# Effect of Workdays Lost to Presumptive Malaria on Households' Poverty Status among Food Crop Farming Households in Rural South West, Nigeria

**BY**

*Adekanye J.O, Adeoti A. I, Adepoju A.O and Awoyemi T.T
Department of Agricultural Economics
University of Ibadan, Ibadan.
*Corresponding Author: drjamesadekanye2020@gmail.com

***ABSTRACT***

*This study examined the influence of Workdays Lost to Presumptive Malaria (WLPM) on poverty status of Food Crop Farming Households (FCFHs) in rural South West, Nigeria. The primary data were collected with well-structured questionnaire administered on 395 FCFHs randomly selected using multistage sampling technique. Data were analysed using descriptive statistics, Foster-Greer-Thorbecke and two stage probit least square regression model at $\alpha_{0.05}$. The results show that 88.6% of the households were male-headed, age was 56.41 ±9.34 years. Years of schooling and farming experience were 4.80±4.65 and 29.53 ±10.78, respectively. Only 37.2%, 45.1% and 24.6% have access to electricity, extension services and agricultural credit, respectively. The annual farm income was ₦452,711.70±153,704.70 (equivalent to ₦37,725.97 per month). In a year, an average of 73.49 workdays (valued at ₦58,358.5) was lost to presumptive malaria per household. The Mean Per Capita Household Expenditure (MPCHE) per month was ₦5,605.89, the poverty line (i.e 2/3 of MPCHE) was ₦3,737.26. FGT model results indicate that poverty incidence, depth and severity were 0.425, 0.031 and 0.004, respectively. The incidence of poverty increased with increased in WLPM. In the 2SPLS analysis, the coefficient of WLPM was positive (β=0.0607) and statistically significant (p-value = 0.049), implies that increase in WLPM increase the probability of households being in poverty. The result of the Wald test of exogeneity suggests that the WLPM is truly endogenous to household poverty status. Therefore, WLPM had an increasing effect on poverty status of the respondents. The study recommended that, poverty interventions should adequately incorporate strategies on malaria prevention and control; and be extended to rural areas as a way of poverty reduction among rural populace. Also, the national health insurance scheme needs to incorporate rural farming households and people in the informal sector to reduce the out-of-pocket spending on malaria treatment as a poverty reduction strategy.*

**Key words:** Presumptive malaria, Poverty status, Farming households, South West, Nigeria.

## Introduction

Agriculture holds the key to rural development, poverty reduction and overall economic development (Oluwafemi *et al.*, 2010). It is the bedrock of every nation for the role it plays in providing food for the populace, employment opportunities, export revenue and contribution to the nation's Gross Domestic Product (Oparinde and Daramola, 2014). The proportion of the Gross Domestic Product (GDP) attributed to agriculture holds between 30 and 40% (CBN, 2009).

The food crop sub-sector contributed about 28% to GDP representing about 75-76% of the share of the agricultural sector's contribution to GDP (CBN, 2012).

The food production role of the agriculture sector depends largely on crops production subsector as all the staples consumed in the nation comes from crop production, 90% of which is accounted for by smallholder farmers (CBN, 2012). In Nigeria, agriculture is characterized by a large number of smallholder farmers with small holdings ranging from 0.05 to 3.0 hectares of land area, low capitalization and low yield per hectare (Ogundari and Ojo, 2007). Nigeria's agriculture is also labour intensive and rain fed, which requires farmers to timely prepare land, plant, weed and harvest to ensure that the crops' growth stages coincide with the most favourable growth conditions. The success of agricultural livelihoods therefore depends on the health of the workforce.

Liverpool-Taise *et al.*(2011) reported that there was a pervasive inefficiency and low productivity among Nigeria farmers: most smallholder farmers produce significantly below their production frontier and profit margins from agricultural enterprises are generally low. This low return in agricultural production has prevented a substantial reduction of poverty, especially in the rural areas in Nigeria. According to Oseni and winter (2009), the poverty rate has decreased in recent years but the general belief is that the current poverty level should not be as high as it is, where more than 80% of the rural households in Nigeria relate their poverty status to problems in the agricultural sector.

Good health and productive agriculture are important in the economy of a country especially in the fight against poverty. Health enhances work effectiveness and the productivity of an individual through increase in physical and mental capacities (Ajani and Ugwu, 2008). However, health capital is affected by a number of preventable diseases such as malaria, musculoskeletal disorders, HIV/AIDS, injuries, yellow fever, typhoid fever, schistosomiasis, onchocerciasis, diarrhea, among others (Ugwu, 2006). Olatunji *et al. (2013)* reported that the productivity of farmers is affected by a number of occupational hazards and health problems such as malaria, musculoskeletal disorders, farm injuries, yellow fever, diarrhea, respiratory diseases and skin disorder.

Malaria is a major public health problem in Nigeria. It remains an important cause of morbidity and mortality. Nigeria accounted for 32% of the global estimate of 655,000 malaria deaths in 2010 (WHO, 2012). An estimated 97% of the country's approximate population of 160 million residents is at risk of malaria. Children under age 5 and pregnant women are the groups most vulnerable to illness and death from malaria infection in Nigeria. It accounts for about 60% of all outpatient attendance and 30% of all hospital admissions, seven (7) out of every ten (10) patients seen in Nigeria hospitals are ill of malaria (FMoH, 2007). A typical bout of malaria lasts from about 10 to 14 days with 4 to 6 days of near complete incapacitation and a recuperation period of 4 to 8 days characterized by fatigues and weakness (Berman *et al*, 1999). In addition to the direct health impact of malaria, there are also severe social and economic burdens on communities and the country as a whole, with about 480 billion Naira lost to malaria annually in the form of treatment costs, prevention efforts, loss of work time, and so forth (FMoH, 2012).

Malaria and agriculture are intimately related because agricultural environments provide suitable conditions for breeding of mosquitoes. The peak of malaria transmission has been found to coincide with the peak of planting and harvest seasons when demand for labour is suppose to be high. With this, vast expanse of land goes uncultivated and substantial harvests are lost because workers are sick.

There are many ways through which the relationship between malaria and poverty operates. Poverty sustains the conditions where malaria thrives, and malaria impedes economic growth and keeps communities in poverty. At the household level, poor housing can expose people to contact with infective mosquitoes. Simple preventive measures such as insecticide-treated bed nets are unaffordable to the poorest if they must pay for them. Lack of resources prevents people from seeking timely health care. Poverty reduces one's ability to purchase health inputs like medical care and nutritious foods which in turn negatively impacts one's health status (Fuchs, 2004). According to Ajani and Ugwu (2008), achieving self-sufficiency in food production and the much desired growth in agricultural sector of the economy will continue to elude Nigeria if health issues in agriculture are not properly addressed.

This study was not an epidemiologic or clinical study of malaria. Following Leighton and Foster (1993) and Attanayake *et al.* (2000), the study focused on "perceived" or “self-reported’’ malaria. That is, what people perceived to be "malaria" and what health workers typically, presumptively diagnosed as "malaria" and not with the prevalence of malaria as measured by presence of parasites in the blood that are not manifested in illness symptoms. Presumptive self-diagnosis of malaria implies diagnosing the illness based on symptoms associated with the illness without other confirmatory tests. This method of diagnosis gained a lot of popularity because most presumed malaria treatments in endemic areas especially in sub-Saharan Africa like Nigeria were already done at home (Chukwuocha, 2016). Although, WHO (2010) recommended universal testing before the treatment of the suspected cases of malaria, however, malaria rapid diagnostic tests (RDTs) are not yet widely available in Nigeria (Anonymous, 2013) and so, presumptive diagnosis continues to be the most common method for determining a patient's malaria status (Uzochukwu *et al*., 2011). Also, NPC/NMCP ICFI (2012) reported that nearly 60% of Nigerians seek treatment for malaria at drug shop outlets in the private healthcare sector, while Ajayi *et al*. (2008) equally affirmed that just 20% of malaria cases get to the health centres; others are treated with self-medication, prescriptions procured from herbalist homes or patient medicine stores.

