

# Cost Burden of Malaria: Evidence from Nigeria

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**ABSTRACT**— *This paper provides findings on cost burden of malaria in Nigeria. Cost computations were extrapolated to monthly income fraction and GDP lost to the illness. Results of the study are shown across different employment groups. Computations for indirect and direct costs were conducted using the Human capital and Bottom up approach respectively.*

*The results show that one in two persons employed in the labour force will experience loss in labour contribution as a result of malaria with indirect cost of about ₦ 5,532.59 (\$37.16) and ₦ 4,828.73 (\$32.43) per person per day for the patient and care giver, respectively. Individuals spend approximately ₦ 2,730.46 (\$18.34) on the average for treatment of one bout of the illness which translates to approximately 3% of monthly income. Overall, indirect and direct costs related to one episode of malaria in Nigeria sum up to approximately ₦1, 906.08 billion (\$12,801.07 million) implying about 8% of GDP. GDP fraction lost to malaria is higher for the informal sector particularly self-employment in agriculture.*

*Strategies to enhance welfare, labour contributions and economic output in Nigeria should focus on adequate measures to reduce malaria prevalence or complete eradication.*

**Keywords**--- Malaria, Cost Burden, Human capital Approach, Bottom up Approach

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## 1. INTRODUCTION

Malaria is commonly associated with poverty as its incidence is concentrated in the world's poorest countries (Gallup and Sachs, 2001; Asante and Asenso-Okyere, 2003). The ailment is considered instrumental to poverty inducement in most economies of the world and its existence is generally promoted by poverty prevalence. Studies by Gallup and Sachs (2001) and Asante and Asenso-Okyere (2003) provide evidence of malaria prevalence in developing economies with lower growth rate inducements in relation to the ailment. Globally, evidence of malaria prevalence is highest in Nigeria accounting for one in four reported cases identified in the world health region (WHO, 2014). About half of the Nigerian adult population experience at least one bout of the illness per year and children under five years of age have as much as 2-4 attacks in a year (FMOH, 2005; UNICEF, 2010). The illness accounts for over 60% of total reported illnesses. More than 60% of all outpatient visits and 30% of hospitalization in Nigeria are also related to malaria (UNICEF, 2010; NBS 2012).

The growing resistance by the plasmodium parasite to existing line of drugs further worsens the burden of the illness in requiring treatment with more expensive drug particularly the Artesimine combination therapy (ACT) (WEF 2006; Alaba and Alaba 2009). Effective medication when ill with malaria therefore requires the use of costly medication. This has unfavourable welfare implication particularly for informal sector workers who are predominant in the country and are not readily covered by the National Health Insurance Scheme (NHIS). This effect is expectedly higher amongst agricultural employment workers; more vulnerable to the parasite as a result of work activities in environments that are favourable for breeding mosquitoes.

Studies that have examined the burden of malaria in Nigeria and some other African economies commonly centred on direct and indirect cost estimates alongside GDP losses (Alaba and Alaba, 2009; Okorosobo et al, 2011; Jimoh et al., 2007; Kioko et al., 2013; Etiaba et al 2015), with no attention given to fraction of income spent on treatment of at least one episode of the illness. This is required to provide further insights to burden of the illness in cases of more than one episode within a particular time period. Literature findings on costs associated with malaria particularly in Nigeria are obtained from sample values derived from selected local governments in one or two states of the federation. Such estimates do not provide true representation of the population figures. This study overhauls this limitation using data on malaria prevalence across the country. The study therefore provides findings for direct and indirect cost associated with malaria in Nigeria with an extension of welfare implication of the illness to household income and GDP losses. With the

use of sample data from the Harmonised Nigerian Living Standard Survey we were able to provide findings on costs associated with malaria for the thirty-six states of the federation along with the federal capital territory. The analysis was conducted across different employment types mainly to determine variation in welfare losses for individuals in formal and informal employment.

The study is divided into six sections. Following section one is section two; the study background information. Section three comprises theoretical, methodological and empirical literature review while section four covers study methodology. Study results and discussion of findings are presented in section five and section six presents the conclusions from the study.

## **2. HEALTH EXPENDITURE AND ILLNESS PROFILE IN NIGERIA**

### **2.1 Health Care Financing in Nigeria**

Health care in Nigeria is financed through public and private sources. Public provision of health care in Nigeria is funded by the federal, state and local government. While private provision includes funding by households, firms and donors (Soyibo, 2005; Lawanson, 2014; Olawumi, 2015). There are also funding from the National health insurance scheme (NHIS). Health insurance provision in Nigeria generally covers individuals in the formal sector<sup>1</sup>. Employers of labour are required to contribute 10% of employee's basic salary while workers contribute 5%. Employers in the scheme are also mandated to register with the NHIS and appoint an NHIS-registered health maintenance organisation (HMO)<sup>2</sup> of their choice. (NHIS, 2015)

