STATISTICAL ANALYSIS ON THE OCCURRENCE OF MALARIA, TYPHOID FEVER AND DIABETES, FROM 2009-2014: A CASE STUDY OF KOGI STATE SPECIALIST HOSPITAL LOKOJA, KOGI STATE, NIGERIA

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ABSTRACT

The objective of the study was to determine the disease that has the effective measure of control and the one that had the highest number of occurrence. The population for the study was 3,108, that is; malaria has 2,029, typhoid with 290 and diabetes 787and sample was not taken since the three diseases were analyzed as it occurs. The data was considered valid and reliable since it was a secondary data collected direct from the sources. The study revealed that among the three diseases, Malaria had the highest prevalence and the least response to drug and that there is significant difference in the effectiveness of the control measures among the means of Malaria and typhoid fever. We finally recommended that, these diseases can be prevented through a variety of means, which are; Sanitation, Self-care and Public Health Measures.

Keywords: Statistical Analysis, Prevalence, Malaria, Typhoid Fever and Diabetes

INTRODUCTION

In most activity we do, there is always one estimation or the other, from here the area of statistics comes into place. The field of statistics has

widespread application that cut across all areas of study. Statistics in the beginning consists merely of the collection of data and their presentation in charts and tables. It is now considered to encompass the science of basing inferences on observed data and the entire problem of making decisions in the face of uncertainty (Ali; 2014). The meaning to which statistics could be put is enormous. Its definition always depends on its use. Some could see it as data while some saw it as information. However, we can now define statistics as the scientific methods of collecting, organizing, summarizing, presenting and analyzing data, as well as drawing valid conclusions and making reasonable decisions on the basis of such analysis as quoted by (Aideyan; 2014). The word "health" means different things to different people, depending on the situation. The English world "health" comes from the Old English word "hale", meaning "wholeness, being whole, sound or well". Health as defined by the World Health Organization (WHO, 1948) is a state of complete, physical, mental and social well-being and not merely the absence of disease or infirmity. But an article in the Lancet "states that health is not a state of complete, physical, mental and social well-being". Neither is it "merely the absence of disease or infirmity". The article says that the World Health Organization definition of health will not do, in an era marked by new understandings of disease at molecular, individual and societal levels (Lancet, 2009).

However, Health can be defined as the condition of the body and the degree to which it is free from illness or the state of being well. And a healthy living is one of the most essential needs for human existence because health is wealth. What is this disease that causes ill – health? Disease can be defined as an illness or sickness with specific,

well-defined symptoms that affects a person, plant or animal. In other words it is the disorderliness or an unhealthy condition of the body or mind. There are several common diseases that affect humans in our world today, but for the purpose of this study, we considered only three of them which are Malaria, Typhoid fever and Diabetes. Malaria is a vector-borne disease that is widespread in the tropical and subtropical areas of the world (WHO; 2003). While Typhoid fever is seen as a water-borne disease, also very common worldwide (WHO, 2008). Malaria and Typhoid fever remains the diseases of major public health importance and cause of morbidity and mortality in the tropical Africa. Both diseases are common in many countries of the world where the prevailing environment conditions of warm humid climate, poor sanitary habits, poverty and ignorance exists. These two diseases has been associated with poverty and underdevelopment (Okorie, Uniaru, Uzoamaka; 2015). Also Diabetes is not only a health crisis, it is a global societal catastrophe. Governments worldwide are struggling to meet the cost of diabetes care. Costs to employers and national economies are escalating and everyday low-income families are being driven into poverty by loss of earnings due to diabetes and the life-long costs of health care.

In this recent time, many people are being tied down in hospitals; some are being killed because of the different infectious diseases caused by organisms such as bacteria, viruses, fungi or parasites. Some of such common diseases are Malaria, Typhoid fever and Diabetes. Some of these diseases brake out as an epidemic, an epidemiology as stated by (Epidemiology Health Service of Psychosocial Research; 2004) This brought up the purpose of testing for the high occurrence of these diseases and the significant differences between

the various diseases in control measures. Also we would be able to know the disease that has the least response to drugs, of which will be used as guide towards the organization of disease control programme.