Although, malaria is commonly recognized as a disease of poverty (Gallup and Sachs, 2001; Sachs and Malaney, 2002). The disease thrives in poverty and also impedes economic growth and keep households in poverty (Teklehaimanot and Mejia, 2008). However, the link between malaria and poverty at the micro or household level remain unclear. Given that malaria is endemic throughout Nigeria, and that 40% of people in the country are living below poverty line of 137,430 naira ($381.75) per year (NBS, 2020), malaria incidence may increase significantly in Nigeria because many may not be able to afford the newly introduced drugs due to poverty (Yusuf *et al*., 2010). Though the causal effect of malaria on poverty has been increasingly documented (Fosu and Mwabu, 2007; Somi *et al.,* 2007; de Castrol and Fisher, 2012), the empirical evidence regarding the two-way causality between malaria and poverty is still limited. Hence, this study empirically examined the relationship between presumptive malaria and poverty in rural areas of South west, Nigeria. Specifically, the study examined the influence of workdays lost to presumptive malaria illness on poverty status of food crop farming households in rural South west, Nigeria.

**Literature Review**

Researchers have made efforts at examining the causal relations between health status of individuals and poverty. Claeson *et al*. (2001) posited that just as poverty is a cause of, it is also an effect of ill health. Poverty exposes individuals/household to several deprivations which translate into poor health outcomes. At community level, poverty makes individuals perform harmful cultural norms, and run into challenges which include poor sanitation, inadequate access to clean water as well as community organization, which may give rise to poor health outcomes. In addition, the health condition of the poor is adversely affected by the provision of poor quality health services and decreased access to health services due to poor transportation networks. The health of the poor also deteriorates more rapidly than that of their rich counterparts because of the exclusion of the poor from using health facilities as they are faced with high out-of-pocket expenses. Conversely, poor health outcomes lead to loss of income, thus causing poverty. The unhealthy persons tend to be uncreative and may have fewer earning opportunities which in turn lower their income/wealth (Bloom and Canning, 2000).

Godlonton and Keswell (2005) examined the influence of health status on poverty and found that families which had more unhealthy folks were more susceptible to poverty than those with fewer unhealthy individuals. Whitehead *et al.*(2001) observed that health expenditures influence poverty by means of three main media; first:, untreated illness, where the most dangerous effects are felt by those denied health services for the reason of their inability to afford the cost. Such people are prone to prolonged suffering and worsening health conditions. The second category is reduced access to care. Studies have shown that high Out-of-Pocket expenditures cause an indiscriminate reduction in access to care (Mbugua *et al.*,1995). The third category is catastrophic expenditures and long-standing poverty. People purchase health care even if doing so will cost them fortune and their long-term incomes, as health expenditure are most of the time compulsory payments (Whitehead *et al.*, 2001). Tipping (2000) reveals that the poor usually defer seeking treatment until a tragedic condition arises, as a consequence of poor financial status. This hindrance often leads them in the long run to seek treatment at more costly facilities, mostly at hospitals instead of primary health facilities. The negative impacts of high OOP expenditures are therefore worsening health and high medical cost.

Kimani (2014) probed into the consequence of the out-of-pocket health expenses on household poverty in Kenya. He concludes from his study that a reduced access to health care and untreated illness worsens health conditions (of the poorer). It leads to health-poverty trap which is a state of being ensnared into low productive capability and income dispossession due to poor health conditions and related health costs. In such a situation, households become unable to invest in health and nutrition. This further causes more ill health and malnutrition, which calls for medical attention, hence more health expenditures. Some are forced to sell assets and deplete household savings in order to meet health care expenses, thus driven into poverty or deeper into it, if they are already poor.

ECA (2005) reported that malaria top the list of prevailing and difficult infections affecting poor countries, especially the tropical and sub-tropical zones, and poverty may promote its transmission. Poor farmers also play some significant roles in malaria transmission, they are also deficient inadequate asset base to cushion its impacts; they are more dangerously affected by the malaria illness. Because children are more prone to malaria attacks, a significant amount of adults' time (mostly women) is diverted to taking care of the sick children. Recurring episodes of the disease attacks in farming households results in decreasing farm production, farm income as well as increasing poverty. Malaria is considered the single greatest cause of poverty in several developing nations of the world, not just because it deprives the impoverished from accessing basic necessities of life, but because it also de-empowers them, robs them of their rights and marginalizes them (WHO, 2000).

Yusuf *et al*. (2010), using a multilevel analysis, examined poverty and fever vulnerability in Nigeria. Data were extracted from the Nigeria Demographic and Health Survey in 2008; where under-five children data were extracted from the 25,004 children's records in the data set. A two-level random effects logistics model was fixed. The fever prevalence was the highest (17%) among children from the poorest class, compared to the 15.8% among the middle class and the lowest among the wealthiest (13%) class. They observed that malaria and poverty nexus are complex, and that poverty encourages the environment for malaria to thrives, and malaria also inhibits economic development and holds communities in poverty.

Booysen *et al*.(2001) and Jackson (2002) submitted that there are two bi-causal relationships between malaria and poverty. On one hand, poverty enhances the spread of the illness and conversely, illness increases poverty of the affected households. In the first case, poverty promotes the susceptibility of people to malaria disease, due to poor nutrition and lowering of immune systems. It is also related to unsafe housing conditions and poor sanitation practices due to insufficient knowledge and poor access to means of protection like the use of mosquito nets. In the second case, several bouts of malaria can make households and individuals move into deeper poverty where its primary impact is noticeable mainly on the incomes and the expenditures of individuals and households.

Asenso-Okyere *et al.*(2009) reported the existence of a vicious circle of malaria and poverty, which reduces economic opportunities for the majority of people worldwide. Certainly, the loss of human capital and lower productivity due to malaria illness results in a poorer economic growth rate. This will eventually have negative effects on the impoverished that are already trapped in a sadistic circle of poverty and malaria. Since malaria aggravates poverty, which is a precursor of poorer economic development, then the linkage of malaria to poverty is eventually to poorer economic development. Lower income due to decreasing productivity as a result of ill health from malaria will eventually leads to poor economic development that will escalate poverty. The health, efficiency and welfare outcomes of malaria illness differ in severity.

## Materials and Methods

### Study Area

The study was carried out in south west, Nigeria. The zone falls on Latitude $6^0$ to the North and Latitude $4^0$ to the South. It is marked by Longitude $4^0$ to the West and $6^0$ to the East. Total population of the area as at 2006 was 27,581,992 (NPC, 2006). The zone is bounded in the North by Kogi and Kwara States, in the East by Edo and Delta States, in the South by Atlantic Ocean, and in the West by Republic of Benin. It composes of six states: Ekiti, Lagos, Ogun, Ondo, Osun and Oyo. The geographical location of south west Nigeria covers about 114, 271 kilometer square, which is approximately 12 percent of Nigeria total land mass. There are two distinct seasons, the rainy season, which lasts from April to October and the dry season which starts from November and ends in March. The distribution of rainfall varies from about 1000mm to about 2000mm. Important cash crops such as cocoa, kolanut, citrus, coffee, rubber and oilpalm are grown in the region. Savanna parts of the region produces food crops such as tubers, grains, plantain/banana and vegetables.

Although, malaria is endemic throughout Nigeria (Yusuf *et al*., 2010). The choice of south west Nigeria is premised on the fact that the zone is located along forest zones of the southern Nigeria and guinea / derived savannah, thus the vegetation lies within the rain-forest belt of Nigeria. The climate is hot and humid which favours the proliferation of the mosquito vectors (Babalola *et al*., 2009). Nigeria Demographic and Health Survey (2013 ) indicated that South west is the zone with the lowest number of households with at least one Insecticide Treated Nets (ITNs) or Long-lasting Insecticidal net (LLIN) in Nigeria.

