Investigation of Malaria Prevalence and Health Outcome in Nigeria

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Abstract: *In Nigeria, there is a higher level of malaria prevalence in terms of under-five mortality which depicts a declining health outcome. Though, of recent, there has been an increased health spending nationally, partly due to the need to meet a subset of the Nigeria Vision 20:2020 and millennium development goals (MDGs) goal six which is malaria reduction in order to attain better health outcome and economic growth. This study adopted a time series econometric approach with a scope covering 1970 to 2013 in the investigation malaria impacts on health outcome in Nigeria. The study illustrated the relationship between health outcome and malaria prevalence in Nigeria. This paper revealed that malaria cases impact on under-five mortality, and the degree of this impact determines the effect of malaria prevalence on health outcome in Nigeria, which are of course low life expectancy and reduction in active labour force. The study suggests that if greater resources are available for malaria control, a high health outcome through successful malaria reduction will be recorded before the end of 2015 in Nigeria.*

Keywords: *health outcome, under-5 mortality, malaria cases, health spending & malaria prevalence.*

I.   Introduction

The menace of malaria poses great challenge to both human capital and economic development in Nigeria. In the recent years, there has been increase in human and financial commitments to malaria control, nationally and internationally, partly due to the need to meet the development targets set in the millennium development goals (MDGs). The main focus of the first to the sixth components of the millennium development goals (MDGs), adopted by the United Nations in 2000, is to solve the problems associated with diseases and poverty respectively. The sixth of the listed objectives of the MDGs is to reduce to half, malaria prevalence between 1990 and 2015, Alaba and Alaba (2011).

Malaria is a term commonly used for the four species of malaria plasmodia that infect human beings. They are; Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale and Plasmodium malariae. Plasmodium falciparum is the most dangerous form of the disease, accounting for 90 percent of malaria deaths in the world (Benjamin, Mangheni, Tsegai & Ringler, 2012).

Malaria is a disease that is common to both young and old in African countries like Nigeria. For instance, in Nigeria, malaria accounts for 60% of out-patient visits and 30% of hospitalizations among children under five years of age. With a population of about 150 million people, at least 50% of the population in Nigeria suffers from at least one episode of malaria each year and more reported cases of deaths due to malaria than any other country in the world, (WHO, 2012).

Given that malaria is endemic throughout Nigeria, and that more than half of the country's population is living below poverty line, malaria incidence may increase significantly in Nigeria because many may not be able to afford the newly introduced expensive drugs due to poverty. This has serious implications for the achievement of development blueprint in the MDG target and Nigeria Vision 20:2020. Effective control of malaria is capable of reducing household poverty, improvement of human capital, welfare and aggregate national development in Nigeria. This is because the economic development in countries where malaria is endemic depends on the ability to control the disease.

Despite several efforts being put in place by the government to eradicate malaria with its associated impact on health outcome in Nigeria such as; Roll Back Malaria, free insecticide-treated nets distribution, insecticide spraying, National Health Insurance Scheme among other, several setbacks have been encountered which have actually made effective and sustainable control of the disease difficult, FMOH, (2011). These problems have increased malaria impact on health outcome explicitly on under-5 mortality rate, low life expectancy and cost in Nigerian economy in terms of high government spending on health, reduction in labour supply and efficiency, low productivity and income, high malaria cases and death. For instance, malaria is estimated to account for 732,000 deaths among children aged 5 or less, or about 8% of all such deaths; the share in Africa is 16%, (Black et al 2010). This implies that there has not been dramatic reduction in malaria cases and deaths in parallel with the intensified campaign and spending against malaria.

To be specific, in Nigeria, report from 2008 Nigerian Demographic and Health Survey, NDHS also revealed that currently, 75 children per 1,000 live births die before their first birthday (40 per 1,000 before the age of one month and 35 per 1,000 between one and twelve months). Overall, 157 children per 1,000 live births or about 1 child out of 6, die before reaching age five (NDHS 2008). Federal Ministry of Health, (FMOH, 2011) further reported that about 5.9 million babies are born in Nigeria every year, and nearly one million children die before the age of five years. One quarter of all under-five deaths is newborns - 241,000 babies each year. It is therefore obvious that many deaths occur at home and are unseen or uncounted in official statistics.

