

Statistical Analysis Of  
Reported Cases Of  
Malaria In Parklane  
Specialist Hospital In  
Enugu Urban For The  
Period Of 2009 - 2015

**Dr. N.M. Ozofor**

*Senior Lecturer, Department of Science Education,  
Michael Okpara University of Agriculture, Umudike,  
Abia State, Nigeria*

**Onos C.N.**

*Lecturer II, Department of Computer  
Science/Mathematics, Godfrey Okoye University,  
Enugu, Enugu State, Nigeria.*

## ABSTRACT

This research “statistical analysis on the reported cases of malaria in Enugu state urban Area; A case study of parklane specialist hospital, Enugu. (2009-2015)” is a report to determine the regression between malaria and time factor. The data collected is a secondary data and its unit is in thousands, and the data comprises 84 data points which spread from 2009 to 2015. The study reviewed relevant literature to acquaint researchers on the rate of spread of malaria. It can be generally agreed that seasonal variation help in increasing or decreasing rate of spread of malaria as shown on the graph. From the data collected the study used is the method of least square. From the analysis done the following finding were made; it was discovered that there was a linear relationship between prevalence of malaria attack and the various times of the year, the rate of decrease is more in male than in females. Also using the computerized package “Statistical Package for Social Science (SPSS)” to run the data analysis It was also discovered that there was a decrease in malaria attack as the years increases. Generally the reported number of malaria in Enugu Urban Area from 2009-2015 is decreasing. Nevertheless, recommendation is made mandatory for public place, residential areas, companies, schools etc. be made clean to reduce breeding site for mosquitoes to reproduce

**Keywords:** Regression, Malaria cases, Disease, Mosquitoes, Infection, Least Square, Transmission and Treatment

## 1. INTRODUCTION

One of the prominent and ancient diseases profiled and studied is malaria, it has been a burden to mankind greatly, and its mortality rate can't be compared to any other modern disease aside tuberculosis. Malaria has also known to be the commonest disease which is also infectious and a problem of public health everywhere in the world, Africa and south Asia in particular. Malaria parasite is of various species of over 100, the most deadly and common in Africa is called plasmodium falciparum. Plasmodium falciparum, a microscopic parasite is the organism that causes malaria of the dangerous form, the mosquito species that transmit this Plasmodium falciparum belongs to the Anopheles genus and is only transmitted by females of this specie.

Symptoms in an infected person begins 10 days to 4 weeks , a person may be ill as early as 7 days after infection though. This parasite immediately goes to the liver once it gains entrance into a person's body, it multiplies 10,000 times there in the liver, fourteen days after entrance, this parasite explodes into the blood stream where it starts infecting the red blood cells.

An infected person experiences fever, shivering, joint pain, headache, and vomiting. In severe cases, patients can have jaundice, kidney failure, and anemia, and can lapse into a coma. Malaria is preventable and curable. If not diagnosed and treated early, it can also be fatal

There is an estimate of about two hundred and fifty million cases of malaria every year and this leads to an approximate of one million deaths mostly in children of age five and below. In 109 countries, about three billion people are at risk of being infected.

Treated mosquito bed nets with long lasting insecticides includes the most preventive measure to avoid mosquitoes from biting and even kill these mosquitoes, using this same insecticides to spray walls of houses kills mosquitoes as such a preventive measure too. Using several anti malarial drugs is the most effective treatment of malaria, one of such drugs is a derivative of artemisinin. Using anti malaria drugs as a preventive treatment can also reduce the harmful effects of malaria on the mother as well as on the unborn child in the case of a pregnant woman.

There was a target by the World Health Organization (WHO) in 2005 to offer the services of malaria prevention and treatment by the year 2010 to greater than 80% of the people in need of these services, it was aimed at reducing at least by half the proportion of people who has fallen ill or dead due to malaria by 2010 and at least by three quarter by 2015 as against 2005.

Many organizations of international standards have set up objectives for large scale control of malaria. The pattern of malaria is important to study to see if these campaigns of malaria control are effective and to make improvements otherwise. It develops through four larval in starts to a short lived, motile pupa stage. The whole process form egg to emergence of the adult from the pupa takes little more than a week at tropical temperature. Soon after emergence the adults mate and the female goes in search of its first meal.