**Sampling Procedure**

A four-stage sampling technique was used. The first stage was the random selection of Oyo and Osun states from the six states in South west, Nigeria. In the second stage, four (4) and three (3) rural Local Government Areas (LGAs) from Oyo and Osun states, respectively were randomly selected based on probability proportionate to size of rural LGAs in each of the states. The third stage was the random selection of five villages from each of the LGAs, making a total of 35 villages in all (i.e. 20 and 15 villages from Oyo and Osun state, respectively). In the fourth stage, a random selection of four hundred and twenty (420) food crop farming households from the thirty-five villages selected for the study was carried out. This was achieved by making a list of food crop farming households in each of the selected villages from which a random selection of 10% of food crop farming households were done in each of the selected villages. Out of the four hundred and twenty (420) questionnaire administered on the respondents, twenty-five (25) were discarded for incomplete information and inconsistency. Consequently, data from 395 (224 and 171 from Oyo and Osun states, respectively) questionnaire were analyzed for the study.

**Method of Data Collection**

Primary data used for this study were obtained from the respondents with the aid of structured questionnaire. The data collected from the households include socio-economic and demographic characteristics, farming activities, malaria related information such as cause of malaria, mode of transmission, symptoms and practices of households to malaria prevention. Also obtained were data on the number of episodes of malaria attacks suffered by the households in 2014, type /place of treatment, distance to the nearest health centre, cost of treatments, transportation, subsistence, as well as days of incapacitation due to malaria attacks and workdays lost by the caregiver(s). During the interview, efforts were made to ensure that people reported malaria episodes based on symptoms as close as possible to accepted clinical symptoms. The following symptoms were taken as indicative of malaria: fever, headache, chills/shivering, abdominal pain, diarrhea, nausea / vomiting, bitter taste, loss of appetite (anorexia), lassitude (general body weakness), muscular pain and joints pain (Tangpukdee *et al*., 2009; Looareesuwan, 1999).

**Method of Data Analysis**

Statistical tools used in data analysis include descriptive statistics, FGT model and Instrumental Variable probit least square model (or two-stage probit least square). The descriptive statistics included frequency, means, percentages and standard deviation. These were used to profile the socio-economic characteristics of the respondents. FGT model was used to generate the poverty indices while the Instrumental Variable probit least square model was used to analyze the influence of workdays lost to presumptive malaria on households' poverty.

**Poverty Measurement and Decomposition**

The poverty measure that was used in this analysis is the class of decomposable poverty measures by Foster, Greer and Thorbecke (FGT). They are widely used because they are consistent and additively decomposable (Foster *et al.*, 1984). The P-alpha poverty measure was used to generate the poverty indices for the respondents in the study area. This include the head count index $P_0$, Poverty gap index $P_1$, and poverty severity index $P_2$. The general formula for this class of poverty measures depends on a parameter α which takes a value of zero for the head count, one for the poverty gap and two for poverty squared gap in the following expression:

The FGT index is presented below:

$$P_\alpha = \frac{1}{N}\sum_{i=1}^{n}\left(\frac{Z-Y_i}{Z}\right)^\alpha$$

Where:

n = the number of poor (below the poverty line) households in the population of size n,

N= Number of households in the reference population / total sampled population

$y_i$ = monthly per capita expenditure of household i

Z= the poverty line defined as 2/3 of Mean monthly per capita expenditure.

The FGT index allows for the quantitative measurement of poverty status among sub-groups of a population (i.e incorporating any degree of concern about poverty) and has been widely used (Kakwani, 1990).

By setting the value of α to zero, one, two respectively, the FGT poverty measure formula delivers a set of poverty indices.

α =0 is the Headcount index ($P_0$) measuring the incidence of poverty (proportion of the total population of a given group that is poor, based on poverty line);

α =1 is the poverty gap index measuring the depth of poverty, that is, on average how far the poor is from the poverty line;

α =2 is the squared poverty gap measuring the severity of poverty among households, that is, the depth of poverty and inequality among the poor.

**The Poverty Threshold / The Poverty Line**

Some of the studies on poverty in Nigeria that adopted the per capita expenditure approach on poverty include (Adeyonu *et al.*, 2012; Obayelu and Awoyemi, 2010; Okunmadewa *et al.*, 2005; Olaniyan, 2002; Omonona, 2001).

Following Foster *et al*.(1984), Poverty line was computed as 2/3rd of the mean per capita monthly expenditure of all the members of the sampled households; that is, the amount spent on food, clothing, housing, energy, water, education, health care, transport, communication, etc. by the household:

$$\text{Per capita household expenditure (PCHE)} = y = \frac{\text{Total Household expenditure}}{\text{Household size}}$$

$$\text{Mean per capita household expenditure (MPCHE)} = \frac{\text{PCHE}}{\text{Total number of surveyed households}}$$

Poverty line (z) = 2/3*MPCHE.
Where * is a multiplicative sign.
The non-poor threshold is the region greater than or equal to two-thirds of MPCHE while the poor threshold is the region less than two-third of MPCHE.

**Econometric Specification**
**Two-stage Probit Least Squares (2SPLS) Regression Model**.
Somi *et al*. (2007), and de Castro and Fisher (2012) pointed out the possibility of two-way relationship between malaria and poverty, therefore, the presence of 'endogeneity. Following Tenzin *et al.*(2013), presumptive malaria is proposed to increase the workdays lost to illness and increases household expenditure on medical treatment. Thus, increases poverty.
The first equation of poverty status (Y) as a function (f) of workdays lost to presumptive malaria (M) is as shown in equation 1:

$$Y = f(M, W) \ldots\ldots (1)$$

Where W is a vector of independent variables. In some cases, the household poverty will expose household members to illness and also reduce the strength of households to attends promptly to their health needs which will increase the workdays lost to illness. This leads to the reversed causality of household poverty and presumptive malaria as indicated by the equation 2 below:

$$M = g(Y, T) \ldots\ldots (2)$$

Where T is a vector of the other independent variables.

The model above shows a two-way causality between presumptive malaria and household poverty status which raises endogeneity and simultaneity problems (Nasution *et al*., 2014; Tenzin *et al*., 2013). Thus, the application of the ordinary least squares (OLS) is not suitable, because it will produce biased estimates and inconsistency. The usual remedy for the existence of an endogeneity problem is the adoption of instrumental variable (IV) estimation.

Since the dependent variable poverty status is binary, in line with Brueckner and Largey (2006), a two-stage probit least squares (2SPLS) estimation method is adopted. This method is similar to the regular two-stage least squares (2SLS) model used for estimating continuous variables (Wooldridge, 2006). The only exception in this case is that while in the first stage, OLS estimation is computed for workdays lost to presumptive malaria, which is a continuous variable; the second stage uses probit estimation to model poverty status after including the exogenous variables and replacing the endogenous variables with fitted values from the first stage. This technique applies the process described by Maddala (1983).

Following Alvarez and Glasgow (1999) the non-recursive two-stage choice model of this nature is specified as follows;

$Y^* = \gamma_1 M + \alpha_i W_i + \mu_1$ ............................................................................................(3)

$M = \gamma_2 Y^* + \beta_i T_i + \mu_2$ ............................................................................(4)

where presumptive malaria (estimated as workdays lost to presumptive malaria) is a continuous variable defined by M, poverty status is a dichotomous variable defined by $Y^*$, W and T are vectors of independent variables, the measurement error is defined by $\mu_1$ and $\mu_2$, and the coefficients to be estimated are $\gamma_1$, $\gamma_2$, $\alpha_i$ and $\beta_i$. However, $Y^*$ cannot be measured directly but rather by measuring the poverty status of households as 1 or 0 (poor = 1, 0= non-poor), so the value of the Y is as follows:

$$Y = \begin{cases} 1 \ if \ Y^* > 0 \\ 0 \ if \ Y^* \leq 0 \end{cases}$$

From the above equations, a reduced form equation becomes:

$Y = \lambda_i W_i + \pi_i T_i + v_2$ ..............................................................................................................(5)

$M = \lambda_i W_i + \pi_i T_i + v_1$ ..............................................................................................................(6)

In the approach of a two-stage probit least squares (2SPLS), each endogenous variable is estimated using a reduced form equation. Equation 6 is estimated using ordinary least square while equation 5 is estimated using probit analysis.