Health care benefit for the employee under the NHIS covers a spouse, and 4 biological children below 18 years of age. Persons above 18 years who are in tertiary institution are covered under the tertiary insurance scheme. Benefits in the scheme includes outpatient care, maternity care for up to 4 live births, preventive care including immunization, consultation with health care specialists, prescription drugs as contained in the essential drugs lists, diagnostic tests included in the essential diagnostic tests lists and hospital care in a standard ward for a cumulative of 15 days per year. For inpatient care the primary care giver is however responsible for per diem payments. (NHIS, 2015)

Despite intentions to reduce out of pocket payment for health care through the NHIS, the existing highly informal nature of the Nigerian economy excludes majority of the work force from the scheme. The NBS (2010) shows that the formal sector in Nigeria employs only about 6.28% of the working population. This implies that if every individual in the formal sector is registered with the NHIS, then more than 90% of the working population would not have access to the scheme.

Soyibo (2005), Soyibo et al., (2009), CBN (2014) and World Bank (2014) provide evidence of health care spending in Nigeria. Though the figures suggest there has been considerable increase in public sector finance of health care in Nigeria, households still bare the dominant share of health care payments. As at 1998, a total of N158 million was recorded as Total health expenditure (THE) in Nigeria (Soyibo, 2005). In 2005, the figure increased to N977 million (Soyibo et al., 2009) and in 2013 it rose further to N1.65 trillion (CBN, 2014 and World Bank 2014). Although, government spending in THE increased during the periods 1998-2013, it still remained less than 28% of THE. This unveils relatively higher fraction of private spending in THE in Nigeria. Government expenditure in THE rose from about 14.96% in 1998 to approximately 26.07% in 2005. As at 2013, government expenditure share in THE increased slightly to about 27.60%. Sequel to the increase in government contribution to THE in Nigeria, private health expenditure in THE experienced some reduction but the figures still remain considerably high even in recent times. A close examination of the figures show that private health expenditure was about 85% of THE in 1998. As at 2005, it had declined to about 73.98%. In 2013, it again declined slightly to an approximate 72.40%.

Though the share of private health expenditure in THE declined over the period, household health expenditure, which is a component of private health expenditure increased, while the share of other components in terms of firms and donors fell drastically. Relative to other sources, the households' payment for healthcare through out-of-pocket spending still accounts for the highest fraction of THE in Nigeria.

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<sup>1</sup> The formal sector social health insurance scheme covers individuals in the public sector, organised private sector, armed forces, police and allied services, students of tertiary institution and voluntary contribution.

<sup>2</sup> HMO's are created to check agency problems in health care. They check demand side problems by ensuring that insured individuals make some out of pocket payment for medical care and also check supply side problems by monitoring health care providers carefully, penalizing them for profligate prescription and giving them financial incentives to provide for essential care. Some HMO's are both insurers and providers of health care.

## **2.2. Prevalence of Illness in Nigeria**

Among the group of illnesses listed by the WHO, the Centre for disease control (CDC, 2013), identifies ailments that are major determinants of the prevailing health status in Nigeria. This is with reference to mortality figures in the country. From a total of ten illnesses which have major impact on health status in terms of mortality rate, leading causes of mortality in Nigeria are associated with communicable disease. These include malaria, lower respiratory infections, HIV/AIDS, diarrhoea, protein energy malnutrition, meningitis and tuberculosis. For non-communicable diseases, cancer and stroke are identified as the leading cause of mortality. Among illnesses grouped as injuries; mortality figures are more related to road injuries.

The CDC (2013) revealed that mortality in Nigeria is largely due to being ill with malaria. Mortality estimates from malaria show that the illness contributes about 20% to total mortality figures in the country. This is closely followed by lower respiratory infections (19%), HIV/AIDS (9%), diarrhoea (5%) and road Injuries (5%). Others include protein energy malnutrition (4%), cancer (3%), meningitis (3%), stroke (3%) and tuberculosis (2%). The remainder of all other illness conditions constitute 27% of total mortality figures in the country.

In terms of definite contributions of malaria to health status measures in Nigeria, it is shown that the illness singly accounts for a total number of about 11,000 maternal deaths per 100,000 live births, 250 infant mortality per 1,000 live births and 390 under-five mortality per 1,000 live births (CSLAC, 2012). Malaria contribution to mortality figures has unequivocal implication on life expectancy in the country (LHO, 2012). This is because it influences the number of years that a new born is expected to live. Evidence from the NBS (2012) shows that the illness accounted for about 65% of total reported illnesses in Nigeria. In 2011, it had dropped to about 54% of total reported cases of illness. This shows higher incidence of malaria relative to other illness types in Nigeria and is an indication that individuals and household will spend more on treatment of the illness than other forms of illnesses. We associate this possibility with earlier statistics above which gives inkling to overall drop in donor contribution to health care financing part of which is for malaria control as well as relatively higher payment for health care by household through out of pocket payment than government finance.