REVIEW OF LITERATURE

In a study conducted by (Birhanie, Tessema, Getacheean, Bamiaku; 2014) that malaria and typhoid fever co infection was 13(6.5%) for 2-5 year old children and poor hand washing habit were significantly associated with malaria and typhoid infection, respectively. Smoking prevalence in Type-2 diabetes: results of the study of Health in Pomerania (SHIP) and the German National Health Interview and Examination Survey (GNHIES) indicated that smoking contributes to the development of diabetes and diabetes-related complications. The aim of their analysis was to determine smoking prevalence in adults with type 2 diabetes mellitus using data from the two population-based studies in Germany (Schipf, Werner and Volzke; 2009). From their further study of Health in Pomerania (SHIP) (n=4283) and the 1998 German National Health Interview and Examination Survey (GNHIES 98) (n=6663) subjects aged 20-79years were investigated. Descriptive statistics on smoking prevalence and behaviours were calculated for type 2 diabetes mellitus and compared with the general population using weightings reflecting the European adult population. And the results showed that the prevalence of current smokers was lower among persons with types 1 of diabetes than without type 2 diabetes mellitus in SHIP (17.3% vs 38.0%) and in GNHIES 98 (24.7% vs 32.1%). Only in men, there were more former smokers in type 2 diabetic patients than in subjects without diabetes in both studies. Among current and former smokers, the number of cigarettes smoked was higher

among persons with diabetes than without type 2 diabetes mellitus. For men, this finding was consistent in SHIP and GNHIES 98. While in women, this difference was only observed in GNHIES 98. And then, they concluded that, the association between smoking and type 2 diabetes mellitus are likely to reflect behavioural changes secondary to illness or medical counseling. The high proportion of current smokers among type 2 diabetic patients, particularly men, should be monitored in repeated surveys following the introduction of disease management programmes (Schipf, Werner and Volzke; 2009).

RESEARCH METHODOLOGY

This is ex - post facto research design, this is because the event has already happen. The researchers have no control over data generation. The data for the various diseases were kept as they occur by the officers in charge. Data can be defined as facts and other relevant materials, past and present, serving as bases for study and analysis. Data forms the bases for testing the hypothesis formulated in a study. While Data collection is the process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer stated research questions, test hypothesis and evaluate outcomes.

METHOD OF DATA ANALYSIS

The data used for this study are secondary data which have already been collected and processed by some agency or persons. Secondary data may be abstracted from existing records, published sources or unpublished source, and the data used for this study was extracted from the hospital record of statistics.

The Analysis of variance (ANOVA) was employed to analyze the data at a significant level of 5% was used throughout the analysis. The chi – square

test is a technique designed to test the significance of the difference between a set of expected frequencies. While the Analysis of variance is sometimes referred to as ANOVA, and it is defined as a statistical technique for the analysis of measurements which depend on several kinds of effects operating simultaneously, which permits us to decide which effects are important and enables us to estimate these effects.

Table 4.6: Data Collected for the Analysis of the Three Diseases (Malaria, Typhoid Fever and Diabetes).

Year	Malaria	Typhoid Fever	Diabetes	Total	Means
2009	78	20	111	**209**	69.67
2010	238	40	119	**397**	132.33
2011	252	54	142	**448**	149.33
2012	400	60	181	**641**	213.67
2013	527	61	99	**687**	229.00
2014	534	55	135	**724**	241.33
Total	**2,029**	**290**	**787**	**3,106**	
Means	**338.17**	**48.33**	**131.17**		

The statistical model is:

$$y_{ij} = \mu + T_i + \beta_j + \sum_{ij}$$
$$i = 1 \ldots . 3$$
$$j = 1 \ldots . 6$$

Where y_{ij}= observation of ith treatment in jth block
μ = the universal constant
T_i = the ith treatment effect
β_j = the jth block effect
$\sum_{ij}$ = Random error.

Test of Hypothesis:

H_0: There is no significant difference in the effectiveness of the control measures.

H_i: There is significant difference in the effectiveness of the control measures.

Level of Significance:

We use *a = 5% = 0.05* as the level of significance.

Test Statistics:

$$F_1 = \frac{MST}{MSE} \sim F_{(t-1),(t-1)(b-1),\propto}$$

$$F_2 = \frac{MST}{MSE} \sim F_{(t-1),(t-1)(b-1),\propto}$$

Decision Rule:

Reject the null hypothesis, H_o. If F_{cal} is greater than F_{tab} and accept H_o if otherwise.