These costs of malaria in terms of under-five mortality, life expectancy and infant mortality and morbidity depict a declining health outcome in Nigeria, which is a socio-economic cost to the economy. This malaria prevalence and poor health outcome in Nigeria become worrisome as one may wonder the possibility of Economic growth attainment in the midst of severe malaria cases like ours or the actualization of development goals in the midst of declining health outcome, if not first by observing reductions on socio-economic burden of malaria on health outcome. Considering these high mortality and morbidity rates, high cost of treatment of this endemic disease, low life expectancy, poor and declining health outcome, poverty as a result of depletion of savings and it's consequence in economic growth, this study seeks to investigate the socio-economic implication of malaria prevalence on Nigeria health outcome. In an explicit, the study seeks to investigate the impact of malaria menace on health outcome in Nigeria. The following research questions shall guide this research work;
1. Is there significant impact of malaria endemic on under-five mortality in Nigeria?
2. Is there a long run relationship between health expenditure and malaria Prevalence in Nigeria?
In line with research questions, the broad objective of this study is to determine the impact of malaria on health outcome in Nigeria. Specifically, the study aims:
1. To determine the extent to which malaria endemic impact on under five mortality in Nigeria.
2. To ascertain the long run relationship between health expenditure and malaria prevalence in Nigeria.

II. Empirical Literature

In a study to determine the relationship between deaths from malaria, public health and non health expenditure in Nigeria, **Bello (2005)**, adopted gross output transfer models on data from 1975-2001. The study revealed that there is a negative relationship between deaths from malaria, public health expenditure, per capita income and non-public health, but a positive relationship between deaths from malaria and political instability. The study further found that between 1975 and 2001, average of 5.86% of the GDP was lost to malaria death annually. While **NHMIS, (1999)** observed that malaria is by far the most important cause of morbidity and mortality in infants (38% and 28%) and young children (41% and 30%). **Bello (2005)** recommended that in addition to the current ₦14,000 per capita health expenditure, a transfer of an additional ₦45,684.00 per head from other sectors to the health sector to avert death from malaria.

This is similar to **Olufunke and Olumuyiwa** (2009) in their investigation of malaria in rural Nigeria, implications for the millennium development goals; they found that an estimate of about 10% of gross domestic output of Oyo state is being lost annually to malaria attack. This has serious implications for the achievement of development blueprint in the National Economic Empowerment and Development Strategies (NEEDS) and the MDG target. They concluded that effective control of malaria is capable of reducing household poverty, inequality, welfare and aggregate national development. **Ichoku et al**. (2010) also found that the incidence of catastrophic payments was about 29% at the 5% threshold and that more people are caught up in catastrophic financing when the threshold is 5%. The numbers are quite high. This study showed that such private health spending (either for malaria or any other illness) accounted for more than 20% of household non-food expenditure.

In a different study, **Alaba and Alaba (2011)** accessed the impact of Malaria in Rural Nigeria and Implications for the Millennium Development Goals, with data for the study collected using multi-stage-sampling techniques. The study sampled three health zones from Oyo State namely Ibadan, Ogbomoso, and Oyo were used as the base strata. The study revealed that the average number of workdays lost per malaria episode by the productive forces in the household was 16 and 15 days in the agrarian households and the non-agricultural segment respectively for all households which have serious implications for the achievement of development blueprint in the MDG target, which is similar to **Olufunke and Olumuyiwa** (2009) submission.

To examined the trends in health outcomes infant mortality in Nigeria as a wake-up call for intervention towards achieving the 2015 MDGs target, **Ojewumi and Ojewumi (2012)** applied data on the Trends in Infant and Child Mortality in Nigeria and noted that between 1990 and 2008, under-five mortality in Nigeria only falls from 199 to 157 against the 62 MDGs target by 2015. The study therefore, suggests an urgent action and greater national priority on child survival through interventions that will be integrated at community and family levels, targeting pregnant women, under-five children and accessing the hard-to-reach in order to meet the 2015 MDGs.

At the micro level, **Olalekan and Nurudeen** (2013) traced the impact of health spending on malaria reduction, using private direct costs (PDC) and private indirect cost (PIC) of malaria attack per episode approach to examine the trend of malaria burden and the effectiveness of malaria control measures using Asa Local Government Area of Kwara State as a case study. The research findings indicated that 37percent of the population of the studied sample suffered malaria attack with a dependency ratio of 33percentage. An average of about 3 days are lost by sick adult, about 2 days by the caretaker while on the average a sick student misses about 2 school days. The study recommended that government should expand the provision of free and highly subsidized insecticide treated mosquito nets. While **Chima and Goodman** (2003) suggested that malaria reduction may be attained by avoiding malaria areas or by undertaking production in such a way as to avoid exposure to mosquitoes.

In a study to illustrate the link between health spending and malaria reduction in Nigeria which is a subset of the millennium development goals (MDGs), **Nwanosike (2014)** argued that key mechanism through which health spending affects economic growth is via reduction in malaria cases and death. The study findings asserts that if greater resources are available for malaria control, a high economic growth and successful malaria reduction will be recorded before the end of 2015 in Nigeria. In order to compare the benefit incidence analysis of this government program on malaria in Enugu between urban and rural areas, **Nwagha et al.** (2014) used semi-structured questionnaires administered to 150 pregnant women and also 150 mothers of under-5 children, who were randomly selected from each of the two communities (rural and urban) from a local government in Enugu state, Nigeria. Nwagha et al revealed that within each socio-economic stratum (SES), the average monthly expenditure in the urban community was higher than that of the rural community except for least poor SES (p<0.05).