## **3. LITERATURE REVIEW**

In line with Grossman (1972a), the onset of illness compels individuals to seek for medical care, incurring costs which may be direct or indirect. Individuals desire good health for two main reasons: for the satisfaction derived from consuming good health and the market return of being healthy which could be measured using wage rate or labour productivity in a perfect market situation. In this light, Grossman (1972a) shows that individuals will invest in health until the marginal return of gross investment in health capital equals the marginal costs of such investment. Illness costs are therefore grouped into two main categories which are treatment costs or otherwise direct costs and productivity loss or indirect costs.

McLinden (2013) conceptualise direct costs of illness as financial costs associated with medical treatment and provision of health care. Direct costs is further grouped into medical and non-medical costs. Direct medical costs consist of cost of hospital stays, outpatient visits, drugs, and medical devices used for the treatment of an ailment. Direct non-medical costs includes travel cost to obtain health intervention, time spent by patients and their care givers in order to recuperate from illness (Zhang et al. 2013)

Indirect costs comprise of loss of resources due to morbidity and mortality from illness. Hence it places a value on life which may be controversial based on ethics (Joel, 2006). Indirect costs also denote productivity losses due to illness. It is measured as costs associated with days absent from work or losses associated with inefficiency at work which is referred to as work disability, presenteeism or workers incapacitation (Joel, 2006). Productivity losses are sometimes calculated by multiplying the cumulative number of missed workdays by a daily salary (Koopmanschap and Rutten, 1996). Some studies had made use of loss in wages or income due to ill health as a proxy for productivity losses (Ghatak and Madheswaran, 2011; Zhang et al, 2013). However where team work is involved, productivity losses may exceed wage rates because the absence of a worker may drastically affect output or wages (Zhang et al, 2013). Other forms of indirect costs from illness are non-monetary or intangible. These include pain, suffering, and discomfort, which are not considered as economic costs. They are reflected in illness morbidity which results to inefficiency of labour on the job otherwise known as presenteeism (Zhang et al, 2013).

Three basic methodological approaches have been identified in the literature for estimating direct cost of illness. They include: The top down approach (TDA), the bottom up approach (BUA) and the econometric or incremental approach (ECA) (Joel, 2006; McLinden, 2013). The TDA otherwise referred to as the aggregate approach or the gross costing approach requires allocation of portions of known total health expenditure to a class of diseases based on the severity of the ailment group. Developed by Rice (1967), the method consists of allocating total national health care expenditure by type of care among 16 international classifications of diseases (ICD) categories. This approach hence makes use of specific codes that characterises the severity group of the disease and from a large expenditure database specifies what is expended on the illness category (McLinden, 2013).

The BUA otherwise known as the micro costing approach estimates illness costs associated with a particular treatment or service and the number of times the ill individual uses such treatment (McLinden, 2013). This approach requires identifying individuals with the disease of interest either from person based data or sources that provide individual cases. All units of health care used by a patient and cost incurred for each unit are determined. Total direct cost of illness is then computed by summation of all unit costs. Mean per person costs can then be extrapolated to the whole population using incidence or prevalence data. (McLinden, 2013). The BUA is a person based estimation method and allows for greater detail of analysis and hence reflects differences in costs between patients depending on the state of the disease.

The ECA estimate the incremental difference between a cohort of the population with the disease and the cohort without the disease. Both cohorts are matched using regression analysis by various demographic characteristics such as age, sex, race, and geographical location. The ECA is estimated using the mean difference (MD) approach or the multiple stage regression (MSR) approach. The MD approach compares the mean costs incurred by each of the cohorts to determine the incremental difference attributable to the disease of interest. This approach usually adopts use of costs per case of the disease (Swensen et al., 2003). The MSR approach is used for large number of cases with zero cost of treatment and few cases with very high costs. The incremental cost of the disease is measured comparing the regression estimate with the disease dummy variable turned on to the regression and the estimate with the disease dummy variable turned off. The MSR often uses a two stage regression. It is used to estimate the likelihood of individual receiving any care and the excess of care received.

A number of theoretical approaches have been identified in the literature explaining the methodology involved in analysing indirect cost of illness. These include: the production function approach (PFA), the Willingness to pay (WTP) approach, the Human capital approach (HCA) and the Friction Cost Approach (FCA) (Salihu and Sanni, 2013; Filipovic et al., 2011). Studies adopting the PFA are usually based on macroeconomic analysis of the economic burden of diseases or poor health status. Such studies commonly adopt the augmented Solow model to capture the effect of ill health on economic growth and total factor productivity (Gallup and Sachs, 2001; Ahuja et al., 2009; Cole and Neumayer, 2006; Asante and Asenso-Okyere, 2003). Bloom and Canning (2005) however made use of the PFA in a micro study analysis measuring the effect of reported health status on wage rate.

The WTP approach quantifies the amount an individual is willing to pay to reduce the probability of contacting an illness or an undesirable health outcome and the risk of mortality (Salihu and Sanni, 2013). The machinery for determining how much individuals are willing to pay compels the use of survey data. It includes survey studies, examining additional wages for high risk jobs or examining the demand for products that lead to improvement in health and safety (Joel, 2006). Such safety products could include the use of mosquito treated nets, condom use, seat belts etcetera. This approach requires individuals to state the maximum amount they would be willing to pay to acquire a service or prevent infection from a disease (Jimoh et al., 2007). However the amount an individual is willing to pay depends on his income and financial status, which makes the results income sensitive. This approach has also been criticised on grounds that respondent's interpretation of questions may be biased if they desire to engage in strategic behaviour (Sachs and Malaney, 2002).

