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Impact of Malaria on Households Productivity in Adamawa State of Nigeria: A Case Study of Adamawa Central Senatorial Zone

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Abstract

The study examines the impact of malaria on household's productivity in Adamawa state of Nigeria, a case study of Adamawa central senatorial zone. The study is cross-sectional in nature. Data for the study was sourced through the administration of structured questionnaires designed in five (5) Likert scales. A sample of 400 respondents were determined using Taro Yamani formula. Out of which 350 were returned for the analysis. The study employs both descriptive and inferential statistics in the form of Ordered logistic regression in analysing the effect of Adult deaths caused by malaria, malaria infected persons, and cost of treating malaria on households' productivity. Findings show that there is a negative relationship between infected malaria persons, adult deaths cause by malaria and household's productivity. Also, infected malaria persons, adult death cause by malaria is found to be statistically significant in affecting the productivity of households. On the other hand, cost of treating malaria was found to be significantly and positively related to household's productivity. The study recommends that government and other international partners should give more attention to the menace of malaria in the study area by providing vaccines and equipping rural hospitals so as to eradicate the disease in order to improve productivity of household in Adamawa Central Senatorial Zone and Nigeria at large.

Keywords: household productivity, malaria, health expenditure, ordered log it regression
JEL classification: *J00, I00, E20, CO1*

Contribution to/Originality Knowledge
The paper contributes to the existing literature on the impact of malaria on household's productivity in Adamawa Central Senatorial Zone. It is also one of the very few studies that look at the devastating impact of malaria on the productivity of households and on economic growth at large.

1.0 Introduction

Health is an essential requirement for better quality of life, social and economic development to both firms, government and the households. It implies both social, mental and physical wellbeing of the economic agents. Basically, it is obvious that an unhealthy population affects the workforce, increases health expenditure reduces output growth partly because substantial proportion of resources that could have been used for investments would be diverted to combating and preventing diseases. The real correlation between malaria and poverty has been recognised for many centuries (Jurg and Mercel, 2013).

In developing countries like Nigeria, the impact of malaria on human health, productivity of the household and the human development is low compared to developed economies. Malaria is the most prevalent tropical disease identified as health threat to more than 40% of the world's population and out of which more than 300 million acute cases each year between 1.1 and 2.7 million people die (WHO,

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2015). More than 90% of the world malaria is identified in the Sub-Saharan Africa constituting about 10% of the total disease burden and plasmodium falciparum remains the main cause of severe clinical malaria infection and deaths recorded. It is obvious that the largest labour employer is agriculture in Nigeria particularly in the rural area. In addition to health care costs, malaria causes loss of agricultural labour and slows adoption of improved practices in agriculture (Kwadwo, Felix, Jifar and Kwaw 2010).

According to WHO (2020) in World Malaria Report Geneva, malaria is a leading cause of illness and deaths in Nigeria, having the highest malaria burden in the world. In 2019, the country recorded over 61 million cases of malaria, an increase of 2.4 million compared to 2018 and 95,000 deaths attributable to menace of malaria.

Adamawa state is one of the states affected by insurgency in the North Eastern Nigeria. As a result of the activities of the insurgency in the parts of the state, nearly half (46%) of one thousand one hundred and twenty (1120) health facilities provided by World Health Organization (WHO) under Health Resources and Mapping System (HERAMS) are fully or partially damaged; and thus resulting to weakening of the health care delivery services. In 2017 according to WHO (2018) malaria accounts for 70% which is equivalent to about 850,000 cases of reported fever in Adamawa state; most of the effected people were women and children, hence, a Seasonal Malaria Chemoprevention campaign targeted children at high risk locations like Yola North, Yola South Fufore, Girei, Song, Gombi and Hong and some local governments like Mubi, Michika, Madagali and Maiha. The use of seasonal malaria chemoprevention preventive strategy was successful during the first implementation in Borno state in 2017 with impressive result.

