one person to the other. It is associated with strokes, retinal damage, diseases of the coronary arteries and heart problems.

In early stage of hypertension, high cardiac output tends to be the culprit. In the later stages, peripheral resistance seems to play a more central role (Kaplan, 1981). 95% of all hypertension cases were categorized as essential hypertension that also known as primary hypertension or idiopathic hypertension. Environmental factors including obesity, high alcohol intake, high salt intake, insulin resistance, low potassium intake, ageing, sedentary lifestyles, stress and low calcium intake contribute to the development of hypertension (Carretero and Oparil, 2000). This study is aimed at using regression analysis to evaluate the relationship between age and high blood pressure and to forecast the blood pressure of patient using the formulated regression equation.

STATEMENT OF THE HYPOTHESIS

The following hypothesis is formulated;
Ho: There is no correlation between age and high blood pressure among patients
H1: There is correlation between age and high blood pressure among patients

MATERIALS AND METHODS

This study is designed on how regression can be used to analyze the nature of the relationship between age and blood pressure. The systolic blood pressures of eighteen (18) patients was randomly selected with a period of three consecutive months obtained i.e. from the files/records of the Hospital March- May, 2016, which from the sample of study. The targeted population of study of a medical facility in Sapele was arrived at using a

simple random sample without replacement (SRSWWOR) lottery method from a whole list of medical facilities abound in the Metropolis. Regression analysis was employed and hypothesis formulated were tested using Analysis of Variance (ANOVA) techniques.

DATA PRESENTATION AND ANALYSIS

Table 1: Distribution of Age and Cumulative Average of Blood Pressure From March – May 2016

Patients	Age	Average pressure (mmHg)
1	43	128
2	48	120
3	56	135
4	61	143
5	67	141
6	70	157
7	49	158
8	50	155
9	37	102
10	28	100
11	51	159
12	45	149
13	68	160
14	59	135
15	61	155
16	60	153
17	70	160
18	46	130

Source: Field Survey (2019)

Regression Model

Using the least square method of the regression analysis, the data in Table 1 has to be identified in terms of x and y, i.e. the independent variable and the dependent variable respectively. The method is used to minimize the error sum of square (SSE) and the regression model is given by:

$$Y = b_o + b_i X_i + e_i$$

Where

Y is the study variable or dependent variable

bo is the intercept

bi is the slope

X is the independent variable

Ei is the Error term

Some assumptions of the models

(i) Linearity assumption

(ii) Y (blood pressure) depends on x (age)

(iii) Normality assumption

$e_i \sim N(O, \delta^2)$

Table 2: Calculation using the Ordinary Least Square Method

Patients	X	Y	XY	X^2	Y^2
1	43	128	5504	1849	16,384
2	48	120	5760	2304	14,400
3	56	135	7560	3136	18,225
4	61	143	8723	3721	20,449
5	67	141	9447	489	19,881
6	70	157	10990	4900	24,649
7	49	158	7742	2401	24,964
8	50	155	7750	2500	24,025
9	37	102	3774	1369	10,404
10	28	100	2800	784	10,000
11	51	159	8109	2601	25,281
12	45	149	6705	2025	22,201
13	68	160	10, 800	4624	25,600
14	59	135	7, 965	3481	18,225
15	61	155	9, 455	3721	24,025
16	60	153	9, 180	3600	23,409
17	70	160	11, 200	4900	25,600
18	46	130	5, 980	2116	16,900
	969	2540	139, 524	54, 521	364, 622

$$Y = b_o + b_i X_i + e_i$$

$$where\ \hat{b}1 = \frac{n\sum XY - \sum X \sum Y}{n\sum X^2 - (\sum X)^2}$$

$$= \frac{18\ (139,524)}{18\ (54,521)} - = \frac{(969)(2540)}{(969)^2}$$

$$= \frac{2,511,432}{981,378} - = \frac{2,461,260}{938,961}$$

$\hat{b}_1 = 1.183$

$b_o = \bar{y} - \hat{b}_1 \bar{x}$

$= 141.11 - 1.183\ (53.83)$

$= 141.11 - 63.68$

$b_0 = 77.43$

Hence, the regression equation is given as

$Y = 77.43 + 1.183x_1$

Adequacy Test

Having known the regression equation, the question now is how adequate is could the model be used as forecasting techniques in decision making: the above question brings the test of adequacy into play using an assured significance level of 5%.

Table 3: ANOVA

Source of Variation	Sum of squares	Degree of freedom	Mean square	F- ratio
Regression	28.32	1	28.32	13.74
Error	38.68	16	2.06	
Total	62.00	17		

H_0: $\beta = 0$ (i.e. no significance relationship between age and high blood pressure).

H_1: $\beta \neq 0$ (i.e. there is significance relationship between age and high blood pressure).

$\alpha = 0.05$

Test statistic: F-ratio = 13.74

Decision Rule: Reject Ho if F calculated is greater than F tabulated at the appropriate degree of freedom.

Since F calculated = 13.74 > F tabulated 0.05 (1, 16) = 4.49, we reject Ho and accept H_1 and conclude that there is significant relationship between age and high blood pressure at $\alpha = 0.05$ level of significance.

Blood Pressure Forecast from Age of Patient

The blood pressure of a patient can be forecasted from the regression equation

$Y = 77.43 + 1.183x_1$

Table 4: Forecasted Blood Pressure

Age (X)	Forecasted blood Pressure (Y)
80	172
85	178
87	180
90	183

Calculation of Correlation Coefficient

$$r = \frac{n\sum xy - \sum nx\sum}{\sqrt{(n\sum x^2 - (\sum(x)^2)n\sum y^2 - (\sum y)^2}}$$

$$r = \frac{18\,(139,524) - (2540)(969)}{\sqrt{18\,(54,521) - (966)^2\,[(364,622) - (2540]^2]}}$$

$$r = \frac{50172}{\sqrt{(42417)(111596)}}$$

$= 0.729$

Coefficient of Determination

Ho: There is no correlation between age and high blood pressure

Hi: There is a correlation between age and high blood pressure

$\alpha = 0.05$ level of significance

Test Statistic

$$t = \frac{r\sqrt{N-2}}{\sqrt{1-(r^2)}}$$

$$t = \frac{0.729\ x\ 4}{\sqrt{1-(05314)}} = \frac{2.916}{0.6845}$$

$= 4.26$

Decision Rule: Reject Ho if t-calculated is greater than t- tabulated at $t_{0.95}$.

Conclusion: Since t calculated is 4.26 and is greater than t tabulated = 1.75, we reject Ho and accept Hi and concluded that there is a correlation between age of patients and high blood pressure at $\alpha = 0.05$ level of significance.

DISCUSSIONS

The results of this study show that there is a linear relationship between age and high blood pressure among sampled patients in the study sample observations. The null hypothesis Ho: $\beta = 0$ in the adequacy test was rejected at $\alpha = 0.05$ level of significance and H_1 was accepted which indicates that there is significant relationship between age and high blood pressure. Also, the coefficient of determination test also rejected the null hypothesis since t - calculated of 4.26 was greater than t - tabulated of 1.75 at $\alpha = 0.05$ level of significance.

CONCLUSION AND RECOMMENDATIONS

The findings of this study clearly revealed the relationship between age and high blood pressure among patients. Therefore age is a strong determinant in ascertaining high blood pressure status. Based on the above findings, it is hereby recommended that people should form the habit of predicting their blood pressure from the regression equation Y = 77.43 +

1.183x1 and undergo routine checkup to know their blood pressure status and seek early treatment where necessary.

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