The HCA is the most commonly used approach in cost of illness studies (Filipovic et al., 2011; Joel, 2006). The approach quantifies potential productivity losses due to illness in terms of forgone earnings assuming full productivity. The approach is based on the premise that individuals produce a stream of output over the years that are valued as individuals' earnings and the individual's rate of pay is assumed to be equal to the value of a person's labour activity. Hence the HCA measures indirect costs by placing a monetary value on the worth of life. This approach places a lower value on the elderly and non-working group than the young and working group (Joel, 2006). Analysis of productivity losses associated with mortality or permanent disability is determined by the HCA using the product of earnings lost at each age and the probability of living to that age (Joel, 2006). The HCA has however been criticized for ignoring intangible costs such as pain and suffering hence underestimating illness costs and its failure to capture productivity losses only from the patients perspective and ignores losses to the firm or costs associated with the replacement of a worker. Such costs include expenses incurred in searching for a new employee and training the new staff. Thus FCA was introduced to correct these shortcomings FCA (Filipovic et al., 2011).

The FCA considers cost associated with productivity loss from the time of workers absence from work due to ill health through the period of searching, recruitment, training and replacement of the ill worker (Frick 2007, Filipovic et al., 2011). This is known as the friction period and it depends on the flexibility of the labour market and degree of unemployment. The FCA is more related to the employer and is argued to better capture productivity losses to the society (Frick, 2007; Filipovic et al., 2013). The approach is occupation specific and is not clear about what happens to the productivity of an individual who is absent repeatedly and unpredictably (Frick, 2007).

In Africa, most studies examining the effect of illness on the economy have mainly examined illness costs in terms of direct costs, productivity losses and proportion of economic output lost to the disease. Studies in Africa examining illness costs have mainly focused on costs burden associated with malaria (Salihu and Sanni, 2013; Kioko et al., 2013;



Okorosobo et al., 2011; Alaba and Alaba, 2009). This is because in tropical and sub-tropical regions of Africa particularly SSA, malaria is noted as the most common ailment and is known to significantly drive up poverty and poor economic growth (Gallup and Sachs, 2001).

A study conducted in Kenya had shown that individuals who have malaria infection earn 44% lower wage income than those in good health particularly due to morbidity effect of the illness (Kioko et al., 2013). Another study examined illness costs in Nigeria with use of the bottom up approach showed that total direct costs due to malaria in rural Nigeria regardless of sector of employment, amounts to approximately N357.21 (US \$2.23) (Alaba and Alaba, 2009). This figure appears worrisome with the rising statistics associated with poverty in Nigeria. For instance as at 2010 the number of Nigerians living on less than US \$1 per day had risen to 61.25% from previous figures of 51.60% in 2004 (NBS, 2012). The huge cost of treatment associated with malaria could account for why households are willing to pay more for the prevention of the illness than to suffer high treatment cost. Results of the study by Jimoh et al., (2007) had shown that the Nigerian households are willing to pay as much as N7, 323 (US \$61) for the control of malaria per month which is in excess of N2, 715 (US \$22.6) per month of what they bore at the period of the study. An extrapolation of the cost Nigerians are willing to pay for malaria control translates to about 12% of the country's Gross Domestic Product. The NBS (2010) show that some Nigerians who report being sick with malaria do not seek medical treatment due to the high cost of treatment. One implication of such action is a further deterioration of health status which increases the risk of poverty and economic dependence. Findings on household willingness to prevent malaria illness are also buttressed by Onwujekwe et al (2014) with evidence of high ownership and use of Insecticidal treated nets (ITN) in Enugu state. From a sample of randomly selected households, ownership and use of ITN were as high as about 73% and 71.2% respectively. The study showed higher preventive behaviour for rich than poor persons especially in terms of expenditure on window and door nets.

Etiaba et al (2015) examined direct cost of malaria in relation to coping mechanisms of households in Nigeria. Findings of the study showed that households pay mainly through out of pocket for all expenditures related to the illness. Effect of the illness shows devastating effect on household welfare in terms of reducing household savings (79.5%) and other expenditures (22.5%).

Overall, findings from the literature only show cost computations for direct and indirect costs burden of malaria for a single population strata. Findings are not related to other population groups to determine the group that experiences more income losses and spend higher for treatment of the illness. A study in this direction gives policy makers required information to combat the illness and reduce its effects by intense focus on the group that experiences higher burden from malaria. This approach in relation to employment groupings in Nigeria is imperative with the highly informal nature of the Nigerian economy. Again the low NHIS coverage for majority of the population due to high informal employment types necessitates research on cost computation of the illness across employment groupings.