However, the burden and effects of malaria on households' productivity in the world especially in developing countries, like Nigeria identified to be the most vulnerable to malaria infection due to high poverty rate and environmental issues leaving such countries with a lot of deaths that consequently lead to low productivity and cuts down the income of households from rent, wages, interest and profit is of great concern. These drawbacks call the attention of many researchers such as; Adebayo, Olagunju, and Adewuyi (2015) that examined the impact of malaria on the productivity of arable crop farmers and further estimate the cost implication of malaria (direct and Indirect) in some Nigerian rural communities. The findings of the study revealed that, malaria prevalence, household size, farming experience and cost of malaria treatment were significant factors that influenced crop productivity in the study area. Similarly, Gunda, Shamu, Chimbari and Mukaratirwa (2017) examined the economic burden of malaria on rural households in Gwanda district, Zimbabwe. Retrospective analysis of secondary data and a cross-sectional household survey were utilized to estimate the household economic burden of malaria, the result of this empirical study showed that households spent an average of $3.22 and $56.60 for managing an uncomplicated and a complicated malaria episode respectively. A household lost an average of eight productive working days per each malaria episode resulting in an average loss of 24% of the monthly household income. An estimated 35%, mostly poorer households suffered catastrophic health expenditures. Malaria imposes significant economic burdens particularly on the poorer and vulnerable households.

In light with the literatures reviewed, it is clear that most of the previous studies focused on the economic burden of malaria, its impact on economic growth, and cost of treating malaria with little attention given to the effect of malaria on households' productivity particularly in Adamawa state. In addition to that, there are very few studies conducted on the impact of malaria on households' productivity in Adamawa state from the previous literatures considering the importance of household's productivity with regards to malaria. Hence, the main objective of this study is to examine the impact of malaria on household's productivity in Adamawa Central Senatorial Zone.

2.0 Literature Review

2.1 Concept of Malaria

According to WHO (2016) malaria is Derived from the Italian word for "bad air," it was originally thought that swamp fumes in Rome was the cause of malaria, as outbreaks were regularly occurring. Conceptually, Malaria is a life-threatening blood disease caused by parasites transmitted to humans through the bite of the Anopheles mosquito. Once an infected mosquito bites a human and transmits the parasites, those parasites multiply in the host's liver before infecting and destroying red blood cells. The disease can be controlled and treated if diagnosed early on. Unfortunately, this is not possible in some areas of the world lacking medical facilities where malaria outbreaks can occur. Researchers are working hard on improving the prevention of malarial infection, early diagnosis and treatment, with just one malaria vaccine close to being licensed so far. Here are some key facts on malaria:

2.1.1 Some Key Facts On Malaria Worldwide

Malaria was first identified in 1880 as a disease caused by parasitic infection, the name of the disease comes from the Italian word malaria, meaning "bad air". Malaria is transmitted to humans through bites by infected mosquitoes and the most common time for these mosquitoes to be active is between dusk and dawn. Worldwide, there were an estimated 198 million cases of malaria in 2013 and 584,000 deaths. Malaria occurs mostly in poor, tropical and subtropical areas of the world. Malaria was eliminated from the US in the early 1950s, but the mosquitos that carry and transmit the malaria parasite still remain, creating a constant risk of reintroduction. Reported malaria cases in the US reached a 40-year high of 1,925 in 2011. A malaria vaccine for humans is close to being approved for use in Europe with estimated of 3.4 billion people in 106 countries and territories are at risk of malaria - nearly half of the world's population. Annual funding for malaria control in 2013 was three times the amount spent in 2005, yet it represented only 53% of global funding needs. Malaria incidence rates are estimated to have fallen by 30% globally between 2000 and 2013 while estimated mortality rates fell by 47%. The World Health Organization (WHO) has set out to reduce all malaria cases and deaths by 90% by 2030.Malaria can kill within 24 hours of symptom onset. There were 212 million new cases of malaria worldwide in 2015, with 90% of these cases occurring in the Africa Region. In 2015, there were an estimated 429,000 malaria deaths worldwide, with 92% of these deaths occurring in Africa. Children under five are particularly susceptible to malaria illness, infection and death. In 2015, malaria killed an estimated 303 000 under-fives globally, including 292 000 children in the African Region. In 2015, it is estimated that 13 countries accounted for 75% of malaria deaths. The global burden of mortality is dominated by countries in sub-Saharan Africa, with Democratic Republic of the Congo and Nigeria together accounting for more than 36% of the global total of estimated malaria deaths. Four countries accounted for 81% of estimated deaths due to *P. vivax* malaria (Ethiopia, India, Indonesia and Pakistan).Nigeria contributes the highest burden to global malaria morbidity and deaths. 25% of global malaria cases; about 30% of global malaria deaths (WMR, 2016).