Notation:

t = 3 (number of the disease or treatment)

b = 6 (number of years or block)

y.. = 3,106 (sum of totals)

n = tb = 3 x 6 = 18.

Data Computation:

Sum of square

$$SST = sum\ of\ square\ total$$

$$SST = \sum\sum y^2_{ij} - \frac{y_{..}^2}{n}$$

$$SST = 78^2 + 238^2 + \cdots + 135^2 - \frac{(3106)^2}{18}$$

$$= 971,812 - 535,957.5556$$

$$= 435,854.4444$$

$$\simeq 435,854$$

$$SSt = sum\ of\ square\ Treatment(diseases)$$

$$SSt = \frac{\sum y^2_{\ i}}{b} - \frac{y_{..}^2}{n}$$

$$SSt = \frac{2,029^2 + 290^2 + 787^2}{6} - \frac{(3106)^2}{18}$$

$$= 803,385 - 535,957.556$$

$$= 267,427.4444$$

$$SSt \simeq 267,427$$

$$SSB = sum\ of\ square\ Block\ (Years)$$

$$SSt = \frac{\sum y.^2_{\ j}}{t} - \frac{y_{..}^2}{n}$$

$$SSt = \frac{229^2 + \ldots + 724^2}{3} - \frac{(3106)^2}{18}$$

$$= 603,006.6667 - 535,957.5556$$

$$= 67,049.11114$$

$$SSB \simeq 67,049$$

$$SSE = sum\ of\ square\ Error$$

$$SSE = SST - SSt - SSB$$

$$= 435,854 - 267,427 - 67,049$$

$$SSE = 101,37$$

Mean sum of Square:

$$MSt = mean\ square\ treatment$$

$$MSt = \frac{SSt}{t-1}$$

$$= \frac{267,427}{3-1}$$

$$MSt = 133,713.5$$

$$MSB = mean\ square\ block$$

$$MSB = \frac{SSB}{b-1}$$

$$= \frac{67,049}{6-1}$$

$$MSB = 13,409.8$$

$$MSE = mean\ square\ error$$

$$MSE = \frac{SSE}{(t-1)(b-1)}$$

$$= \frac{101,378}{(3-1)(b-1)}$$

$$= 12,672.25$$

F-Value:

1. For the F_{cal} we have:

   $F_1 = \frac{MSt}{MSE} = \frac{133,713.5}{12,672.25} = 10.55$ (For the treatment/diseases)

   $F_2 = \frac{MSB}{MSE} = \frac{13,409.8}{12,672.25} = 1.058. \simeq 1.06$(For the block/year)

2. For the F_{tab} we have

$$F_1 = F_{(t-1),(t-1),(b-1),\alpha}$$
$$= F_{(3-1),(3-1),(6-1),0.05}$$
$$= F_{2,(2)(5),0.05}$$
$$= F_{2,10,0.05}$$
$$= 4.10$$
$$F_2 = F_{(b-1),(t-1),(b-1),\alpha}$$
$$= F_{(6-1),(3-1),(6-1),0.05}$$
$$= F_{5,(2)(5),0.05}$$
$$= F_{5,10,0.05}$$
$$= 3.33$$

Conclusions:

1. For the treatment (Disease), the F_{cal} = 10.55 >F_{tab} = 4.10, we therefore reject H_o and accept $H_1$and conclude that there is significance in the effectiveness of control measure.
2. For the block (Year), since the F_{cal} = 1.06 <F_{tab} = 3.33, we therefore accept H_o and then conclude that there is no significant difference in the effectiveness of the control measures.

Table 4.6.1: ANOVA Table for the Results of the Three Diseases

Source of Variation	Degree of Freedom	Sum of Square	Mean of Square	F_{-ratio}	F_{tab} (0.05)
Diseases (B)	2	267,427	133,713.5	10.55	4.10
Years (A)	5	67,049	13,409.8	1.06	3.33
Error	10	101,378	12,672.25		
Total	**18**	**435,854**			

Table 4.6.2: Tables for the Means of the Three Diseases

Diseases	Means
Malaria	338.17
Typhoid Fever	48.33
Diabetes	131.17

Since we are comparing the adjacent means, we will then resort to LSD method.