In addition, we observed that no study to the best of our knowledge examined treatment costs related to the illness in terms of monthly income loss. An examination of costs burden of malaria in this light provides findings on how much income is lost to an episode of malaria particularly due to its high prevalence in the country and possibility of experiencing repeated cases as a result of vulnerability of the populace to the malaria parasite. Figures for the fraction of income losses to malaria treatment also provides findings on how much the illness reduce income and hence welfare of the Nigerian populace. This follows from high poverty rates in the country. Figures on poverty profile show that as at 2010, approximately 60% of the Nigerian population lived on less than US \$ 1 daily. This implies that more than half of the population are poor (NBS, 2012). Welfare losses will thus be reflected in terms of income fraction lost to the illness.

## 4. METHODOLOGY

### 4.1 Computation of Costs

Following the argument that there is productivity loss associated with illness, this study computes indirect cost associated with an episode of malaria using specifications of the HCA presented as

$$IDC_i = NMD_i * DE_i \quad (1)$$

Where  $IDC_i$  represents average indirect costs,  $NMD_i$ , represents the number of missed workdays<sup>3</sup>, and  $DE_i$  is daily earnings for an individual  $i$  (Koopmanschap and Rutten, 1996; Joel, 2006; Alaba and Alaba, 2009; Ghatak and Madheswaran 2011; Salihu and Sanni, 2013; Mclinden, 2013). Equation 1 is estimated only for persons with malaria who are gainfully employed. Earnings of such persons and missed workdays are used to compute average figures for productivity loss due to a bout of malaria. Thus individuals with malaria who did not miss any workday were not included in the sample used to determine productivity loss from malaria.

<sup>3</sup> This study examines mean workdays lost for a one month work period.

Computation of direct costs associated with a bout of malaria is determined using the bottom up approach<sup>4</sup> given as:

$$DC_i = \sum_j^4 TEM \quad (2)$$

Where **DC<sub>i</sub>** represents average direct cost associated with treatment of a bout of malaria for an individual **i**, TEM, represents total expenditure for the treatment of malaria. Total expenditure for treating malaria is determined as a summation of four different types of cost (transport costs to the hospital, physician consultation charges, as well as costs of drug and hospitalisation expenditure) covered in the HNLSS.

To further determine cost burden for treatment of an episode of malaria, the study measures the proportion of monthly income expended on a bout of malaria as

$$MiM_i = \left( \frac{DC_i}{Minc_i} * 100 \right) \% \quad (3)$$

Where **MiM<sub>i</sub>** characterise average percentage value of monthly income of an individual **i** spent on malaria treatment. **DC<sub>i</sub>** represents mean value of total costs incurred during treatment of one bout of malaria and **Minc<sub>i</sub>** symbolise average monthly income of an individual **i** in the sample.

This study estimates the fraction of GDP lost to an episode of malaria using total cost associated with a bout of the illness as a percentage of GDP<sup>5</sup>. For simplicity, the study computes total direct and indirect cost in relation to the illness assuming every individual of all age group in Nigeria experiences one bout of malaria per year. In line with statistics of malaria incidence; that about half of the adult population in Nigeria experiences at least one episode of malaria per year with children below five years of age having as much as 2-4 bouts each year (FMOH, 2005; UNICEF, 2010), we assume a case where all persons in the population experience one episode of the illness. This enabled us determine the total cost for a bout of the illness in Nigeria. Total direct cost for all persons in the population is hence determined as;

$$TDC = DC_i * Pop \quad (4)$$

Where **TDC** represents total direct cost for all persons in the population, **DC<sub>i</sub>** symbolise direct cost per individual as obtained in equation 2 and Pop represents population size.

Secondly the study computes indirect costs only for the fraction of individuals in the economically active population who missed workdays due to the illness. Fraction of persons in the working population who missed workdays is determined by the fraction of individuals in the study sample who missed workdays due to malaria. The study hence computes total indirect costs associated with malaria in three stages: Stage 1 indicates determination of number of persons in the economically active population, stage 2 shows computation of proportion of persons in the economically active population who missed workdays due to malaria and stage 3 shows computation of indirect costs for persons who miss workdays from malaria.

First stage:

$$EA = X * Pop \quad (5)$$

Where EA characterise the fraction of economically active population in the total population and X represents the percentage of the economically active population in the total sample surveyed in the HNLSS.

Second stage

$$EAM = M * EA \quad (6)$$

Where EAM, symbolise persons in the economically active population who missed workdays due to malaria, M denotes percentage of the economically active respondents who missed workdays due to malaria as obtained in study sample.

Third Stage

$$TIDC = IDC_i * EAM \quad (7)$$

TIDC implies total indirect cost for an episode of malaria in Nigeria **IDC<sub>i</sub>** is defined already as mean indirect cost for each individual and EAM is as earlier defined.

Total cost (TC) associated with an episode of malaria in Nigeria is hence estimated as the sum of total direct costs and total indirect costs as:

<sup>4</sup> The bottom up approach has been explained in chapter 3.