Moreover, WMR (2016) reveals that worldwide Malaria affects 3.3 billion people, or half of the world's population, in106 countries and territories. WHO estimates 216 million cases of malaria occurred in 2010, 81% in the African region. WHO estimates there were 655,000 malaria deaths in 2010, 91% in the African Region, and 86% were children under 5 years of age. Malaria is the 3rd leading cause of death for children under five years worldwide, after pneumonia and diarrheal disease. It was also found that in Africa as of 2016, thirty countries in Sub-Saharan Africa account for 90% of global malaria deaths. Nigeria, Democratic Republic of Congo (DRC), Ethiopia, and Uganda account for nearly 50% of the global malaria deaths. According to the report malaria is the 2nd leading cause of death from infectious diseases in Africa, after HIV/AIDS. Almost 1 out of 5 deaths of children under 5 in Africa

are due to malaria. The report also maintained that malaria in Nigeria is a major public health problem where it accounts for more cases and deaths than any other country in the world. Malaria is a risk for 97% of Nigeria's population. The remaining 3% of the population live in the malaria free highlands. There are estimated 100 million malaria cases with over 300,000 deaths per year in Nigeria compare to 215,000 deaths per year in Nigeria from HIV/AIDS. Malaria contributes to an estimated 11% of maternal mortality. Malaria accounts for 60% of outpatient visits and 30% of hospitalizations among children under five years of age in Nigeria. Malaria has the greatest prevalence, close to 50%, in children age 6-59 months in the South West, North Central, and North West regions. Malaria has the least prevalence, 27.6 percent, in children age 6 to 59 months in the South East region.

2.2 Theoretical literature

2.2.1 The Solow Neoclassical Growth Model:

This theory is an alternative to Harrod-Domar model line of thought without its crucial assumption of fixed proportion in production. He postulates a continuous production function linking output to the inputs of capital and labour which are substitutable. In the process, it assumes that there are diminishing returns to the use of these inputs. The aggregate production function, Y=f(K,L) is assumed characterised by constant return to scale, for example, in the special cases of Cobb-Douglas production function , at any time t we have Y(t)=K(t){A(t)L(t). where Y is gross domestic product, K is the stock of capital(which may include human capital, physical capital etc.), L is labour, and A(t) represents the productivity of labour, which grows over time at an exogenous rate. Because of constant returns to scale, if all inputs are increase by the same amount then output will increase by the same amount, that is $yY = f(yK, yL)y$, here y is some positive amount. This implies that the Generalised Cobb-Douglas production is open to the possibility of constant return to scale it becomes Solow-type models. On the other hand, if the model admits the possibility of constant or increase in return to capital it refers to Romer (1987) endogenous growth model which addresses technological spill-overs that may be present in the process of industrialization.

2.2.2 Neoclassical Growth Theory

Neoclassical growth theory is an economic theory that outlines how a steady economic growth rate can be accomplished with the proper amount of the three driving forces: labour, capital and technology. The theory states that by varying the amounts of labour and capital in the production function, an equilibrium state can be accomplished. The theory also argues that technological change has a major influence on an economy, and that economic growth cannot continue without advances in technology. Neoclassical growth theory starts by outlining the three factors necessary for a growing economy, and it champions the idea that a temporary equilibrium and growth can be achieved with the right allocation mix of the three factors.