## **2. RESEARCH OBJECTIVES**

The objectives are to statistically analyse the reported cases of malaria and its extent of treatment in Parklane specialist hospital. The specific objectives include:

- To find out the extent at which malaria parasite spread among people in Enugu Urban Area in terms of gender.
- To find out the different malaria parasite symptoms, drugs currently in circulation and the most effective of them.
- To find out adopted prevention of malaria as well as the symptoms, diagnosis and treatment.
- To ascertain if there is a relationship between various times of the years and prevalence of the disease.

## **3. LITERATURE REVIEW**

Molecular genetics analyses of plasmodium falciparum (malaria) have led to the cloning and sequencing of a number of antigens that are potential candidates for vaccination against malaria.

The dynamics of malaria depends on the epidemiological condition of the area and drug susceptibility (Snow et al., 1997). Attempts have been made to assess in the course of endemic areas study the important of these antigens in the protection from malaria. There is this knowledge that children suffer more than the adults in areas with stable malaria and perennial transmission, this is as a result of immunity in age classes.

In Africa, every child experiences at least a clinical malaria attack yearly resulting in 200 million of malaria episodes per annum of which 4-6 million are complicated. It is not clear as to why only some children suffer very severe malaria. It is estimated that each malaria episode has a case fatality of 0.5 - 2% (Taylor and Molineux, 2002). In those who lack immunity, infection of malaria results to the most severe disease. As immunity takes time to develop after repeated exposure to infection, most of the burden of this disease is bore by children. There are other diseases that cause fever aside malaria, acute respiratory tract infection (ARI) is a common co-morbid condition (Dempsey et al., 1993). Again, there exist a relationship between hapato-splenomegaly and malaria strongly. The sequence of invasion is probably similar for all Plasmodium specie. The parasite must engage receptors (Chitnis 2001) on RBCs for binding and undergo apical reorientation (Dvorak et al 1975) junction formation (Aikawa et al 1978) and signaling. The parasite then induces a vacuole derived from the red blood cell (RBC) plasma membrane and enters the vacuole by a moving junction. Three organelles on the invasive end of parasites (rhoptries, micronemes, and dense granules) define the phylum Apicomplexa. Receptors for invasion of RBC by merozoites and for invasion of liver by sporozoites are found in micronemes (Adams et al 1990). In endemic countries like Africa, study has shown that malaria prevalence, based on parasitaemia or placental infection varies between 8.8 %– 36.2% in multigravidae and between 15.7 %– 64% in primigravidae. (Archibald, 1956, Cannon, 1958, Spitz 1959, Jelliffe, 1988, Bray and Anderson, 1979, McGregor, 1983, Stekete, 1988). It has also been shown that mean haemoglobin concentration is significantly higher in women with malaria parasite than without. The still birth rates are also higher in primigravidae (1.5%-10.6%) than multigravidae (0.9%-6.9%). However, it is interesting to note that malaria related maternal mortality, which is mostly due to severe anemia, is very low in epidemic situation (1.5-4.1%) (Wickramasuriya, 1937, Fullerton, 1962. In a research by Charold. (2009), it was found that there are four species of parasite that causes malaria in human, all member of the group plasmodium falciparium is the commonest of these species in tropical areas and it is primarily transmitted during the wet season. This species accounts for at least half of all clinical cases of malaria and probable death from the disease. Another specie is the plasmodium vivax which is most distributed parasite widely existing in tropical climate. Specie that can be found in tropical climate is the plasmodium malaria but is less common than plasmodium vivax. The specie plasmodium oval is relatively rare, it is restricted to tropical climate and found mostly in eastern Africa. Malaria is transmitted by mosquitoes of the germs anopheles; about 60 of the world's 390 species of anopheles mosquito are known to transmit the malaria parasite. Transmission of malaria starts right when mosquito bites an infected person and ingests blood that contains the parasite into the stomach of the mosquito, there is a development of

these parasites rapidly into mature male and female gametes fuse which produces a cell called zygote. In the liver cell different phase occurs; namely Exoerythrocytic phase, Dominant or hypnozoites phase, Erythrocytic phase and vector phase.