III. Methodology And Models

In modeling the impact of malaria prevalence on health outcome in Nigeria, the model captures the dynamics of annual malaria cases, health spending, per capita income and malaria death rate on health outcome (proxy under-5 mortality) within the nation. This research is a country-specific study which centered on Nigeria. In building these models, the Ordinary Least Square (OLS) was used as the estimation technique. The method of OLS is extensively used in regression analysis primarily because it is intuitively appealing and mathematically much simpler than any other econometric technique (Gujarati, 2003). The OLS method is based on some assumptions (see Gujarati, 2003) which make the OLS estimators to become BLUE (Best Linear Unbiased Estimator). However, the model is a co-integration model will be use to capture the objective two.

3.1.1 Model I

Model two of this study expresses under five- mortality rate as a function of malaria cases, health spending, literacy rate and Per capita income.

$$under = f\left(Mcase, Hspend, Litr, PCI\right) . \qquad . \qquad . \qquad . \qquad . \qquad \textbf{3.1}$$

The model can be specified econometrically as;

$$Under_t = \varphi_0 + \varphi_1 Mcase_t + \varphi_2 Hspend_t + \varphi_3 Litr_t + \varphi_4 PCI_t + V_t . \qquad . \qquad . \qquad 3.2$$

Where ; Mcase = Malaria cases, Hspend = Government Health expenditure, Under = Under-five mortality, PCI = Per Capita Income, Litr = literacy rate

This work captures the case of drop-out in school enrollment by taking note of attrition rate of the enrollment which we use as a proxy for literacy rate.

3.1.2 Model II

To capture the objective two, this work shall utilize the co-integration approach to investigate the long-run relationship between government health spending and malaria prevalence in Nigeria. This model is preferred because of its ability to present long run relationship and it is expressed as follows:

$$\Delta\mu_t = \delta\mu_{t-1} + \gamma_i \sum_{i-1}^{k} \Delta\mu_{t-i} + e_t ----------------3.8$$

Where Δ is the first difference operator, μ_t = errors generated from cointegrating-regression, μt-1= one period lag of the cointegrating-regression error, Σ = summation sign, K = amount of lag used, e_{it} is assumed to be normally distributed and white noise.

NB: The data used in this study shall sourced from World Development Indicators 2013, National Bureau of Statistics –Annual Abstracts of Statistics, as well as statistical bulletin of the Central Bank of Nigeria.

IV. Presentation And Analysis Of Results

The ordinary least square (OLS) regression results for the first model and co-integration test result for the second models are presented below:

Table 4.1 Regression result table   Dependent Variable – (Under_5)

Variables	Coefficients	t- values
Mcase	2.19e-07	3.03
Hspend	1.13e-07	3.09
PCI	-.0011953	-2.55
Litr	-4.11e-07	-3.11
Constant	62.56119	26.57

R-squared   = 0.9368 Adj R-squared = 0.9266 Number of obs =   44

From the regression result above, the sign of each variable in the model conforms to its "a priori" expectation. For instance, malaria cases (Mcase) shows number of people in the population that suffered malaria illness in one time or the other in a specific year. The coefficient of malaria cases is about 2.19, meaning that holding other variables constant, a unit increase in cases of malaria leads to an increase in the under-five mortality by about 22 units. The findings are also in conformity with the findings of Ojewumi and Ojewumi (2012) who in their study assert that malaria prevalence affects severely under-five mortality which decreases health outcome.

 Health spending (Hspend) shows that keeping other variables constant, a unit increase in health spending leads to about 11 units increase in under-five mortality. This result is in line with Nwanosike (2014) findings that the health expenditure does play vital roles in the control of under-five mortality through government sponsored malaria programmes and campaigns such as roll back malaria, provision of long lasting insecticides treated net, Artemisin Combined Therapy (ACT), among others. Per Capita Income (PCI) is about -0.0011, meaning that keeping other variables constant, a unit increase in per capita income leads to about 11 units decrease in the level of under-five mortality. The coefficient of literacy rate (Litr) is about -4.11, meaning that holding other variables constant, a unit increase in the literacy rate leads to an increase in the level of under-five mortality by about 41 units. In the model, the coefficient of constant is positive and it is statistically significant. The constant coefficient of **62.56119** represents the value of under-five mortality at the beginning of the study period i.e. (under_5) = **62.56119**, at the beginning of the study period if other factors held constant.