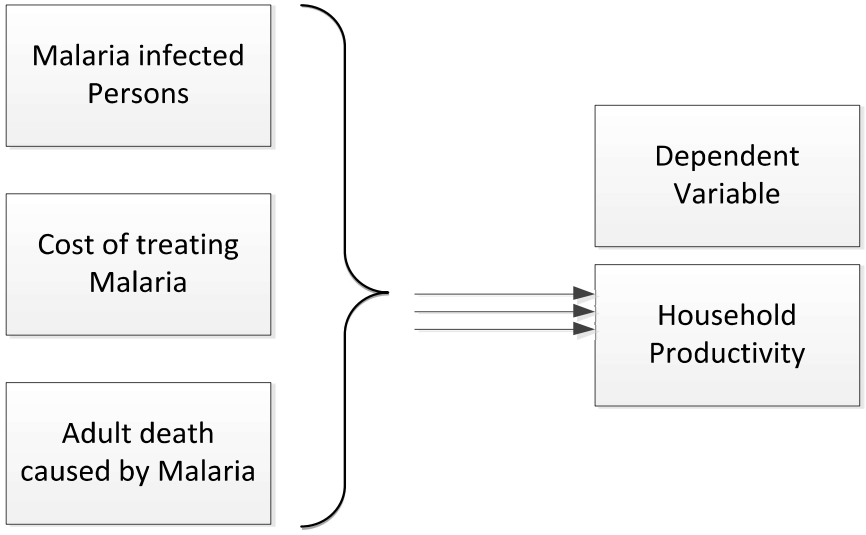
However, neoclassical growth theory makes it clear that temporary equilibrium is different from long-term equilibrium, which is achieved without any of the three factors needed for short-term growth. The neoclassical growth theory is based on the understanding that the accumulation of capital within an economy, and the ways in which people use that capital, is important for economic growth. Further, the relationship between the capital and labour of an economy determines its output. Finally, technology is thought to augment labour productivity in such a way that it increases the output capabilities of labour. In this regards, the production function of neoclassical growth theory is used to measure the growth and equilibrium of an economy, and is depicted as: Y = AF (K, L). "Y" denotes an economy's gross domestic product (GDP); "K" represents its share of capital; "L" describes the amount of unskilled labour in an economy; and "A" represents a determinant level of technology. However, due to the relationship between labour and technology, an economy's production function is often re-written as: Y = F (K,

AL).Increasing any one of these inputs allows a person to see how it would affect the GDP, and therefore the equilibrium, of an economy. However, it's important to note that the three factors of neoclassical growth theory are not all equal. The returns of both unskilled labour and capital on an economy are diminishing. That means that increases in these two inputs have exponentially decreasing returns. Technology, on the other hand, is boundless in the growth it can add and output it can produce. If, for example, an industrial economy relies on physical labour to produce its output, it is capped at the amount of jobs available and the amount of workers within the economy. With technology, these caps are non-existent, and it's possible to realize exponentially high growth and high equilibrium.

2.3 Conceptual Framework

Conceptual frame work for this study was formulated to show the relationship between dependent and independent variable of the study. For the purpose of this study households productivity is dependent variable. While independent variable is Malaria which is proxy by Malaria infected persons, cost of treating malaria and death cause by malaria and this can be seen from figure 2.3.1 below.

Figure 2.3.1: Independent Variable [Malaria]



Source: Designed by Authors

2.4 Empirical Literature

Olawulana and Ogususi (2020) implore the impact of malaria on the productivity among SMEs in Ogun state, Nigeria a cross-sectional research. A sample of 200 SMEs was selected using multi stage sampling techniques. The data collected for the study were analysed using correlation analysis. The findings from the study discovered that malaria impacted negatively on the productivity of SMEs in Ogun state.

In another study by Funke (2020) examining economic burden of malaria in Kenya. The study used scoping of literature. The data collected were analysed using descriptive statistics. The results from the study shows that malaria constitute significant economic burden particularly incurring huge sum of money in cost of malaria treatment

Peter (2017). Empirically examines the relationship between government health expenditure and malaria in Nigeria from period 1990 to 2013. Employing the techniques of cointegration and error correction model, the empirical results reveal that government health expenditure particularly when employed judiciously is significant in reducing malaria deaths in Nigeria.

Abiodun and Oyekale (2013) examined the effect of malaria morbidity and associated incapacitation on the welfare of farming households. Multi-stage random sampling procedure was used for sampling 120 farming households and data were analysed using both descriptive and multiple regression techniques. Their results showed that increase in age of farmers and food expenditure significantly reduced households' income, while farm size, non-food expenditure, total income lost due to malaria and travelling time increased it ($p<0.10$

Adebayo, et al (2015).examine the impact of malaria on the productivity of arable crop farmers and further estimate the cost implication of malaria (direct and Indirect) in rural Nigeria. Data were collected from a random sample of 91 crop farmers through the use of a well- structured questionnaire. The data were analysed using descriptive statistics and multiple linear regression. Their findings reveals that, the household heads are largely had primary education. Specifically, malaria prevalence, household size, farming experience and cost of malaria treatment were significant factors that influenced crop productivity in the study area.