The intermittent fever that characterizes malaria is caused by the stage of this parasite's development. Charold, (1999). In fact since early roman times, long before scientist knew that malaria could be caused by four different species of parasites, people have distinguish different types of malaria by the frequency of the intermittent fever. Tertian malaria is the infections caused by plasmodium falciparium and plasmodium vivax, fever in this case occurs every 48 hours approximately. Malignant tertian malaria is the infection caused by plasmodium falciparium, fever in this case is severe and of high fatality rate, plasmodium falciparium malaria can also result in convulsions, severe headache and even cerebral malaria at times. plasmodium vivax causes the disease called benign tertian malaria(quart malaria), fever in this case occurs every 72c hours. It takes the duration of 7 to 21 days between a mosquito bite and the illness to start. Arua (1997), although, it takes a longer time to cause symptoms in some type of malaria parasite. Infection can also occur by blood transfusion, in this situation, the number of parasite in the transfusion determines the time the symptoms start. Mental confusion and cyclosis are sometimes encountered. Diagnoses is very important before treatment can also be administered; because other ailments also exhibits symptoms same as malaria. Diagnosis can be done in various ways, one of such diagnosis method is screening. The screening tool for malaria diagnosis is microscopic thick and thin blood smears examination. The thick smear examination detects the presence of any organism while the thin smear examination points out specifically the infecting plasmodium specie, both the thick and thin blood smear examination can be prepared on the same microscopic slide. (Bruce Chatt 1983)

#### **4. COLLECTION AND DATA PRESENTATION**

The data required for this study are monthly reported cases of malaria. It covers 2009 to 2015 with a total of eighty four data points. This hospital was chosen as a result of interest in the study of malaria in sub-urban areas where is claimed to be mostly prevalent. The hospital chosen for this research is parklane specialist hospital Enugu. This hospital is popular since most sick people in other hospitals in Enugu are normally referred to this hospital. Also in the case of emergency, it is a good decision to run this hospital. With all this in mind it is expected that data collected from this hospital is expected to be genuine and invariably yield a good and accurate result. The data was collected from records department of the hospital where the daily activities of the hospital were recorded.

##### **4.1 DATA ANALYSIS**

The data represented in table 1 shows the monthly figures of reported cases of malaria within seven years period (2009-2015). A close look at the data shows that malaria cases are spread all over the period. The value of the

data rises and declines at different intervals there by indicating the presence of seasonal influences. While table 2 shows the sex distribution of malaria case spread across same period as it is seen above in the table.

**4.2 REGRESSION ANALYSIS**

Any of scientific studies are directed to words discovering the form of relationships between variables and predicting the values of a variable form some functional relationship, which is one of the important areas of applied statistic. Regression analysis is a statistical tool usually employed in this respect. This is because its values are dependent on the values of the other variable called predictor variables. From the above points one can see that regression analysis is very useful as it provides a summary or reduction of observed data in order to explore and present the relationship between the dependent and independent variables in a data set. The simplest form, which involves only one independent variable, is called the simple linear regression. In this case the model describing the relationship between the dependent (Y) and independent variable (X) is expressed as:-  
 $Y = B_0 + B_1X$

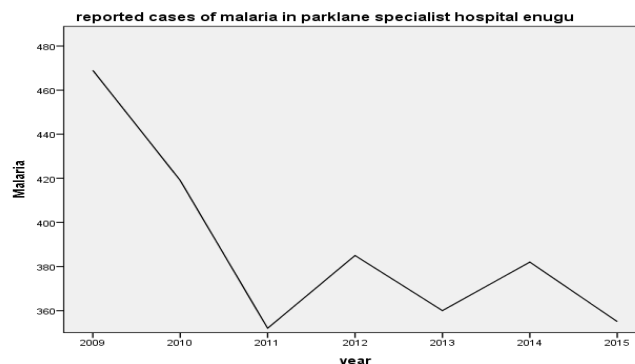
Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.744 <sup>a</sup>	.554	.465	30.938
a. Predictors: (Constant), year				

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5945.143	1	5945.143	6.211	.055 <sup>b</sup>
	Residual	4785.714	5	957.143		
	Total	10730.857	6			
a. Dependent Variable: Malaria						
b. Predictors: (Constant), year						

Coefficients <sup>a</sup>						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	447.14	26.15		17.10	.000
	year	-14.571	5.847	-.744	-2.492	.055
a. Dependent Variable: Malaria						