The parameter of the reduced form equation is used to generate a predicted value for each endogenous variable. The predictive values are substituted into each endogenous variable in equations 3 and 4. Then the equation is estimated with the predicted value of the reduced form equation as an instrument in the right hand side of the equation. It has been shown that the estimated original model equation in the second stage showed consistent results (Alvarez and Glasgow, 1999). The advantage of using the 2SPLS approach is that it can be applied to either a binary dependent variable with a continuous endogenous regressor on the right hand side or a continuous dependent variable with a binary endogenous regressor on the right hand side. However, according to Greene (2000), the major drawback of 2SPLS is that the standard errors produced are biased and their correction is difficult. This implies that statistical inference would not be legitimate.

However, a solution to this shortcoming is to use the consistent 2SPLS parameter estimates along with bootstrapped standard errors. Bootstrapping is a statistical technique where the sampling distributions for the parameter estimates of interest are simulated through an iterative process (Mooney and Duval, 1993; Mooney, 1996). The advantage of bootstrapping is that it allows for the creation of confidence intervals for statistics where sampling distributions are unknown or in the case of the 2SPLS, are difficult to estimate.

Analysis and estimation of the above equations was carried out simultaneously using STATA software because it combines the two steps (First and Second-Stage regressions) into one step and the output is given in one step.

## Measurement of variables

### Dependent variables

Y=Households Poverty status (1= poor, 0 = non-poor)

### Independent variables for the poverty equation

The explanatory variables included in the model are similar to those used in previous related studies (Sanusi *et al*.,2013**;** Adewunmi, 2013; Akinbode , 2013; Igbalajobi *et al*. 2013; Akerele and Adewuyi, 2011; Apata *et al.*, 2010; Ibrahim and Umar, 2008 )

$X_1$=Age of household head (years)

$X_2$=Squared age of household head (years)

$X_3$=Household size (in number)

$X_4$=Dependency ratio (number)

$X_5$= Room density (number)

$X_6$=Years of schooling of household head (number of years)

$X_7$=Years of farming experience (years)

$X_8$=Farm size cultivated by the household (hectares)

$X_9$=Access to extension services (if access=1, 0=otherwise)

$X_{10}$=Access to credit (if access=1, 0=otherwise)

$X_{11}$=Connected to electricity (If connected=1, 0=if otherwise)

$X_{12}$= Malaria financial cost (prevention and treatment) to the household (Naira)

$X_{13}$= Workdays lost to presumptive malaria by the household (measured in manday), this was instrumented for (Using access to ITNs/LLINs, distance to health centre and malaria awareness campaign)

### Ethical considerations

Written informed consent was obtained from all the heads of the households participated in the data collection process and assurance given to them that all information received would be handled confidentially. They were informed that participation is voluntary and also assured of their right to withdraw from the interview at any time they would wish during the interview. The survey was also anonymised so that household or individual information is not identifiable.

Ethical clearance for the study was obtained from the Osun State Specialist Hospital Osogbo Health Research Ethics Committee (Clearance number: HREC/27/04/2015/SSHO/027).

## Results and Discussion

### Socio-economic and demographic characteristics of the respondents

The result of the analysis shows that 88.6% of the households' head were male, age was 56.41±9.34 years, 88.4% were married, household size was 7±2 persons and farm size was 1.72±0.56. Years of schooling were 4.80±4.65 which is far below the universal basic education of at least 6 years (primary school) with 37% of them had no formal education. Years of farming experience was found to be 29.53± 10.78. Only 37.2%, 45.1% and 24.6% of them have access to electricity, extension services and agricultural credit, respectively. The annual farm income was ₦452,711.70±153,704.70 (equivalent to ₦37,725.97 per month). All these were illustrated in Table 1.

**Table 1: Socio-Economic Characteristics of food crop Farming households (n=395)**

| Variables | Frequency | Percentage |
|---|---|---|
| **Sex of the household head** | | |
| Male | 350 | 88.6 |
| Female | 45 | 11.4 |
| **Age of Household head (years)** | | |
| Less than 45 | 49 | 12.4 |
| 45-54 | 106 | 26.8 |
| 55-64 | 152 | 38.5 |
| Above 64 | 88 | 22.3 |
| **Mean** : 56.41 | | |
| **Std. Dev** : 9.34 | | |
| **Marital status of household head** | | |
| Married | 349 | 88.4 |
| Widow/Widower | 46 | 11.5 |
| **Household size** | | |
| 2-5 | 111 | 28.1 |
| 6-9 | 266 | 67.3 |
| Above 9 | 18 | 4.6 |
| **Mean** : 6.52 | | |
| **Std. Dev** : 1.63 | | |
| **Household head's years of Schooling** | | |
| 0 (No formal education) | 146 | 37.0 |
| 1-6 | 142 | 36.0 |
| 7-12 | 100 | 25.3 |
| Above 12 | 7 | 1.8 |
| **Mean** : 4.80 | | |
| **Std. Dev** : 4.65 | | |
| **Farming experience (years)** | | |
| 1-10 | 11 | 2.8 |

| | | |
|---|---|---|
| | 96 | 24.3 |
| 11-20 | | |
| 21-30 | 93 | 23.5 |
| 31-40 | 142 | 36.0 |
| Above 40 | 53 | 13.4 |
| **Mean** : 29.53 | | |
| **Std. Dev**: 10.78 | | |
| **Farm size (Hectares) cultivated** | | |
| Less than 1 | 13 | 3.3 |
| 1-1.5 | 120 | 30.4 |
| 1.6-2.0 | 193 | 48.9 |
| 2.1-3.0 | 57 | 14.4 |
| Above 3 | 12 | 3.0 |
| **Mean :** 1.72 | | |
| **Std. Dev:** 0.56 | | |
| **Household access to electricity** | | |
| Access | 147 | 37.2 |
| No access | 248 | 62.8 |
| **Household access to extension** | | |
| Access | 17 8 | 45.1 |
| No access | 217 | 54.9 |
| **Household access to credit** | | |
| Access | 97 | 24.6 |
| No access | 298 | 75.4 |
| **Household's farm income (₦ / Annum)** | | |
| Less than 200,000 | 8 | 2.0 |
| 200,000-299,999 | 58 | 14.7 |
| 300,000-399,999 | 97 | 24.6 |
| 400,000-499,999 | 100 | 25.3 |
| 500,000-599,999 | 68 | 17.2 |
| 600,000-699,999 | 35 | 8.9 |
| 700,000 and above | 29 | 7.3 |
| **Mean** : 452711.70 | | |
| **Std. Dev**: 153,704.70 | | |

Source: Field survey, 2015.

## Estimation of Workdays Lost to Presumptive Malaria

Table 2 shows that the average workdays lost to presumptive malaria sickness in the study area was 51.28±19.92 days with minimum and maximum values of 11 and 112 days, respectively. The work-days lost to care-giving was estimated at 22.21± 13.48 days. This implies that the bulk of the workdays lost (69.8%) is actually due to malaria sickness of the adults and older children who provides source of family labour on the farm while the remaining 30.2% of workdays lost to presumptive malaria is attributable to care-giving alone.

**Table 2: Average workdays lost to malaria sickness and caregiving**

| Form of Workdays lost | Workdays lost | Std dev. | As % of total workdays lost to malaria | Minimum | Maximum |
|---|---|---|---|---|---|
| Workdays lost by the sick persons | 51.28 | 19.92 | 69.8 | 11 | 112 |
| Workdays lost by the care-givers | 22.21 | 13.48 | 30.2 | 0 | 70 |
| **Total workdays lost** | **73.49** | | **100.0** | | |

Source: Field survey, 2015.