<sup>5</sup> Figures for 2009 nominal GDP were used in conformity with the period for which the Household National Living Standard Survey (HNLSS) was conducted.

$$TC = TDC + TIDC \quad (8)$$

Total cost associated with malaria as a fraction of GDP is hence estimated as

$$GDP_{lost} = \left(\frac{TC}{GDP} * 100\right) \% \quad (9)$$

The study objectives are examined across employment types. Employment types are firstly grouped into formal and informal employment<sup>6</sup> and further into self-employment in agriculture, other self-employment types (owned account)<sup>7</sup> and wage employment<sup>8</sup>.

## 4.2 Data Source

Data used for the study is from the HNLSS. The survey adopted a two stage sampling technique in which the selection of enumeration areas represented the first stage or primary sampling unit (PSU) while the selection of households formed the second stage or secondary sampling unit. Ten enumeration areas were selected in each local government area (LGA) with ten households systematically selected in each enumeration area. This produced a total of 100 households per LGA and 77,400 households nationally. The survey covered a total of 333,568 individuals. The HNLSS was carried out over a period of 12 months and extracted information on a wide range of socio economic and demographic variables that measure living standards of the individual and households in Nigeria. These include information on education, health, poverty, household expenditure amongst others.

Data collected on health provides information on the health condition of the individual two weeks before the interview date. Respondents were asked to identify type of illness experienced most frequently two weeks prior to the survey, who diagnosed the ailment, number of days for which usual activities were halted due to illness, amount spent on medication, consultation, hospital admissions, and transport to the hospital. For all age groups the HNLSS had an overall of 332,937 individuals. A total of 24,849 (7.46%) individuals reported one form of the 21 illness type recorded during the survey. Persons who had malaria account for 3.07% (10,221). A total of 188, 497 were in the economically active population with persons in the work force reporting illness comprise 16,882 in number with those reporting only malaria consisting of 5,116 (30.30%).

## 5 RESULTS AND DISCUSSION

### 5.1 Estimates of Workdays Lost and Indirect Cost (Productivity Loss) due to Malaria

From a total of 5,116 persons who had malaria in two weeks prior to the HNLSS, we was observed that 2,554 (50%) persons indicated lost workdays due to the illness. This implies that one in two individuals in the economically active population who fell ill with malaria experienced some lost in labour contribution to economic output. Analysis of workdays and productivity loss from malaria indicates disproportionate effect of the illness across the various employment categories in the study. The results for productivity loss from a bout of malaria for the patient with malaria and the respective caregiver, and across the different employment groupings are presented in table 1.

Results at the national level indicate that in Nigeria, individuals and their caregivers loose an average of 6 and 5 workdays respectively to an episode of malaria. Daily income loss by individuals and their caregivers respectively amounts to about ₦ 5,532.59(\$37.16<sup>9</sup>) and ₦ 4,828.73 (\$32.43). These culminate to average total productivity loss of approximately ₦ 59,586.70 (\$400.18) per episode of the illness.

Closer examination of the result for workdays lost to an episode of malaria across formal and informal employment suggests that malaria has higher detrimental effect on living standard of individuals in the informal sector. This is

<sup>6</sup> This study defines persons in formal sector employment as employees in the government sector, Nongovernmental organisations, and international corporative/Diplomatic mission. Persons in informal employment type are those in self-agricultural employment, local corporative, private sector apprentice, unpaid family business, paid household employees, and all self-employment types.

<sup>7</sup> Owned account employees refer to persons in informal business enterprise (e.g. shop keepers and traders), dress makers, barbers, carpenters and taxi drivers.

<sup>8</sup> Wage employment individuals are grouped as persons in formal employment type, local corporative employees, paid household chores and other forms of paid informal employment.

<sup>9</sup>The dollar equivalent was computed using the united states dollar average exchange rate value for 2009 given as ₦ 148.90 per \$1 (CBN, 2012)

because individuals in the informal sector lose more workdays to malaria relative to those in the formal sector and such employment type requires workers presence in order to earn income. In the informal sector, persons with malaria illness and their caregivers lose an average of about 6 and 5 workdays, respectively. The resultant effect is an average total productivity loss of about ₦ 60,403.20(\$405.66) for both the patient and the caregiver. In the formal sector, both malaria patients and their caregivers are absent from work for an average of about 5 workdays. Total productivity loss per episode of malaria for formal sector workers and their care givers sums to an average value of about ₦ 61,128.70(\$410.54). This suggests that workdays lost by malaria patient in the informal sector and their caregivers are higher than that of persons in the formal sector. The results also show that individuals in wage employment lost relatively smaller workdays to an episode of malaria than those in self-employment in agriculture and other self-employment. This result suggests higher detrimental effect of malaria on economic activity of persons engaged in self-employment in agriculture.