Furthermore, The R^2 value is 0.9231and R^{-2} (adjusted for loss in degree of freedom) is 0.9129. The value of R^2 shows that the model explains variations in under-five mortality to the tune of 92%. This implies that 92 percent of the variations in under-five mortality were explained by malaria cases, literacy rate, per capita income, and malaria death and health expenditure.   In order not to obtain spurious regression results, the variables were tested for stationarity employing the Augmented Dickey – Fuller (ADF) test. From the unit root test, it was found that all the variables are only stationary after first difference at 1%, 5% and 10% critical levels respectively. That is to say they are all integrated of order one i.e. I(1). This means that the mean, variance and autocovariance of each series are constant over time after difference at the chosen critical level.

In testing the objective two of this research work, which is "to ascertain the long run relationship between health expenditure and malaria prevalence in Nigeria", a cointegration test was then carried out. Since the study does not want to lose any useful information due to differencing, it carried out a cointegration test on the estimated model. This test is carried out using the Augmented Dickey Fuller test on the residuals obtained from the regression.

Table 4.2 Cointegration Test Result

Variable	t-ADF	Critical value at 1%	Critical value at 1%	Critical value at 1%
Residual (U$_{t-1}$)	-3.612	-3.628	-2.950	-2.608

From table 4.1 above, since the absolute value of computed t-ADF > critical t-ADF, especially when compared at the 5% critical value i.e. (/-3.501278/>/-2.8889/), we conclude that the estimated error term is stationary which means that the variables are cointegrated. This result is in line with the findings by Olalekan and Nurudeen (2012) who observed that there was a linear long-run impact of health spending on malaria reduction in Nigeria. Put in another way, there is a sustainable long run relationship between health expenditure and health outcome Nigeria proxy by under-five mortality in Nigeria. In other words, there is long run relationship between health outcome proxy by under-five mortality and malaria prevalence in Nigeria proxy by malaria cases.

4.2 Evaluation of Research Hypotheses

The hypotheses of this study can be evaluated from the results of our models. For Ho$_1$: malaria endemic has no significant impact on under-five mortality in Nigeria.

From the t-tests that were carried out on each of the variables on the malaria cases, health spending, per capita income and literacy rate were all found to be statistically significant. This means that these variables have significant impact on under-five mortality in Nigeria. For the first hypothesis, we reject the null hypothesis that malaria endemic has no impact on under-five mortality in Nigeria and accept the alternative hypothesis. For the second hypothesis, since the computed t-ADF > critical t-ADF, we conclude that there is long run relationship between health outcome proxy by under-five mortality and malaria prevalence in Nigeria proxy by malaria cases.

V. Research Findings

Based on the investigations of this study, the following findings were revealed:

➢ It is found that malaria prevalence imposes significant costs on the economy through government and individuals spending on malaria programmes and drugs. Interestingly, findings from this study revealed that there has been a significant reduction in malaria death on the economy within the recent years.

➢ The estimated negative impact of malaria prevalence on the health outcome is very large, but the mechanism behind this inverse impact is through labour force reduction. This is because malaria contributed to loss of days not only to the economically active labour force but also to the dependent population especially, the children of under-five years.

➢ The findings revealed the literacy rate is a direct factor that affects health outcome proxy by under-fiver mortality in Nigeria. This finding was similar to those of previous studies in which ignorance of the causes and mode of transmission of malaria increase the risk of under-five mortality, thereby reducing the level of health outcome in Nigeria.

➢ The research revealed that malaria cases and malaria death impact on under-five mortality, and the degree of this impact determines the effect of malaria prevalence on health outcome in Nigeria, which are of course low life expectancy and reduction in active labour force.

➢ Finally, this study finding disclosed low per capita income as a significant factor that causes higher rate of under-five mortality. This is so, because, in the presence of low per capita come, individuals and households find it difficult to purchase malaria drugs for their for sick children, thereby increasing under-five mortality and lowering health outcome.

VI. Policy Recommendations

From the research findings on the impacts of malaria prevalence on health outcome in Nigeria, the following research policy recommendations and conclusions were suggested;

Firstly, government should ensure that capital expenditure and recurrent expenditure on health are properly managed in a manner that it will raise the nation's health sector and accelerate health outcome. Public health education should be intensified; particularly in the rural communities where emphasis should be on environmental sanitation, protection from mosquito bites, as well as the distribution of free long-lasting insecticide treated net.

Again, it is important to conclude that there is sustainable long run relationship between malaria prevalence and health outcome in Nigeria. This implies that malaria prevalence is one the major causes of under-five mortality and therefore demands an urgent response for actualization of the development blueprint in the MDG target and Nigeria Vision 20:2020.

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