**Determination of poverty line and FGT Decomposition Results**

Table 3 shows the summary of households' expenditure on food and other non-food basic items. The Mean Per Capita Household Expenditure (MPCHE) for the households stood at ₦5605.89 with the 2/3 of MPCHE amounting to ₦3,737.26. Hence, households were classified as poor if their MPCHE fall below ₦3737.26k and non-poor if their MPCHE is equal or above the poverty line of ₦3737.26k.

**Poverty Decomposition**

The FGT results reveal a poverty incidence, depth and severity of 0.425, 0.031 and 0.004, respectively (Table 4). It implies that 42.5% of the households were poor. Poverty depth value of 0.031 implies that an averagely poor household in the study area had 3.1% deprivation of income (i.e had to mobilize resources up to 3.1% of the poverty line more per person per day in order to break out from poverty). The severity of poverty index value of 0.004 shows the seriousness of poverty. It implies that the core poor were about 0.4% worse off compared to the averagely poor. Therefore, the study has found that poverty is prominent amongst the sampled households in the study area.

**Poverty Incidence by Workdays Lost to Presumptive Malaria**

Table 5 shows the variation observed in the poverty incidence as workdays lost to presumptive malaria increased. It was observed that as workdays lost increased, poverty incidence also increased. It also implies that the more the poorer the group, the more the workdays lost to presumptive malaria. This might not be unconnected with their inability to afford preventive measures and poor treatment when sick of malaria. These findings concur with Ochi *et al.*(2015) who linked increased poverty among households in agricultural communities with an increase in workdays lost to malaria illness.

**Table 3: Distribution of Average household monthly expenditure**

| Monthly expenditure | Average value (₦) | Percentage |
|---|---|---|
| **Food** | **20945.57** | **60.0** |
| Health care | 2133.08 | 6.1 |
| Rent allowance (Housing) | 1022.36 | 2.9 |
| Clothing | 1667.09 | 4.8 |
| Children education | 2483.80 | 7.1 |
| Transport | 2758.73 | 7.9 |
| Water | 147.80 | 0.4 |
| Electricity | 431.77 | 1.2 |
| Kerosene | 1011.24 | 2.9 |
| Energy: Fuel / Gas / Charcoal | 146.33 | 0.4 |
| Petrol for generator | 99.49 | 0.3 |
| Batteries for radio / torchlight | 188.38 | 0.5 |
| Toiletries | 545.16 | 1.6 |
| GSM maintenance | 1131.09 | 3.2 |
| Other expenses | 207.09 | 0.6 |
| **Total Non-food expenditure** | **13973.41** | **40.0** |
| **TOTAL (Food + Non-Food)** | **34,918. 98** | **100** |
| **Mean Per Capita Household** | **5605.89** | |
| **Expenditure (MPCHE)** | **3737.26** | |
| **Poverty line (2/3 MPCHE)** | | |

Source: Field survey, 2015.

**Table 4: Poverty Incidence, Depth and Severity among the households**

| Poverty index | Value |
|---|---|
| Poverty incidence ($P_0$) | 0.425 |
| Poverty depth ($P_1$) | 0.031 |
| Poverty severity ($P_2$) | 0.004 |

Source: Field survey, 2015.

Table 5: Workdays lost to Presumptive Malaria and Incidence of Poverty among Households

| Workdays lost to Presumptive malaria | Number of Respondents | Percentage of Total | Poverty Incidence P(0) |
|---|---|---|---|
| Less than 40 | 23 | 5.8 | 0.260870 |
| 40-59 | 89 | 22.5 | 0.382022 |
| 60-79 | 139 | 35.2 | 0.402878 |
| 80-99 | 87 | 22.0 | 0.448276 |
| Above 99 | 57 | 14.5 | 0.578947 |
| **Total** | **395** | **100** | |

Source: Field survey, 2015.

**Effects of Presumptive Malaria on Household poverty.**

The appendix section presents result of partial correlation for the choice of instruments for the workdays lost to presumptive malaria. The instruments proposed include distance to health centre, distance to water source, environmental sanitation practice, access to mosquito net (ITNs or LLINs), participation in malaria awareness campaign, use of local herbs, and housing type of household (poor or good). The results of the partial correlation analysis reveal that, distance to health centre, access to mosquito nets and participation in malaria awareness campaign had significant and the highest coefficients of correlation value of 0.2165, -0.2103 and 0.1284, in that order, with the workdays lost to presumptive malaria and they were, therefore, used as the instruments for workdays lost to presumptive malaria in the 2SPLS analysis.

**Factors that Affect the Number of Workdays Lost to Presumptive Malaria**

The first stage regression model results (Table 6) show that age and age squared of household head, dependency ratio, extension services, connection to electricity, distance to health center, and use of mosquito nets were the variables that significantly affect the number of workdays lost to presumptive malaria. The coefficient on the age of household head was negative (β=-4.9046) and significant at 1%. This implies that when the age of household head increased by one unit, the workdays lost to presumptive malaria decreased by 4.9%. This is possible because of the likelihood of increasing immunity due to recurrent bouts of malaria. However, the coefficient of age squared of household head was positive (β = 0.0470) and significant at 1%, implying that the inverse association of age with workdays lost to presumptive malaria were weakened over time possibly due to a decrease in immunity or tolerance level with age; thus, they becomes more susceptible to malaria attack.

The coefficient of the dependency ratio, which measures the proportion of non-working (majorly, the children and adults) members of the household to the working members was negative (β=-27.3232) and statistically significant at 1%. This implying that these categories of household members are enjoying special protection from malaria attacks, since majority of them are not really involve in farming activities and back home, there were preventive measures against mosquito bites. Hence, increase in this variable reduces the workdays lost to presumptive malaria by the households.

The co-efficient of access to extension services was found to be positively (β=12.0908) and significantly associated with workdays lost to presumptive malaria; this is because the more farming households had contacts with extension services, the likelihood of increasing farming activities, and the greater the exposure to mosquito bites leading to malaria attacks, hence the more workdays lost to malaria attacks. Conversely, the coefficient of access to electricity was negative (β=-7.2031) and significantly related to workdays lost to malaria. This implies that access to electricity reduced the number of workdays lost to malaria. This might not be unconnected with the fact that availability of electricity to power electric fan improves comfort inside bed nets (VonSeidlein *et al.,* 2012; Hughes, 2014), thus encourage the use of mosquito nets. Heat inside bed is the reason given by some people in the previous researches for poor usage of mosquito nets (Pulford *et al.,* 2011). Also, electric fan drives away mosquito before reaching its intended victim (Hughes, 2014).

Distance to health centre had negative coefficient (β=-0.3600) and significant at 10% level. This is contrary to the *a priori* expectation that the longer the distance to the health centre, the more difficult for people to access health services, hence the more the prevalence of malaria. It however implies that some of the health centres in the study area were either ill-equipped or had no competent personnel. Also, some of the rural people might not even go to the health centres when they perceived malaria but resorted to self-medication which eventually prolonged the workdays lost to malaria.

Access to mosquito nets had negative coefficient (β=-10.4898) and significant at 1% level. Access to and sleeping under mosquito nets (ITNs or LLINs) reduced the frequency of mosquito bites; hence, less malaria attacks reduced workdays lost to malaria.

The coefficient on financial cost of malaria was positive (β=0.0015) and significant at 1%. An indication that households who were more exposed to malaria, lost more workdays to malaria and would have spent more on malaria treatment.

**Results of instrumental variable probit least square (2-stage probit least square)**

Table 7 shows the factors associated with household's poverty status in the study area, using the estimates of the second stage regression for poverty with bootstrapped standard errors. The correlation between the errors of the two equations was statistically significant (The likelihood Ratio Test for $H_0$: $\rho$=0 against $H_1$: $\rho \neq 0$ gave a $\rho$-*value* of 0.0001). That is, the likelihood function of the 2SPLS model was significant (Wald chi2 (13) = 42.39, Prob > chi2=0.0001), indicating the strong explanatory power of the model. Thus, rejecting the hyphothesis that the two dependent variables are not jointly determined. This justified the use of Two Stage Probit Least Square (2SPLS) technique.