Gunda, et al (2017) examine the Economic burden of malaria on rural households in Gwanda district, Zimbabwe. Using retrospective analysis of secondary data and a cross-sectional household survey were conducted to estimate the household economic burden of malaria. The study showed that Malaria imposes significant economic burdens particularly on the poorer and vulnerable households. Although there are no user fees at rural clinics, households incur other costs to manage a malaria patient. These costs are far worse for complication.

Gupta and Chowdhury (2014) estimated the economic burden of malaria in India, Using a nationally representative sample, by applying the cost-of-illness approach, using the information on cost of treatment, days lost and earnings foregone, from the National Sample Survey data. Their results indicate that the total economic burden from malaria in India could be around US$ 1940 million. The major burden comes from lost earnings (75%), while 24% comes from treatment costs. Since mortality is low, this is not a major source of economic burden of malaria. An analysis of the trend and patterns in public expenditure by the National Vector Borne Disease Control Programme shows a declining focus of the central government on vector-borne diseases. Also, allocation of financial resources among states does not reflect the burden of malaria, the major vector-borne disease in the country.

Nyiatagher, Umeh, and Ocholi (2015) Analyze the effects of malaria on households' consumption in North-Central Nigeria. A multistage sampling technique was used to collect data from 600 houses affected with malaria in North-Central Nigeria. Descriptive statistics and household expenditure models were used for the analysis. Their study found that only 39.0% of the households in the study area had three meals per day during the period of malaria attack compared to 61.7% before malaria attack. The test of hypothesis at 5% level of significance revealed that the adjustments strategies adopted by households affected with malaria in the study area significantly smooth household consumption.

At the micro level, Olalekan and Nurudeen(2013) traced the impact of health spending on malaria reduction, using private direct costs (PDC) and private indirect cost (PIC) of malaria attack per episode approach to examine the trend of malaria burden and the effectiveness of malaria control measures using Asa Local Government Area of Kwara State as a case study. The research findings indicated that 37 percent of the population of the studied sample suffered malaria attack with a dependency ratio of 33percentage. An average of about 3 days are lost by sick adult, about 2 days by the caretaker while on the average a sick student misses about 2 school days.

Alaba and Olufunke (2010) using cost of illness approach, examines the impact of malaria on households' income and national income and welfare. The outcome of this analysis suggests that incidence of malaria in rural sector alone reduced Oyo State's aggregate domestic income by about 10 per cent. Considering the positions of the component states that makes up the entity called Nigeria, in actualizing the bottom-up approach to development and attainment of the MDGs, similar trend in all States of the federation may spell doom for the Nigerian economy. Also, if we extend our analysis to other sectors of the economy the impact may have more significant effect on revenue profile, and by implication the means by which the government is able to fulfil her responsibility status and thus meeting the set target relating to the MDGs.

2.5 Literature Gap

Having reviewed a number of literatures it was found that most of the previous studies focused on economic burden of malaria; prevalence of malaria infection among pregnant women; its impact on economic growth with less attention given to the effect of malaria on household productivity particularly in Adamawa central. In addition to that, the methodology and techniques of analysis used by the previous studies cited above are chi- squares and binary models and these are not sufficient enough to capture the effect of malaria on household productivity. Hence these study considers the need to use logit regression analysis as an improve techniques because it's a powerful statistical method that allows the examination of the relationship between two or more variables of interest and the techniques provides satisfactory results for estimates of structural parameters (Gujarati, 1995). It depends on whether the parameters are statistically significant and theoretically meaningful than chi- square and binary models used by the previous studies. Hence, this study seeks to fill the gap by examining the impact of malaria on households' productivity in Adamawa Central Senatorial Zone.