Where:

Number of diseases, n = 3

Mean square error, MSE = 12,672.25

Level of significance, a = 0.05

Total number of observations, n = 18

Df of Error = 10

P = 18 – 10 = 8

$$LSD = t_{\alpha/2}, n-p\sqrt{\frac{2MSE}{n}}$$

$$= (t_{0.025,10})\sqrt{\frac{2(12,672.25)}{3}} = (2.764)(91.9139)$$

$$= 254.05$$

Let the means be represented by:

$$\bar{y}_1, \bar{y}_2 \; and \; \bar{y}_3$$

And the differences in the means are:

$/\bar{y}_1 - \bar{y}_2/ = /338.17 - 48.33/ = 289.84 > 254.05$(Significant)

$/\bar{y}_1 - \bar{y}_3/ = /338.17 - 31.17/ = 207 < 254.05$(Not Significant)

$/\bar{y}_2 - \bar{y}_3/ = /48.33 - 31.17/ = 82.84 < 254.05$(Not Significant)

From the result above, the mean of the disease 1 and 3, and 2 and 3 are the same while the mean of the disease 1 and 2 are not the same at the given a – level. Therefore, Malaria and Typhoid fever are the diseases, which have significant difference existing in their means

Table 4.6.3: LSD Table for the Means of the Three Diseases

Group Variable	n = 6	n = 6	n = 6
1 Malaria	338.17[a]	289.84[b]	207
2 Typhoid Fever	254.05*[c]	48.33	-82.84
3 Diabetes	10.55*	1.06	131.17
	MSE =	12,672.25	

a = Group Means are placed on the diagonal

b = Difference between the group means above the diagonal

c = Fisher LSD test values are below the diagonal.

* = p < 0.05, Df = critical t = 254.05

DISCUSSION OF FINDING

From the analysis of the three diseases; Malaria, Typhoid Fever and Diabetes, using ANOVA, difference in the control measures was discovered to exists amongst the means of these diseases and this differences was in "malaria and typhoid fever", using the Fisher's least significant difference (LSD), a method of multiple comparison. This means difference that exists in the control measures indicates that

malaria and typhoid fever are not equally contacted by the victims. Also from the analysis of data using the Analysis of variance (ANOVA), at 5% level of significance, the null hypothesis, H_0 was rejected, which means that there is significant difference in the effectiveness of the control measure. So we went further to carry out a multiple comparison, using the fisher's least significant difference (LSD). After the analysis, it was discovered that, there is significant difference amongst the means of "malaria and typhoid fever", but no significant difference among the means of "typhoid fever and diabetes" and "malaria and diabetes". And since there is significant difference amongst the means of "malaria and typhoid fever", this indicates that malaria and typhoid fever are not equally contacted throughout the period of the 6 years (2009-2014) that is observed by the victims. From the graphs, it shows that malaria has the highest prevalence. Then with regard to the Chi-square test, it shows that the diseases affecting humans in that area and within that period (2009-2014) does not depend on whether you are male or female, anybody that is exposed to it will contact it. From the analysis, even though malaria is the least that responds to drugs, with the current control programme, the disease is not completely eradicated but it will be reduced to the barest minimum in the future to come.

CONCLUSION

It is very important to make analysis of the diseases affecting humans because it is very useful to evaluate or make critical opinion on the success of the disease control programme embarked on over the years and studying the current rate of diseases. In conclusion, the successful act of figuring out the pre-determined objective of the study was due to the

adequate care in the collection of relevant data and the choice of appropriate or suitable statistical tools.

RECOMMENDATIONS

As we know and believe that "Good health is wealth". Health is one of the most important thing needed in the life of humans, so proper consideration should be giving to them at all times.

From the analysis performed so far, the following were recommended;

- Government should provide adequate facilities and should also increase the allocation for health services so as to create enough fund for the drugs pertaining to these diseases and as well as the health services in the country.
- The programme of various health committees should be expanded through adequate fund, such as Expanded Programme on Immunization (EPI), and suitable research personnel should be employed to carry out the necessary investigation on any health matters.
- People should keep their environment clean and neat in order to prevent mosquito bite from which they easily get malaria parasite. And also the use of mosquito coils, spraying of insecticides and sleeping under a treated bed net is advised.
- Finally, people are advised to visit hospitals to see the doctor whenever they are not physically sound rather than stay at home to take self-medication.

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