The result of the Wald test of exogeneity (at the bottom of the table 7) of the instrumented variable (/athrho=0): $Chi^2(1)$= 9.42 Prob>chi2 = 0.0021 was statistically significant at 1% level. Hence, the rejection of the null hypothesis of no endogeneity. That is, the null hypothesis that workdays lost to presumptive malaria is exogenous is rejected at 1% level of significance, which also justifies the use of the 2SPLS.

The coefficient of workdays lost to presumptive malaria was positive and significant at 1% level, indicating that a unit increase in workdays lost to presumptive malaria will increase the likelihood of household being in poverty by 0.06 percent. This finding has implication for increased poverty among households in malaria prevalent agricultural communities, as it may give rise to a no-win situation of *'low agricultural investment- low crop output- high poverty continuum'*. Workdays lost to presumptive malaria therefore constitutes an important poverty dimension that cannot be ignored. This finding is in line with the conclusion of Ochi *et al*.(2015).

The coefficient of age of the household's head was positive and significant at 5% level. This implies that a unit increase in the age of household's head will increase the probability of household being in poverty by 0.37%. This implying that, as household heads get older, they become economically inactive which in turn affects their productivity and income, thereby increase the level of poverty. However, the coefficient of the squared age of household head was negative and statistically significant at 5% level. This implies that, as a person becomes older, there is likely more sources of transfer income which can reduce the level of poverty.

Table 6: Factors that Affect the Number of Workdays Lost to Presumptive Malaria

| **Workdays lost** | **Coefficient** | **Std Error** | **Z** | **P-value** |
|---|---|---|---|---|
| Constant | 154.0205*** | 28.0732 | 5.49 | 0.000 |
| Age of Household head | -4.9046*** | 0.8772 | -5.59 | 0.000 |
| Age squared | 0 .0470*** | 0.0076 | 6.17 | 0.000 |
| Household size | 0.7171 | 0.8334 | 0.86 | 0.390 |
| Dependency ratio | -27.3232*** | 9.6393 | -2.83 | 0.005 |
| Room density | 3.2269 | 2.0119 | 1.60 | 0.109 |
| Years of schooling | 0.1910 | 0.3441 | 0.56 | 0.579 |
| Farm Experience | 0.0275 | 0.1841 | 0.15 | 0.881 |
| Farm size cultivated | 0.8111 | 1.8773 | 0.43 | 0.666 |
| Access to Extension Services | 12.0908*** | 1.9454 | 6.22 | 0.000 |
| Access to Credit | 3.3917 | 2.2658 | -1.50 | 0.134 |
| Connected to Electricity | -7.2031*** | 1.7394 | -4.14 | 0.000 |
| Financial cost of Malaria | 0.0015*** | 0.00008 | 17.34 | 0.000 |
| Distance to Health Centre | -0.3600* | 0.1925 | -1.87 | 0.061 |
| Access to Mosquito Nets | -10.4898*** | 3.2049 | 3.27 | 0.001 |
| Malaria Awareness Campaign | 2.7074 | 4.9128 | 0.55 | 0.582 |

Source: Field survey, 2015.

Access to extension services was found to be negative and significant at 1%. The negative coefficient of extension services implies that household's access to extension services reduce the probability of household becoming poor. This finding agrees with Umeh and Asogwa, 2011; Ogbonna *et al*., 2012, who found that availability of extension services improved farmers' productivity and profitability and hence reduced poverty. Also, the coefficient of access to electricity was found to be positive and significant at 10%. That is, access to electricity increases the probability of the households being in poverty. This indicated that households with electricity supply were subjected to high tariffs and thus increasing their likelihood of being poor.

The coefficient of malaria financial cost to the household was found to be negative and significant at 1%. This implying that as households increased their spending on adequate malaria prevention and prompt treatment, there is tendency for reduced workdays lost to the presumptive malaria and this will reduce the probability of households being in poverty.

**Conclusion and Recommendations**

Despite the current efforts by government to eradicate rural poverty in the country, poverty still remains a serious problem in the study area given that about 42.5% of food crop farming households in the study area were still below the poverty line. Therefore, the study has found that poverty is prominent amongst the sampled households in the study area, in which workdays lost to presumptive malaria was one of the determinants. Our analyses revealed further that presumptive malaria, defined in terms of workdays lost to presumptive malaria negatively affects household income and increases poverty. The result suggests further that the endogeneity bias between workdays lost to presumptive malaria and household poverty status is due to reciprocal causation.

Therefore, poverty alleviation policies should be seen as having the potential additional effect of reducing the prevalence of malaria. Hence, we recommend that poverty interventions should adequately incorporate strategies on malaria prevention and control. Similarly, if malaria is indeed a cause of poverty, then malaria control activities are much more than just a public health policy, but also a poverty alleviation strategy. Therefore, current efforts towards malaria prevention and control, such as free distribution of mosquito nets (ITNs or LLINs), intermittent preventive therapy (IPTs) for pregnant women, adequate supply of ACT as first line treatment for malaria must vigorously be pursued and make sure it is adequately extend to rural areas as a way of poverty reduction among rural populace. Also, the national health insurance scheme need to be re-designed to incorporate the rural farming households and the people in the informal sector, as a way to reduce the out-of-pocket spending on malaria treatment.

**Table 7: Second stages results of determinants of poverty with corrected standard errors**

| Variables | Coefficient | Boostrap standard error | z-stat | *P*- level |
|---|---|---|---|---|
| Workdays lost to presumptive malaria | 0.0606*** | 0.0180 | 3.37 | 0.001 |
| Age of household head | 0.3659** | 0.1577 | 2.32 | 0.020 |
| Square age of household head | -0.0032 ** | 0.0014 | -2.30 | 0.022 |
| Household size | 0.1992 | 0.1283 | 1.55 | 0.120 |
| Dependency ratio | 1.2496 | 1.0636 | 1.17 | 0.240 |
| Room density | -0.4718** | 0.2135 | -2.21 | 0.027 |
| Years of schooling of household head | -0.0400 | 0.0416 | -0.96 | 0.336 |
| Farm experience of household head | -0.0082 | 0.0157 | -0.52 | 0.602 |
| Farm size cultivated | -0.2487 | 0.1974 | -1.26 | 0.208 |
| Access to extension | -0.8357*** | 0.2624 | -3.18 | 0.001 |
| Access to credit | 0.1582 | 0.2055 | 0.77 | 0.442 |
| Connected to electricity | 0.3100* | 0.1662 | 1.87 | 0.062 |
| Malaria financial cost to the household | -9.55e-05*** | 2.79e-05 | -3.42 | 0.001 |
| *Constant* | -12.2444** | 4.9387 | -2.48 | 0.013 |
| /Athrho | -1.2057 | 0.6999 | -1.72 | 0.085 |
| /lnsigma | 2.6821 | 0.0322 | 83.24 | 0.000 |
| Rho | -0.8354 | 0.2115 | | |
| Sigma | 14.6150 | 0.4709 | | |
| No of obs. = 395<br>Replications = 49<br>Wald chi2(13) = 42.39<br>Prob > chi2 = 0.0001<br>Log Likelihood =1810.10 | | | | |

Source: Field survey, 2015.
** and *** Significant at 5% and 1% respectively.
The standard errors are estimated using the bootstrap method with 50 replications in the pooled OLS regressions.
Wald test of exogeneity of the instrumented variable (/athrho = 0): chi2(1) = 9.42 Prob > chi2 = 0.0021
Instrumented: Workdays lost to presumptive malaria

Instruments: age agesquare hhsize depratio roomdensity yrsschl farmexp farmsize extension credit electricity finacialcost disthcentre itns malcampaign.



**REFERENCES**

Adewunmi, O. I. 2013. Poverty Profile of Rural Farm Households in South West Nigeria. *Agronomie Africaine 25 (3): 309 - 319* .

