MALARIA INCIDENCE, TUBERCULOSIS AND ECONOMIC GROWTH IN NIGERIA

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ABSTRACT
The health sector globally is still devoting more energy and resources in terms of advocacy, prevention, control and management of malaria and tuberculosis with the aim to eradicate their spread. However, the world and Nigeria in particular is not on track to reach critical targets of the WHO Global technical strategy for reducing global malaria case incidence by 90% or more by 2030; and reducing the global malaria mortality rate by 90% or more as well as ending tuberculosis (TB) by 2030 which are among the target of sustainable development goals. Against this background, this study examine the impact of malaria and tuberculosis on economic growth in Nigeria. Secondary data covering the period from 1986 to 2023 were used for the study. The data set were first tested for stationarity properties to avoid spurious regression estimates using Augmented Dickey Fuller (ADF) unit root tests. In addition, the study employed Autoregressive Distributed Lag Model (ARDL) Bound test technique to examine long-run relationship and impact of malaria incidence, tuberculosis and healthcare literacy on economic growth. The ARDL Bound testing confirmed that, there is long-run relationship between malarial incidence, tuberculosis, healthcare literacy and economic growth in Nigeria. This was further confirmed by the ARDL long-run coefficients which indicated that; malaria incidence and healthcare literacy (HLR) have positive and significant impact on economic growth in Nigeria. A percentage increase in malarial incidence and healthcare literacy increase economic growth by 42 units and 13 units respectively.. On the other hand, the study confirmed that, tuberculosis (TBC) has a significant negative impact on economic growth (GDP) as a unit increase in the incidence of tuberculosis (TBC) would reduce economic growth (GDP) by about 20 units. In line with the findings, the study recommended among other measures that; government should intensify effort in combating malaria and tuberculosis while providing free treatment for the households especially the rural dwellers to relief them of those curative costs which depletes average household income to enable them contributes meaningfully in the production of goods and services in the economy.

Keywords: Malaria Incidence, Tuberculosis, Economic Growth, ARDL

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1. INTRODUCTION

Health sector of any economy remains one among the veritable sectors that contributes toward the development of human capital needed for any meaningful economic growth and development. A healthier population generally leads to stronger economic growth by boosting productivity, increasing the workforce's ability to work, and fostering human capital development.

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Healthy individuals are more physically and mentally capable, leading to higher productivity and output. They are less likely to be absent from work due to illness, contributing to a more stable and reliable workforce. A healthy workforce can work more efficiently and effectively, leading to increased economic output (WHO, 2025).

The health sector globally is still devoting more energy and resources in terms of advocacy, prevention, control and management of malaria and tuberculosis with the aim to eradicate their spread. However, the world is not on track to reach critical targets of the World Health Organisation (WHO) Global technical strategy for malaria 2016-2030; reducing global malaria case incidence by 90% or more by 2030; and reducing the global malaria mortality rate by 90% or more as well as ending tuberculosis (TB) by 2030 which are among the target of sustainable development goals (WHO, 2023).

Too many people are not getting the treatments they require to prevent, diagnose, and cure malaria, despite a tremendous effort to scale up control over the past 20 years. Approximately 1.4–1.9 billion individuals suffer catastrophic or impoverishing health costs, and 30% of the world's population lacks access to basic health services. The most vulnerable are disproportionately affected by these disparities (Federal Ministry of Health, 2021). With a predicted 68 million cases and 194,000 deaths from malaria in 2021, Nigeria has the greatest malaria burden in the world, contributing roughly 27% of the disease's total cases (WHO, 2023). There is a year-round danger of transmission across the entire nation. Nonetheless, the country's northeastern and northern regions have the greatest rates of malaria infection.

In a related development, Tuberculosis (TB) is one of the world's leading infectious disease killers. Until the emergence of COVID-19, the bacterium that causes TB was described as, "the most destructive pathogen on the planet," killing more than 4,300 people each day. Despite being preventable, treatable, and curable, this ancient disease continues to kill more people each year than HIV and malaria combined. While a wide range of evidence-based and scientific interventions have been developed to combat TB, due to continued underinvestment and low global prioritization (compared to other diseases), TB persists, resulting in close to 11 million TB cases and 1.6 million deaths annually (United State America Information Department, 2023).