**Table 1:** Average Estimates of total workdays lost and productivity loss per episode of malaria across Employment types

Level/label	Patient			Care giver			Patient and Caregiver
	Workdays lost	Daily Income (N)	Productivity loss (Indirect cost) (₦)	Workdays lost	Daily Income (₦)	Productivity loss (Indirect cost) (₦)	Total Productivity Loss(Indirect cost)
All (National)	6.15	5,532.59	3,4047.55*** (16.24)	5.29	4,828.73	25,539.10*** (3.43)	59,586.70*** (19.67)
Employment Type							
Informal	6.34	5,551.96	35,221.61*** (16.11)	5.31	4,744.08	25,181.60*** (3.283)	60,403.20*** (19.40)
Formal	5.23	5,758.46	30,099.47*** (5.68)	4.47	6,946.32	31,029.20* (1.60)	61,128.700*** (7.29)
Formal/Informal							
Wage employment	5.31	5,686.40	30,217.52*** (5.894)	4.50	6,946.32	31,258.50* (1.61)	61,476.00*** (7.51)
Informal							
Self-employment in Agriculture	7.05	4,663.40	32,876.96*** (18.03)	5.930	3,411.20	20,225.00** (2.447)	53,102.00*** (20.47)
Other Self Employment (Owned account)	5.58	7,010.48	39,125.494*** (8.68)	4.940	5,555.40	27,438.10** (2.466)	66,563.60*** (11.15)

Source: Authors computation

Note:

1. Mean coefficient reported with t- values in bracket.
2. \*, \*\* and \*\*\* indicates statistical significance at 10%, 5% and 1% levels respectively
3. Level of statistical significance was based on conventional Tabular T-values of 1.65 at 10%., 1.96 at 5% and 2.58 at 1%.

Results of the study showed that persons in self-employment in agriculture and their caregivers respectively lose as much as 7 and 6 workdays on the average to an episode of malaria resulting in a total of ₦ 53,102.00 (\$400.18) as indirect cost. Those in other self-employment types along with their caregivers lose an average of about 6 and 5 workdays respectively to a bout of malaria. This implies the sum of about ₦ 66,563.60(\$447.04) as indirect costs. Persons with malaria engaged in wage employment along with their caregivers are both not able to go to work for about 5 workdays on the average, resulting to indirect costs of about ₦ 61,476.00 (\$412.87)



## 5.2 Direct Costs for Treatment of an Episode of Malaria

Across the different employment grouping in the study, are variations in costs incurred for treating malaria. The results for malaria treatment across the employment categories are shown in Table 2. The figures indicate that each individual in Nigeria spend an average of ₦ 2,730.46(\$18.34) as total expenditure for treatment of malaria. Further examination of direct cost figures indicates that there are slight differences in treatment cost incurred by formal and informal sector workers. The figures show that persons employed in the informal sector spend about ₦ 2,652.66 (\$17.82) as total direct cost for treating malaria. On the other hand those who are employed in the formal sector incur mean treatment cost of about ₦ 2,601.52(\$17.47) when ill with malaria. The result therefore suggests that cost burden associated with malaria in Nigeria is slightly higher for those who are in the informal sector than those in the formal sector.

**Table 2:**Direct cost estimates (treatment costs) due to malaria across employment types

Level/Label	Estimates of Direct cost (₦)	% of Monthly income
All	2,730.46*** (32.35)	3.14*** (13.85)
<b>Employment Type</b>		
Informal	2,652.66*** (31.85)	3.02*** (13.22)
Formal	2,601.52*** (14.10)	3.22*** (5.06)
<b>Informal/Formal</b>		
Wage employment	2,590.43*** (14.37)	3.17*** (5.12)
<b>Informal</b>		
Self-employment in Agriculture	2,852.17*** (24.92)	3.10*** (15.56)
Other Self Employment (Owned account)	2,264.72*** (24.14)	2.54*** (5.60)

Source: Authors computation

Note:

1. Mean coefficient reported with t- values in bracket.
2. \*, \*\* and \*\*\* indicates statistical significance at 10%, 5% and 1% levels respectively
3. Level of statistical significance was based on conventional Tabular T-values of 1.65 at 10%, 1.96 at 5% and 2.58 at 1%,

Closer examination of employment types reveal that individuals in self-agricultural employment spend highest for treatment of a bout of malaria than those in wage and other self-employment. Persons in self-agricultural employment spend about ₦ 2, 852.17 (\$19.16) while those in wage and other self-employment spend approximately ₦ 2, 590.43(\$17.40) and ₦ 2, 264.72(\$15.21) respectively. The relatively high spending by self-agricultural workers can be due to neglect of illness till it becomes severe before seeking medical attention. This is because agricultural activities in Nigeria are practised mainly in the rural areas where literacy level is expectedly low. The result however suggests unfavourable welfare effect of malaria on self-agricultural sector workers compared to individuals in wage and other self-employment.

In terms of income fraction spent on treatment, the results show that regardless of employment type, individuals spend approximately 3% fraction of monthly income for the treatment of a bout of the illness. This implies that if all factors remain constant, individuals are able to save about 3% of monthly income when they do not fall ill with malaria.