Adeyonu A. G., Oni O. A., Okoruwa V. O. and Omonona B. T. 2012. Seasonality in Poverty Level of Rural Farming Households in Oyo State Nigeria. *ARPN Journal of Agricultural and Biological Science VOL. 7, No. 8, Pp 570-575.*

Ajani, O.I.Y and Ugwu P.C. 2008. Impact of Adverse Health on Agricultural Productivity of farmers in Kainji Basin, North – central Nigeria using a stochastic production frontier Approach. *Trends in Agriculture Economics 1(i):1-7.*

Ajayi, I. O. Falade, C. O. and Bamgboye, A. 2008. Assessment of a treatment Guideline to improve home management of malaria in children in rural south-west Nigeria. *Malaria Journal*. 7. 24.

Akerele, D and Adewuyi, S.A. 2011. Analysis of Poverty Profiles and Socioeconomic Determinants of Welfare among Urban Households of Ekiti State, Nigeria. *Current Research Journal of Social Sciences, 3(1): 1–7*

Akinbode, S. O. 2013. Profiles and Determinants of Poverty among Urban Households in South West Nigeria. *American Journal of Economics, 3(6): 322-329*

Alvarez, R.N and Glasgow, G. 1999. Two Stage Estimation of Non-Recursive Choice Models. *Political Analysis*: 8(2): 147-165.

Anonymous. 2013. Retail prices of ACTs Co-paid by the AMFm and Other Antimalarial Medicines:

Ghana, Kenya, Madagascar, Nigeria, Tanzania and Uganda Report of price tracking surveys. August 2013.

Apata, T.G. Apata, O.M. Igbalajobi, O.A and Awoniyi, S.M.O. 2010. Determinants of rural poverty in Nigeria: Evidence from small holder farmers in South-western, Nigeria. *Journal of Science and Technology Education Research Vol. 1(4), pp. 85–91.*

Asenso–Okyere, K. Asante, F.A. Tarekegn, J. and Andam, K.S. 2009. The Linkage between Agriculture and

Malaria. Int'l Food Policy Reseach Institute Discussion Paper (IFPRI) 00861, Washington D.C.

Attanayake,N. Julia Fox-Rushby, J and Mills, A. 2000. Household costs of 'malaria' morbidity: a study in Matale district, Sri Lanka. *Tropical Medicine and International Health volume 5 no 9 pp 595– 606.*

Babalola, D.A. Awoyemi T.T and Awoyinka, Y.A. 2009. Effects of Malaria on Rural Farming Household Labour Supply: The Case of Ikenne Local Government, Ogun State, Nigeria. *Acta Satech 3(1): 19-24.*


Bloom D and Canning D. 2005. Heath and Economic Growth: Reconciling the Micro and Macro Evidence", Centre on Democracy, Development and the Rule of Law, Stanford Working Paper.

Brueckner, J.K and Largey, A.G. 2006. Social interaction and urban sprawl. *CESifo Working Paper,* 1843.

Booysen, F., Rensburg D. Van, Bachmann, M., Engelbeecht, M. and Steyn F. 2001. The socio-economic impact of HIV-AIDS on households in South Africa, Medical Research Council of South Africa, South Africa.

Central Bank of Nigeria. 2012. Statistical Bulletin. December.

Central Bank of Nigeria. 2009. Statistical Bulletin. December.

Chukwuocha U.M .2016. Malaria Treatment in Children Based on Presumptive Diagnosis: A Make or Mar? Pediatric infectious Disease: Open Access, Vol.1, No 2:6, PP 1-3.

Claeson, M., Griffin, C. C., Johnston, T. A.*et al*. 2001. Poverty-Reduction and the Health Sector: The Health,

Nutrition and Population Network's Chapter in the World Bank's Poverty Reduction Strategy Sourcebook. *H N P Discussion Paper.* Washington, DC:

DeCastro M.C and Fisher M.G. 2012. Is malaria illness among young children a cause or a consequence of low socioeconomic status? Evidence from the united Republic of Tanzania. *Malaria Journal, 11:161*.

E.C.A. 2005. Enhancing health system: malaria negative impact in Africa. Economic and Social Policy Division, Economic Commission for Africa (ECA).

Federal Ministry of Health. 2012. Malaria advocacy brief for policy makers. Abuja, Nigeria: Federal Ministry of Health.

Federal Ministry of Health. 2007. National Frame work for monitoring and Evaluation of Malaria Control in Nigeria. FMoH,Abuja.

Foster, J. Greer, J. and Thorbecke, E. 1984. Class of Decomposable Poverty Measures: *Econometrica,* 52(3) : *761-765.*

Fosu, A and Mwabu, G. (edt). 2007. *Malaria and poverty in Africa*. African Books Collective. The University of Nairobi, Kenya Press, 200Pp.

Fuchs, V. R. 2004. Reflections on the Socio-Economic Correlates of Health. *Journal of Health Economics,* 23**,** 653-661.

Gallup, J. L. and Sachs, J.D. 2001. The Economic burden of Malaria. *Am J Trop Med Hyg. 64(1-2 Suppl):85-96.*

Godlonton, S and Keswell, M. 2005. The Impact of Health on Poverty: Evidence from the South African Integrated Family Survey. *South African Journal of Economics* Vol. 73:1**.**

Greene, W.H. 2000. Econometric Analysis. Prentice Hall, New Jersey.



Hughes G. B.2014. Bed Net Project (Internet). (cited 2016 Jun 14). http://www.youtube.com/watch?v=bCcXe4_CHRs.

Ibrahim, H. and Umar, H.S. 2008. Determinants of Poverty among Farming Households in Nasarawa State, Nigeria. *PAT 2008; 4 (1): 11-21.*

Igbalajobi ,O. Fatuase, A.I. and Ajibefun, I. 2013. Determinants of Poverty Incidence among Rural Farmers in Ondo State, Nigeria. *American Journal of Rural Development, 2013, Vol.1, No. 5,131-137* .

Jackson H. 2002. Continent in Crisis, SAfAIDS, Avendule, Harare, Zimbabwe.

Leighton,C and Foster, R. 1993. Economic Impact of Malaria in Kenya and Nigeria. Major Applied Research Paper No. 6.

Kimani, D.N. 2014. Out-of-Pocket Health Expenditures and Household Poverty: Evidence From Kenya. Thesis

Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in Economics of the University of Nairobi.

Liverpool-Taise, L.S., Kuku, O. and Ajibola, A. 2011. *A Review of Literature on Agricultural Productivity, Social Capital and Food Security in Nigeria*, IFPRINSSP Working Paper No. 21, October 2011.

Looareesuwan S. 1999. Malaria. In: Looareesuwan S, Wilairatana P eds, Clinical Tropical Medicine. 1st ed. Bangkok, Thailand. *Medical Media., p 5-10.*

Maddala,G.S. 1983. Limited Dependent and Qualitative Variables in Econometrics. Cambridge: Cambridge University Press, pp 9-23.

Mbugua, J. K., Bloom G. H and Segall, M. M. 1995. Impact of User Charges on Vulnerable Groups: The Case of Kibwezi in Rural Kenya. *Social Science Med, 41(6):829-835.*

Mooney, C. Z, 1996. Bootstrap statistical inference: Examples and evaluations for political science. American Journal of Political Science 40(2), 570–602.

Mooney, C. and Duval Z. 1993. Bootstrapping: A non-parametric approach to statistical inference. Sage University Paper series on Quantitative Applications in the Social Sciences, 07-095.Newbury Park, CA.

National Bureau of Statistics. 2020. “2019 Poverty and Inequality in Nigeria” Report.

National Population Commission (NPC), National Malaria Control Programme (NMCP), ICF

International. 2012. Nigeria Malaria Indicator Survey 2010. Abuja, Nigeria: NPC, NMCP and ICF International.

National Population Commission. 2006. Population facts, Abuja.