Globally, the number of annual case notifications is usually far below the estimated incident cases. Unfortunately, this gap (ie, missing TB cases), which had consistently narrowed over the years, widened in 2020 due to a large drop in the number of newly diagnosed TB cases due to the impact of the COVID-19 pandemic (WHO, 2021; Odume, Falokun, Chukwuogo, Ogbudebe, Useni & Nwokoye, 2020). In 2022, there were about 9.9 million estimated incident TB cases worldwide, but only 5.8 million were notified, leaving a large gap of about 4.1 million missing cases; notably, Nigeria contributed significantly to this global gap, ranking first in Africa (WHO, 2023). These missing TB cases could either be due to underreporting or under diagnosis. In Nigeria, however, under diagnosis contributes to most missing cases; this calls on the country to strengthen access to high-quality screening, diagnostic, and treatment services (WHO, 2022). Regarding the burden of TB at the country level, Nigeria is sixth globally and the first in Africa (WHO, 2021); therefore, controlling this chronic infectious disease is a top priority for the national TB program (Federal Ministry of Health, 2021).

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Nigeria is considered as Africa's most populous nation with an estimated population of 206 million people (United Nation, 2022). Nigeria faces numerous challenges that affect population health, many of which are also faced by other West African countries. Historically, health-care investment in Nigeria has been low by global standards, with high individual out-of-pocket costs restricting access to care. Healthcare facilities especially the primary healthcare centers remain underdeveloped and other challenges such as extreme poverty, health worker shortages and absenteeism, so-called brain drain, and mal distribution of skilled health professionals compound these issues, further restricting access to care and reducing its quality for large parts of the population.

Nigeria over the years embarked on measures of controlling and preventing the prevalence of malaria in the country. Several malaria programmes have been established by the government which has been in existence since 1986 with the National Malaria Control Programme. These include the National Malaria Control Program (NMCP), the National Malaria Elimination Program (NMEP), the National Malaria Strategic Plan and the most recently inaugurated Nigeria End Malaria Council in August 2022. Similarly, to eliminate TB as a major public health problem, Nigeria initially adopted directly observed treatment short-course (DOTS) strategy in 1993. Despite these efforts, Nigeria has the highest burden of malaria globally, accounting for nearly 27% of the global malaria burden, with an estimated 68 million cases and 194 000 deaths due to the disease in 2022 (WHO, 2023). The risk of transmission exists throughout the country, all year round. In addition, regarding the burden of TB at the country level, Nigeria is sixth globally and the first in Africa (WHO, 2023).

Overcoming healthcare challenges, improving population health, and improving economic growth in Nigeria requires targeted, evidence-based intervention to address the key drivers of ill health and economic growth in the nation. Yet, robust population health studies to provide evidence base macroeconomic impact of malaria and tuberculosis on economic growth that will facilitate the development and implementation of interventions programmes and policies are scarce in Nigeria, posing further difficulties for policy makers. This study therefore examines the impact of malaria incidence and tuberculosis on economic growth in Nigeria.

2. LITERATURE AND THEORETICAL REVIEWS

2.1 Conceptual Review

Malaria Incidence

The concept of malaria incidence attracts attention among scholars globally with each providing different perspective in relation to the concept. WHO (2023) defined malaria incidence as the number of new malaria cases per 1000 population at risk per year. Population at risk is defined as population living in areas where malaria transmission occurs.. Similarly, UN (2022) viewed that, incidence of malaria is defined as the number of new cases of malaria per 1,000 people at risk each year. A case of malaria is defined as the occurrence of malaria infection in a person in whom the presence of malaria parasites in the blood has been confirmed by a diagnostic test. The population considered is the population at risk of the disease. Cases reported by the National Malaria Control Programs (NMCPs) are obtained from each country surveillance system. Stressing further, Julie, Alioune, Baltaza, Rose, James, John and Mateusz (2019) National Malaria

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Control Programs (NMCPs) increasingly track and report the number of confirmed malaria cases, typically calculating the incidence of confirmed cases per 1,000 population by dividing the number of reported confirmed cases by the population of each catchment area and multiplying by 1,000.

Tuberculosis

On the other hand, Understanding of the concept of tuberculosis is presented differently by scholars, international and non-governmental organizations, all are geared towards the same meaning. Poonam (2023) provided a vivid explanation on tuberculosis (TB) as a contagious infection that usually attacks your lungs. It can also spread to other parts of your body, like brain and spine. A type of bacteria called Mycobacterium tuberculosis causes it. This bacterium is thought to be over 3 million years old. Similarly, James (2023) explained that tuberculosis is an infectious disease that usually affects the lungs. It is sometimes fatal. However, it is often preventable and treatable. In the past, tuberculosis (TB), or "consumption," was a major cause of death worldwide. Following improvements in living conditions and the development of antibiotic, the prevalence of TB fell dramatically in industrialized countries. In the same vein, Mayo- Clinic (2023) exposed that**,** Tuberculosis (TB) is a serious illness that mainly affects the lungs. The germs that cause tuberculosis are a type of bacteria. Tuberculosis can spread when a person with the illness coughs, sneezes, or sings. This can put tiny droplets with the germs into the air. Another person can then breathe in the droplets, and the germs enter the lungs.