3.0 Methodology

3.1 Study Area

Adamawa is a state in North-Eastern Nigeria, with its capital at Yola. It was formed in 1991 from part of Gongola State with four administrative divisions namely: Adamawa, Ganye, Mubi and Numan. It is one of the thirty-six (36) States which constitute the Federal Republic of Nigeria. Adamawa is one of the largest states and occupies about 36,917 square kilometres. With population of 3,737,223 (Census, 2005) and GDP of $ 4.58 Billion (source, please?). It shares bordered with the Borno state to the northwest, Gombe to the west and Taraba to the southwest. Its eastern border also forms the national eastern border with Cameroon. Topographically, it is a mountainous land crossed by the large river valleys - Benue, Gongola and Yedsarem. The valleys of Cameroon, Mandara and Adamawa mountains form part of the landscape. The major occupation of the people in the state is farming as reflected in their two notable vegetation zones, tile Sub-Sudan and Northern Guinea Savannah Zone. Their cash crops are cotton and groundnuts while food crops include maize, yam, cassava, guinea corn, millet and rice. The village communities living on the banks of the rivers engage in fishing while the Fulanis are cattle rearers. The state has network of roads linking all parts of the country. There are twenty-one Local Government Areas (LGAs):Fufore, Ganye, Madagali, Demsa, Guyuk, Hong, Jada, Shelleng, Maiha, Micika, Mubi North, Mubi South, NumanGirei, Toungo, LamurdeYola North, Yola South, Song, Gombi, Mayo Belwa.

3.2 Sources and Instrument for Data Collection

This study utilized primary source of data. The instrument of data collection was structred questionnaires that were administered to 400 respondents in the study area using. Likert five point scales ranging from 1-5(5=strongly agree,4= agree, 3=undecided, 2= disagree and 1 =strongly disagree) were used as a basis of the questions.

3.3 Population and sample Size

The population for this study are number of people infected with malaria from households of selected local government (Gombi 2000 households, Yola North 1800 households , Yola South 2000 households , Song 1350 households, Girei 1630 households, Fufore 1857 households) in Central Senatorial Zone. The total number of people infected with malaria of households in those Local Government Areas is 10637(Adamawa state Ministry of Health.). However, to get the sample out of the population of study, Yaro Yamane (Yamane, 1973) formula was taken into consideration. Confidence level of 95% and 5% sampling error was considered. This formula is used: $n= N/(1+Ne^2)$. Where, n = Sample size or respondents for this research, N = A population size, E = the level of precision (A 95% confidence level or 5% precision level was assumed). Thus, the sample size is calculated as follows:

$$n = 10637/ (1+10637(0.05)^2)$$

$$n= 386$$

In this regard, the sample size of 386 was drawn from the total population of study of 10637 of some selected Local Government Areas and these are Gombi,Song, Girei, Yola North, Yola South, Fufore, which will be use in collecting the information needed for the study.

3.4 Method of Data Analysis

This study used both descriptive and inferential statistics in analysing the impact of malaria on the productivity of households in Yola Central Senatorial Zone. Descriptive in the form of percentages and tables while inferential in the form of ordered logistic regression.

3.4.1 Model Specification

The specification of econometric model is always based on economic theory or any available information relating to the phenomena being studied (Gujarati, 1995). Hence, the model for this study is based on Solow's neoclassical growth Model. Ordered logistic regression model is used in order to study the impact of malaria on households' productivity in Adamawa State. Malaria is used proxy as infected malaria persons, cost of treating malaria and number of Adult death caused by malaria. Malaria has been regressed on household's productivity. The functional form of ordered logistic regression is expressed as:

$$Log\left\{\frac{\Pr(MMRT)}{1-\Pr(MMRT)}\right\} = \alpha_i + \sum \beta_1 X_i + \mu_i$$

Where:

Pr (MMRT) is the probability for the household's productivity occurring

1-Pr (MMRT) is the probability for household's productivity not occurring

β s are the coefficients the regressors

μ is the error term

For estimable purpose, the econometric model is specified as follows:

$$HPRDV = \beta_0 + \beta_1 IMP + \beta_2 CTM + \beta_3 ADCM + e \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where: HPRDV = Household's productivity, IMP = Infected malaria persons, CTM = cost of treating malaria, ADCM = Adult death cause by malaria, β_0= intercept, β_1, = coefficients of independent variable, e = error term.