Narsey, W. 2008. *The Quantitative Analysis of Poverty in Fiji*. Vanuavou Publications, Suva.

Nasution, A., Rustiadi, E., Juanda, B., and Hadi, S. 2014. Dampak Modal Sosial terhadap Kesejahteraan Rumah Tangga Perdesaan di Indonesia (Impact of Social Capital on Rural Household Welfare in Indonesia).



MIMBAR Jurnal Sosial dan Pembangunan. *Journal of Social and Development, 30*(2).

Obayelu, O. A. and Awoyemi, T. T. 2010. Spatial dimension of poverty in rural Nigeria. *Journal of Development and Agricultural Economics* 2. 6: *231-244.*

Ochi, J.E, Madaki M..J and Murtala N. 2015. Economic And Social Linkages Between Malaria Illness and Crop Production In Yobe State, Nigeria. Paper presented at the 29th International Conference of Agricultural Economists, held in Milan, Italy, August 9-14, 2015.

Ogbonna D.N, Sokari T.G, and Agomuoh A. A. 2008. Antimalarial activities of some selected traditional herbs from Southeastern Nigeria against *Plasmodium* species. *Research Journal of Parasitology **3**(1):25-31.*

Ogundari, K and Ojo S.O. 2007. Economic Efficiency of Small Scale Food Crop Production in Nigeria: A Stochastic Frontier Approach. *Journal of Social Sciences 14(2): 123-130.*

Okunmadewa, F. Y. Yusuf, S. A. and Omonona, B. T. 2005. Social capital and poverty reduction in Nigeria. Research report submitted to the African Economic Research Consortium (AERC), Nairobi for the second phase collaborative poverty research project.

Olaniyan, O. 2002. The Effects of Household Endowments on Poverty in Nigeria. *African Journal of Economic policy. Vol.9, pp77-101.*

Olatunji, S.O, Ehebha E.O and Ifeanyi-Obi C.C. 2013. Utilization of western and traditional healthcare services by farm families in Ukwa-East Local Government Area of Abia State, Nigeria. *J. Agr .Soc. Res. 13 (2): 111-120.*

Oluwafemi R. A, Fasakin K, Adekola A.G, Olatidoye O.P, Obi T.E, Ozor P.L, Irumundomoh H. 2010. The Impact of Agricultural Credit on Livestock Production and Owners Livelihood. The case of Livestock Farmers in Ovia North East LGA of Edo State, Nigeria. *International Journal of Business and Common Market Study. 6 (2), 34-45.*

Omonona, B. T. 2001. The determinant of poverty among farming households in Kogi State, Nigeria. Unpublished Ph.D thesis, university of Ibadan, Ibadan.

Oparinde L.O and Daramola. A.G. 2014. Determinants of Market Participation by Maize Farmers in Ondo State, Nigeria. *Journal of Economics and Sustainable Development. Vol.5, No.1, Pp-69-77.*

Oseni, G. and Winters, P. 2009. Rural Nonfarm Activities and Agricultural Crop Production in Nigeria. *Agricultural Economics, 40(2), 189-201.*

Pulford J, Hetzel M.W, Bryant M, Siba P.M and Mueller I. 2011. Reported reasons for not using a mosquito net when one is available: a review of the published literature. *Malar J.2011;10:83.*

Sachs, J and Malaney, p. 2002. The economic and social burden of malaria: nature 415: 680-685 (medline).

Sanusi, R. A., Owagbemi, T.S. and Suleman, M. 2013. Determinants Of Poverty Among Farm Households In Ikorodu Local Government Area of Lagos State, Nigeria. *Ijafs 4 (1&2), Pp 538-552.*



Somi, M.F., J.R.G. Butler, F. Vahid, *et al.* 2007. Is there evidence for dual causation between malaria and socioeconomic status? Findings from rural Tanzania. *Am. J. Trop. Med. Hyg.* ***77:*** *1020–1027.*

Tangpukdee N., Duangdee C., Wilairatana, P. and Krudsood S. 2009. Malaria Diagnosis: A Brief Review. *Korean Journal Parasitology. Vol. 47, No. 2: 93-102.* MINI-REVIEW.

Teklehaimanot A and Mejia P. 2008. Malaria and Poverty. Ann . N.Y. Acad. Sci. 1136:32-37. New York Academy of Science. Doi: 10.1196/annals. 1425.037.

Tenzin, G., Otsuka, K., and Natsuda K. 2013. *Impact of Social Capital on Poverty: A Case of Rural Households in Eastern Bhutan*. Ritsumeikan Center for Asia Pacific Studies (RCAPS) Working Paper Series, RWP-13004.

Tipping G. 2000. Healthcare Seeking Behaviour in Asian Transitional Economies: Literature Review and Annotated Bibliography. *Development Bibliography* 17. Institute of Development Studies, Sussex, England.

Ugwu, P.C. 2006. Effect of Farmers health on the agricultural productivity of the principal farm operator in Borgu LGA of Nigeria. M.Sc., Project (unpublished). University of Ibadan, Ibadan, Nigeria.

Umeh, J.C and Asogwa, B.C. 2005. Farm management dividends in a friendly policy environment: The case of Cassava industry in Nigeria. Developing Entrepreneurship abilities to Feed the World in a Sustainable Way. Proceedings of the 15 International Farm Management Association Congress and 5th Brazilian Rural Management Congress (IFMAABAR 2005), Campinas, Sao Paulo, Brazil, August 14-15, pp: 24.

Uzochukwu B. S. C, Onwujekwe E, Ezuma N. N, Ezeoke O. P, Ajuba M. O *et al*.2011.Improving rational treatment of malaria: perceptions and influence of RDTs on prescribing behaviour of health workers in Southeast Nigeria. PLOS One 6: e14627.

Von Seidlein L, Ikonomidis K, Bruun R, *et al.* 2012. Airflow attenuation and bed net utilization: Observations from Africa and Asia. *Malar. J.;11:200*.

Whitehead, M., Dahlgren, G. and Evans, T. 2001. Equity and Health Sector Reforms: Can Low-income Countries Escape the Medical Poverty Trap? *The Lancet Vol. 358.*

Wooldridge, J. M. 2006. *Introductory Econometrics: A Modern Approach. 3e*: South-Western/Thomson Learning. *Research Group,* Policy Research Working Paper No. 3644. Washington DC.

World Health Organisation. 2012. World Malaria Report fact sheet available at www.whoint/malaria accessed April15th 2015.
World Health Organisation. 2010. *World Malaria Report*. WHO Press, Geneva.
World Health Organization. 2000. The African summit on Roll Back Malaria', Abuja, WHO.

Yusuf, O.B. Adeoye, B.W. Oladepo, O.O. Peters, D.H and Bishai, D. 2010. Poverty and Fever Vulnerability in Nigeria: A multilevel Analysis. *Malaria Journal, 9: 235.*

***APPENDIX***

Correlation values of instrumental variables with workdays lost to malaria

| Variable | Partial Correlation | Semi-partial Correlation | Partial Correlation$^2$ | Semi-partial Correlation$^2$ | Significance Value |
|---|---|---|---|---|---|
| Distance to health centre | 0.2165 *** | 0.2045 | 0.0469 | 0.0418 | 0.0000 |
| Distance to water source | 0.0603 | 0.0557 | 0.0036 | 0.0031 | 0.2351 |
| Environmental sanitation | -0.0517 | -0.0477 | 0.0027 | 0.0023 | 0.3091 |
| Access to mosquito nets (ITNs or LLINs) | -0.2103*** | -0.1984 | 0.0442 | 0.0394 | 0.0000 |
| Participating in malaria awareness campaign | 0.1284** | 0.1193 | 0.0165 | 0.0142 | 0.0113 |
| Use of herbs | 0.0216 | 0.0199 | 0.0005 | 0.0004 | 0.6708 |
| Housing type (poor or good) | -0.0553 | -0.0511 | 0.0031 | 0.0026 | 0.2767 |

Source: Field survey, 2015.