Economic Growth

In defining the concept of economic growth, Max (2021) viewed that, economic growth is an increase in the production of economic goods and services in one period compared with a previous period. It can be measured in nominal or real (adjusted to remove inflation) terms. Traditionally, aggregate economic growth is measured in terms of gross national product (GNP) or gross domestic product (GDP), although alternative metrics are sometimes used. In a similar way, Kuznets (2019) defined economic growth as a long-term rise in capacity to supply increasingly diverse economic goods to its population, this growing capacity based on advancing technology and the institutional and ideological adjustments that it demands. All three components of the definition are important. Also., Krugman (2016) asserted that, the term "economic growth" has two distinct meanings. Sometimes it refers to the growth of that thing we call the economy; the physical subsystem of our world made up of the stocks of population and wealth and the flows of production and consumption. When the economy gets physically bigger, we call that "economic growth". On the other hand, if the growth of some activity causes benefits to increase faster than costs, we also call that "economic growth

2.2 Theoretical Framework

The study was anchored on Grossman health demand and Solow–Swan theories. The Grossman theory is a health demand theory used for studying the demand for health and medical care outlined by Michael Grossman in a monograph in 1972 entitled; "The demand for health a theoretical and empirical investigation". The theory modeled health based on demand for medical care on the interaction between a demand function for health and a production function for health. Andrew, Nigel and Paul (2012) called the model; "the founding father of demand for health models". It assumes that the individual is a forward-

looking optimizing individual who, in making decisions today, takes account of their possible future consequences. In Grossman's framework, as the name implies, the individuals under laying level of health is treated as a capital good, to be built up by investment and run down by lack of investment (Becker, 1974). It is not a commodity that can be acquired instantaneously - an individual who wishes to increase his stock of health capital to some target can only do so over time. Health Capital as convinced here is different from how healthy an individual happens to feel today: having a flu, or even a more serious illness, will not necessarily reduce ones stock of health capital, regardless of how much it might reduce one's instantaneous level of utility.

On the other hand the Solow–Swan theory is an economic model of long-run economic growth set within the framework of neoclassical economics. Robert Solow and Trevor Swan (1956) independently developed and superseded the Keynesian Harrod–Domar model. It attempts to explain long-run economic growth by looking at capital accumulation through saving, labor or population growth, and increases in productivity, commonly referred to as technological progress. At its core is a neoclassical (aggregate) production function, often specified to be of Cobb–Douglas type, which enables the model "to make contact with microeconomics (Romer, 2011). The model predicts that in the long run, economies converge to their steady state equilibrium and that permanent growth is achievable only through technological progress. Both shifts in saving and in population growth cause only level effects in the long run; that is, in the absolute value of real income per capita. An interesting implication of Solow–Swan's model is that poor countries should grow faster and eventually catch-up to richer countries..

Grossman health demand provides theoretical underpinnings on the determinants of health outcomes as an interaction between a demand function for health and a production function for health. It argues that, health enters the utility function directly as a good people derive pleasure from and indirectly as an investment which makes more healthy time available for market and non-market activities. In this theory, health is considered as durable capital goods which is inherited and depreciates over time and required huge investment. On the other hand, the Solow–Swan theory emphasizes the role of the accumulated saving in the form of capital in combination with other variables such as labor or population growth and technological progress on economic growth in the long run through investment. One thing that is fundamental to this theory is that increase in productivity is a positive function of improvement in health. As long as health improves, productivity will increase, and this will encourage people to invest in human capital development and expand their pool of knowledge.

2.3 Empirical Review

Mohammed, Adewumi and Mokuolu (2016) examined the incidence of malaria, compared input and output levels of household categories, determined the costs and returns of malaria affected households and identified the palliative measures of malaria morbidity on crop output in the study area. Using structured questionnaire, a cohort of 72 farming households were followed up in order to document malaria incidences and farming activities of the households within the 2012 farming season. Households were categorized into low and high incidence based on the proportion of household's members affected with the malaria. The data collected were analyzed using descriptive statistics, gross margin techniques, t-test and regression analysis. The study revealed that Majority of the households (86.11%) had high malaria incidence while 13.89% had

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low malaria incidence. There was no variability in the level of variable inputs used by low and high malaria incidence household except for seed. Crop productivity of households with high malaria incidence was about 25% lower than those of households with low malaria incidence ($p < 0.05$).

Similarly, Sede (2016) examined the impact of Malaria on Nigerian economic growth performance for the period (1992-2013). Annual time series data on real GDP, malaria incidence, Gross fixed capital formation, Public Health Expenditure and secondary school Enrolment rate were obtained from both Central Bank of Nigerian statistical Bulletin and World Bank Development Indicators. The stationarity state of the variables was examined using Augmented Dickey Fuller Test. The variables are integrated of order one. The trace statistics reveal that the variables are co-integrated, hence a long run relationship exist among the regressand and regressors. The parsimonious ECM reveals that malaria significantly impact on economic growth.