A-Priori Expectations

$\beta_0, \beta_1\beta_3 < 0, \beta_2 > 0$

Which assumes that the parameter estimates of β_0, $\beta_1\beta_2\beta_3$ are theoretically meaningful and that there is a direct relationship between dependent variable and the independent variables.

Definit3333ion and variables measurement

- **i)** Household's productivity (HPRDV): the productivity of the households in this study is measured and determine by income and expenditure of the households.
- **ii)** Infected malaria persons (IMP): infected malaria persons is determine and measured by annual number of people that were infected by malaria in the selected study area.
- **iii)** cost of treating malaria(CTM): it is measured and determined by the expenditure incurred on purchase of malaria vaccines and drugs.
- **iv)** Adult death cause by malaria (ADCM): this is measured and determined by the record of the people that were death as a result of malaria in a study area.

4.0. Results and Discussion

Table 4.1: Ordered logistic regression results (Coefficients)

Variables	Coefficients	Std. Err.	Z value	Prob. Value	Confidence interval 95%
IMP	-0.46577	0.1200607	-3.86	0.000***	-0.70109
CTM	0.4774776	0.2469046	-1.93	0.0503**	-0.9614021
ADCM	-0.5351095	0.287155	-2.56	0.000***	0.9441841
Number of obs= 350					
Pro> 0.000					
Pseudo R2= 0.4680					

Source: Authors' computation. Note *** significant at 1% and **significant at 5% level

From the results in table 4.1 , infected malaria persons is negative and significant at 1% level of significance, which is in line with the a priori expectation. Therefore, the hypothesis suggesting that malaria infection affects household productivity negatively is accepted. Also, adult death cause by malaria was found to be negative and significant at 1% level of significance, indicating that there exist a relationship between household's productivity and adult death caused by malaria respectively. In contrast, the coefficient of cost of treating malaria is positive and significant at 5% level of significance which implies that cost of treating malaria is more likely to impact positively on household's productivity. These findings concurs with the finding of Gunda (2017) whose finding revealed that malaria significantly imposed economic burden especially poor households and vulnerable. It is also in line with that of Adebayo (2015) whose finding showed that cost of treating malaria significantly affects household's disposable. The likelihood Ration (LR) Chi2 value is 0.0000, which is significant at 1% level of significance, suggesting that model used is adequate and fit.

Table 4.2: Ordered logistic regression results (marginal effects)

Variables	Coefficients	Std Err.	Z	Pro. value	Confidence interval 95%
IMP	-0.1085604	0.2784	3.90	0.000***	0.163986
CTM	0.1112876	0.0575	1.94	0.0503**	0.001406
ADCM	-.01247210	0.4858	2.57	0.000***	0.029506
Number of obs= 350					
Pro> chi2 = 0.000					
Pseudo R2= 0.4680					

Source: Authors' computation. Note *** significant at 1% and **significant at 5% level

Table 4.2 shows a chi2 probability value of 0.000, which is significant at 1% level, indicating that the variables used in the model are significant in explaining the impact of malaria on household' productivity in Yola Central. The Pseudo R2 (0.4680) is also given which is fit. The likelihood (75.980) is also given.

From the table, infected malaria person had a negative impact on household's productivity whereby a unit increase in infected malaria person will reduce the probability of household productivity by 0.1086 units. Adult death caused by malaria had negative impact on household's productivity in that a unit increase in adult death caused by malaria will decrease the probability of household productivity by 0.1247 units. Cost of treating malaria is significant and had positive impact on household productivity whereby a unit increase in cost of treating malaria will increase the probability of household productivity by 0.1117 units.

Table 4.3 Reliability Statistics

Cronbach's Alpha	N of Items
.762	350

Reliability tests is carried out to know whether the model and the questions set as yardstick for measurement of variable are reliable and can be used for policy purpose. From our analysis the result of the reliability test in table 4.3, Cronbach's Alpha is found to be greater than 0.70 as indicated by Cronbach's Alpha of 0.762, hence, model is reliable and can be used for making inferences.