## 5.3 Total Cost Associated with Malaria and Cost Fraction in GDP across Employment Types.

GDP losses to malaria vary across employment sections. Table 3 presents study findings for total costs associated with malaria in Nigeria and cost fraction in GDP for the different employment types. The result suggests that the Nigerian economy loses close to ₦1, 906.08 billion (\$12,801.07 million) annually to one incidence of malaria attack. Findings at the national level show that total indirect and direct cost associated with one occurrence of malaria are

respectively ₦ 1,485.59 billion (\$9,977.10 million) and ₦ 420.49 billion (\$2,823.98 million). This is an indication that there are more losses to malaria in Nigeria in terms of opportunity cost or labour contribution than direct cost expenditure. Total loss to malaria attack per year corresponds to about 7.56% of GDP. Alaba and Alaba (2009) showed that, about 10% of GDP is lost to the illness in Oyo State<sup>10</sup>. The result however indicates that the economy still losses substantial amounts in terms of monetary value of costs and GDP forgone.

A major fraction of GDP lost to malaria in Nigeria is in connection to the informal sector. The sector accounts for total indirect and direct cost of about ₦ 1, 440.10 billion (\$9,671.60 million) and ₦ 384.64 billion (\$2,583.21 million) respectively. These sum up to a total cost figure of about ₦ 1, 824.73 billion (\$12,254.73 million) and amounts to about 7.23% of GDP. In the formal sector, total indirect and direct costs from malaria are respectively about ₦ 82.60 billion (\$554.73 million) and ₦ 25.21 billion (\$169.31 million)resulting to approximately ₦ 107.81 billion (\$724.04 million) and consequently about 0.43% of GDP.

**Table 3:** Direct and Indirect cost estimates (₦ billion) as a fraction of 2009 GDP across employment types

Level/Label	Total indirect cost patient	Total indirect cost care giver	Total Indirect cost	Total Direct cost	Total Cost (Direct and Indirect)	Total Cost % of GDP
All	1,481.80	3.79	1,485.59	420.49	1,906.08	7.56
<b>Employment Types</b>						
Informal	1,436.63	3.47	1,440.10	384.64	1,824.73	7.23
Formal	82.27	0.33	82.60	25.21	107.81	0.43
<b>Formal /Informal</b>						
Wage employment	108.10	0.33	108.43	32.85	141.28	0.56
<b>Informal</b>						
Self-employment in agriculture	697.97	1.31	699.28	214.65	913.93	3.62
Other self-employment (Owned account)	732.20	2.00	734.20	150.24	884.45	3.51

**Source:** Authors computation

It is further shown that GDP lost to malaria in Nigeria is higher from self-employment in agriculture than other self-employment types and wage employment. Total indirect and direct cost due to malaria from self-agricultural sector employment is respectively about ₦ 699.28 billion (\$ 4,696.31 million) and ₦ 214.65 billion (\$1,441.57 million). This shows a total of about ₦ 913.93 billion (\$6,137.88 million) lost as total cost to malaria from self-employment in agriculture and corresponds to about 3.62% of GDP.Total indirect and direct costs from malaria for other self-employments grouping is respectively shown to be approximately ₦ 732.20 billion (\$4,917.40 million) and ₦ 150.24 billion (\$1,009 million) with total cost value of approximately ₦ 884.45 billion (\$5,939.89 million) and GDP loss of about 3.51%. Values of total indirect and direct cost from malaria for wage employment are correspondingly shown to be approximately ₦ 108.43 billion (\$ 728.21 million) and ₦ 32.85 billion (\$220.62 million). This suggests about ₦ 141.28 billion (\$948.83 million) as total cost and about 0.56% of GDP.

## 6. CONCLUSION

Findings of this study suggests that one in two persons employed in the labour force will experience loss in labour contribution as a result of malaria with indirect cost of about ₦ 5,532.59(\$37.16) and ₦ 4,828.73 (\$32.43) per person per day for the patient and care giver, respectively. Treatment costs which on the average stands at approximately ₦ 2,730.46 (\$18.34) per person shows that individuals lose about 3% of monthly income as curative expenditure. Amounts spent on malaria treatment are not significantly different for formal and informal sector workers. However individuals in self-agricultural employment spend more for treating the illness than those in wage and other self-employment types.

On the aggregate, annual loses in labour contribution to an episode of malaria amounts to about ₦ 1,485.59 billion (\$9,977.10 million) with direct cost of about ₦ 420.49 billion (\$2,823.98 million).This yields a total of about ₦ 1, 906.08

<sup>10</sup>Oyo State is one of the 36 states of the Nigerian federation.

billion (\$12,801.07 million) as monetary losses to a bout of the illness per year and translates to approximately 8% of GDP. GDP lost to the illness is higher from the informal sector than formal sector particularly for self-employment in agriculture. Agricultural production in Nigeria can therefore be very well improved with effective malaria control programmes. Policies geared towards increasing labour contribution to output, welfare enhancement and overall economic growth should focus on measures to reduce or completely eradicate malaria prevalence in Nigeria. Such tactical actions should rank high in policy makers' agenda.

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