The regression equation is

Malaria = 447.14 – 14.57 Year



### 4.3 METHOD OF LEAST SQUARES

One of the methods usually employed to contain the desired line of fit is known as the method of least squares, and the line obtained is called the least squares line for each sample observations  $(X_i, Y_i)$  the method of least squares considers the deviation of each  $y_i$  from, its expected value., where  $B_i$  and  $B_o$  are given as:-

$$B_i = \frac{n \sum X_i Y_i - \sum X_i \sum Y_i}{n \sum X_i^2 - (\sum X_i)^2}$$

$$B_o = \frac{\sum Y_i}{n} - B_i \frac{\sum X_i}{n}$$

i.e.  $B_o = y - B_i x$

Where  $\bar{x}$  and  $\bar{y}$  are the means of X and Y variables respectively.

### 5. CONCLUSION

Based on the aims and objectives of this study the analysis carried out involving 2723 reported cases of malaria in Parklane specialist hospital within the period under study 2009-2015 yielded the following results. Out of the total number of 2723 reported patients, 1348 were males and 1375 were females. This shows the reported case for males is 49.50% against 50.49% for females from 2009-2015. The data exhibited all the traditional components of seasonal indices from the month March to September. One can see that these months belong to the period of rainfall which leads to water logged deposits, which increases breeding site. For mosquitoes to reproduce, this develops to adult and goes about spreading infection through bites. And this shows that some seasons favour malaria more than others. The negative linear trend of our data indicates the extent  $B_1$  decreases on the average of time variable increases. Thus the reduction in the number of reported cases of malaria patients for each unit change in various time of the year is 11.28%.

#### 5.1 RECOMMENDATION

From these findings, it is very obvious human being get infected with malaria through mosquitoes bite. It is hereby recommended that caution should be taken in preventing mosquito bite as well as reduce contact with mosquito indoors or outdoors as making use of insecticides in spraying living and sleeping areas should be encourage. It is finally recommend that since seasonality is obvious in this study, health authorities in charge with health control measures should ensure that chemicals like DDT or organophosphate for vector control are used in water logged area which mosquitoes can use as breeding site.

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## 7. TABLES AND FIGURES

Table 8.1: Reported Cases Of Malaria From 2009-2015

Month/Year	2009	2010	2011	2012	2013	2014	2015
January	21	25	30	29	18	19	33
February	32	36	21	19	28	30	19
March	38	40	28	18	20	17	20
April	42	20	30	35	24	37	29
May	50	48	35	29	40	47	38
June	70	58	49	62	52	39	47
July	61	57	45	70	38	63	55
August	75	38	29	50	63	48	39
September	30	42	18	21	19	30	21
October	19	25	30	17	28	14	18
November	15	19	23	15	18	21	19
December	16	11	14	20	12	18	17
Total	469	419	352	385	360	382	355

Source: parklane specialist hospital, enugu

The data above shows the total number of collected data on monthly reported cases of malaria from 2009 to 2015, from park-lane specialist hospital Enugu, Nigeria.



Table 8.2: Gender Distribution Of Malaria Cases From 2009-2015

Month/Year	2009		2010		2011		2012		2013		2014		2015	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
January	9	12	18	7	12	18	15	14	12	6	6	13	17	16
February	20	12	7	29	9	12	13	6	19	9	12	18	14	5
March	9	29	22	18	10	18	5	13	16	4	10	7	7	13
April	22	20	7	13	21	9	19	16	14	10	19	18	17	12
May	32	18	19	29	19	16	20	9	12	28	29	18	12	26
June	29	41	39	19	19	30	27	35	30	22	22	17	29	18
July	29	32	27	30	15	30	32	38	18	20	29	34	25	30
August	32	43	20	18	12	17	22	28	45	18	35	13	29	10
September	19	11	17	25	9	9	14	7	5	14	11	19	11	10
October	7	12	4	21	14	16	11	6	12	16	7	7	12	6
November	8	7	4	15	17	6	7	8	6	12	14	7	4	15
December	6	10	3	8	10	4	7	13	4	8	6	12	10	7