5.0 Conclusion and Recommendations

On the basis of findings of this study, this study concludes that infected malaria persons, cost of treating malaria and adult deaths caused by malaria significantly impacted negative on the productivity of households in Adamawa Central Senatorial Zone, thereby affecting the economic growth of Adamawa state in particular and Nigeria at large. The study recommends the Nigerian government and Adamawa state government should invest more on the menace of malaria by providing vaccines at cheaper rate and equipping the hospitals in the rural and urban areas of Adamawa Central Senatorial Zone in order to reduce the cost of treating malaria which in turn improves the household's productivity within the zone. Also, awareness and campaign on mode of infection, spread and cure of malaria should be put in place by experts in order reduce the number of infected persons by malaria so as to improve households productivity. While death among adult caused by malaria need to be addressed because adults population is the main driver of an economy, hence the death among them need to be curtailed so as to improve their productivity in general.

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Appendix 1

Questionnaire

Section A: Personal Data

(Please tick the correct alternative which best suits your response to each of the questions).

1. Sex: (a) Male ( ) (b) female ( )
2. Age: (a) Below 20 ( ) (b) 20-30 ( ) (c) 31-40 ( ) (d) 41 and above ( ).
3. Marital status: (a) Single ( ) (b) Married ( ) (c) Divorced ( ) (d) Widowed ( ) (e) Separated ( )
4. Educational Qualification: (a) WASC/GCE ( ) (b) OND/NCE ( ) (c) HND/B.SC ( ) (d) Post-graduate Degree ( ) (e) Professional qualification ( ) (f) others ( )

5. Salary/Income scale: (a) No Salary ( ) (b) N50,000 and below ( ) (c) N51,000 - N100,000 ( ) (d) N101, 000 - N200,000 ( ) (e) Above N200,000

Section B: **Economic factors**

Section B.

This section is based on the 5pointLinkert scale (SA= strongly agree, A= Agree, U= Undecided, D= disagree, SD= strongly disagree), Respondent is require to tick one option.

S/N	ITEMS	SA	A	U	D	SD
	EFFECT OF NUMBER OF ADULT DEATH CAUSE BY MALARIA ON PRODUCTIVITY OF THE HOUSEHOLDS IN ADAMAWA STATE.					
1	Malaria has caused a lot of death among children leading to decrease in Population in Adamawa Central.					
2.	The number of Death Caused by Malaria decrease labor force in AdamawaCentral.					
3.	Malaria prevalence decreases income and productivity of the households in Adamawa Central.					
4.	Most malaria cases are more prevalence in the rural areas of AdamawaCentral.					
5.	Mental and Intellectual ability of adult and Children towatds improved productivity is always hindered by malaria in AdamawaCentral.					
	IMPACT OF INFECTED MALARIA PERSON'S ON HOUSEHOLD PRODUCTIVITY IN ADAMAWA STATE.					
1.	Malaria infection is more prevalent among adult Persons					
2.	Malaria infection is more prevalent among children					
3.	Malaria infection is more prevalent among pregnant woman					

4.	Malaria infection is more prevalent in the Riverine or Marshy Areas in AdamawaCentral.					
5	Prevalence of Malaria among adult reduce the rate of Agricultural Output.					
	EFFECT OF COST OF TREATING MALARIA ON HOUSEHOLDS' PRODUCTIVITY IN ADAMAWA STATE.					
1	High Cost of Malaria treatment has effect on the Income of Households in Adamawa central.					
2	Recent changes in the cost of Malaria treatment reduced Income and Productivity in Adamawa Central.					
3	Traditional ways of treating malaria leads to children and pregnant women death in the Rural Area of Adamawa central.					
4	High Cost of Treating Malaria has impact on Infant Mortality Rate in Adamawa central.					
5	High Cost of Treating Malaria has impact on Maternal Mortality Rate in Adamawa Central.					
	HOUSEHOLDS' PRODUCTIVITY					
1	Expenditure on medical treatment of malaria has effect on the Households Disposable Income in Adamawa Central.					
2	Malaria Decreases the Number of Labour Participation Rate in Adamawa Central.					
3	The Prevalence of Malaria in the Rural Areas Leads to low Output of Agricultural Products in Adamawa Central.					