Source: parklane specialist hospital, enugu

Table 8.3: Calculation of Bo and Bi using the data in Table 1

Year-2009	X <sub>t</sub>	Y <sub>t</sub>	Xy	X <sup>2</sup> <sub>t</sub>	Y <sup>2</sup> <sub>t</sub>		Year-2011	X <sub>t</sub>	Y <sub>t</sub>	Xy	X <sup>2</sup> <sub>t</sub>	Y <sup>2</sup> <sub>t</sub>
Jan	1	21	21	1	441		Jan	25	30	750	625	900
Feb	2	32	64	4	1024		Feb	26	21	546	676	441
Mar	3	38	114	9	1444		Mar	27	28	756	729	784
April	4	42	168	16	1764		April	28	30	840	784	900
May	5	50	250	25	2500		May	29	35	1015	841	1225
Jun	6	70	420	36	4900		Jun	30	49	1470	900	2401
July	7	61	427	49	3721		July	31	45	1395	961	2025
Aug	8	75	600	64	5625		Aug	32	29	928	1024	841
Sep	9	30	270	81	900		Sep	33	18	594	1089	324
Oct	10	19	190	100	361		Oct	34	30	1020	1156	900
Nov	11	15	165	121	225		Nov	35	23	805	1225	529
Dec	12	16	192	144	256		Dec	36	14	504	1296	196

Year-2010	X <sub>t</sub>	Y <sub>t</sub>	Xy	X <sup>2</sup> <sub>t</sub>	Y <sup>2</sup> <sub>t</sub>		Year-2012	X <sub>t</sub>	Y <sub>t</sub>	Xy	X <sup>2</sup> <sub>t</sub>	Y <sup>2</sup> <sub>t</sub>
Jan	13	25	325	169	625		Jan	37	29	1073	1369	841
Feb	14	36	504	196	1296		Feb	38	19	722	1444	361
Mar	15	40	600	225	1600		Mar	39	18	702	1521	324
April	16	20	320	256	400		April	30	45	1400	1600	1225
May	17	48	816	289	2304		May	41	29	1189	1681	841
Jun	18	58	1044	324	3369		Jun	42	62	2604	1764	3844
July	19	57	1083	361	3249		July	43	70	3010	1849	4900
Aug	20	38	760	400	1444		Aug	44	50	2200	1936	2500
Sep	21	42	882	441	1764		Sep	45	21	945	2025	441
Oct	22	25	550	484	625		Oct	46	17	782	2116	289
Nov	23	19	437	529	361		Nov	47	15	705	2209	225
Dec	24	11	264	576	121		Dec	48	20	960	2304	400

Year-2013	X <sub>t</sub>	Y <sub>t</sub>	Xy	X <sup>2</sup> <sub>t</sub>	Y <sup>2</sup> <sub>t</sub>		Year-2015	X <sub>t</sub>	Y <sub>t</sub>	Xy	X <sup>2</sup> <sub>t</sub>	Y <sup>2</sup> <sub>t</sub>
Jan	49	18	882	2401	324		Jan	73	33	2409	5329	1089
Feb	50	28	1400	2500	784		Feb	74	19	1406	5476	361
Mar	51	20	1020	2601	400		Mar	75	20	1500	5625	400
April	52	24	1248	2704	576		April	76	29	2204	5776	841
May	53	40	2120	2809	1600		May	77	38	2926	5929	1444
Jun	54	52	2808	2916	2704		Jun	78	47	3666	6084	2209
July	55	38	2090	3025	1444		July	79	55	4345	6241	3025
Aug	56	63	3528	3136	3969		Aug	80	39	3120	6400	1521
Sep	57	19	1083	3249	361		Sep	18	21	1701	6561	144
Oct	58	28	1624	3364	784		Oct	82	18	1476	6724	324
Nov	59	18	1062	3481	324		Nov	83	19	1577	6889	361
Dec	60	12	720	3600	144		Dec	84	17	1428	7056	289

Year- 2014	X <sub>t</sub>	Y <sub>t</sub>	Xy	X <sup>2</sup> <sub>t</sub>	Y <sup>2</sup> <sub>t</sub>
Jan	61	19	1159	3721	361
Feb	62	30	1860	3844	900
Mar	63	17	1071	3969	289
April	64	37	2368	4096	1369
May	65	47	3055	4225	2209
Jun	66	39	2574	4356	1521
July	67	63	4221	4489	3969
Aug	68	48	3264	4624	2304
Sep	69	30	2070	4761	900
Oct	70	14	980	4900	196
Nov	71	21	1491	5041	441
Dec	72	18	1296	5184	324

Source: parklane specialist hospital, enugu