In the same vein, Judy (2016) determines the effect of the malaria on the economic growth of Kenya. Malaria is proxied by the number of malaria cases per 100,000 people in the country, and estimation is through OLS. Time series data from 1990-2014 was used in the analysis. Secondary data was used and sourced from both national and international sources. Results indicate that when malaria morbidity rises by one unit while holding all the other independent variables constant, the growth in real GDP reduces by 0.00002. The study results indicate that malaria leads to a decline in economic growth in the country; therefore, there is need for the government and other stakeholders to increase investments to cater for prevention, control and treatment of the illness.

Also, Rolle and Iseghohi (2018) investigated the impact of Malaria as a disease burden on national productivity. The study proxy Malaria by both Malaria Death Cases and Malaria prevalent rate. Labour productivity is proxy by Per Capita Income. Annual time series data covering the period 1987-2017 was obtained from World Bank Data base. The stationarity state of the variables was examined using Augmented Dickey Fuller test. At a level, none of the variables were stationary but at first difference they all became stationary, hence they are integrated of order one. The Engel-Granger Co-integration test shows that long-run relationship existed among the variables. The estimated Error Correction Model revealed that malaria constituted drag on labour productivity, public health expenditure made unimpressive contribution to per capita income and secondary school enrolment rate produced adverse effect on labour productivity.

On the other hand, Joses and Rosenabi (2016) estimate future gross domestic product (GDP) losses associated with TB deaths in the African Region for use in advocating for better strategies to prevent and control tuberculosis. The cost-of-illness method was used to estimate non-health GDP losses associated with TB deaths. Future non-health GDP losses were discounted at 3 %. The analysis was conducted for three income groups of countries. One-way sensitivity analysis at 5 and 10 % discount rates was undertaken to assess the impact on the expected non-health GDP loss. The 0.753 million tuberculosis deaths that occurred in the African Region in 2014 would be expected to decrease the future non-health GDP by International Dollars (Int$) 50.4 billion. Nearly 40.8, 46.7 and 12.5 % of that loss would come from high and upper-middle- countries or lower-middle- and low-income countries, respectively. The average total non-health GDP loss would be Int$66 872 per tuberculosis death. The average non-health GDP loss per TB death was Int$167 592 for Group 1, Int$69 808 for Group 2 and Int$21 513 for Group 3

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Similarly, Owoeye and Olaniyan (2015) provide estimates of economic costs of four active tobacco-related diseases in Nigeria. This study is a hospital-based study which utilized an exploratory survey carried out between March to September 2010 to assess and document different components of economic costs of tobacco-related diseases within the Ibadan metropolis, South West Nigeria. A structured questionnaire form was used to collect data on tobacco smoking behaviour, as well as direct and indirect costs associated with outpatient visits and hospitalization. Using the prevalence-based method of the cost of illness (COI) approach, the study found that direct and indirect costs were mainly paid by out of pocket by the victims and their respective families. The results further reveal that the high cost of the disease can be catastrophic for individuals from poor households.

More so, Nweze (2016*) f*ocused on the impact of health programmes on economic growth in Nigeria. It also examined the impact of health programmes on human capital development in Nigeria Data were obtained from Central Bank of Nigeria (CBN) statistical bulletin from the period 1981 to 2012. Ordinary Least Square method and computer software were used to estimate the parameters of two models which were developed for the study. The results obtained showed that there was a positive relationship between health programmes and economic growth in Nigeria as well as a significant impact of health programmes on economic growth. Also, there was a positive and significant impact of health programmes on human capital development in Nigeria.

Furthermore, Okunlola, Sani and Ayetigbo (2023) examine the impact of socio-economic governance on economic growth in Nigeria. It measures socio-economic governance from the perspective of fiscal policy, using indicators such as investment in education, research and development (R&D) and health. This study employs the Autoregressive Distributive Lag (ARDL) Bound Testing method to achieve its objective. The study finds that socio-economic policies aimed at increasing investment in education are crucial for Nigeria's long-term economic growth. Additionally, investment in R&D positively impacts economic growth. However, the study reveals that investment in health negatively affects economic growth in Nigeria in the long run.

3. METHODOLOGY

The research design for the study is known as ex-post facto research design because the research study employ methodology that investigates how independent variables with certain qualities that already exist prior to the study affects a dependent variable to establish a cause- effect relationship among the variables employed for the study. Secondary time series data was used for the study and sourced from annual statistical bulletin of National Bureau for statistics (NBS), World Development Indicators (WDI) and Central Bank of Nigeria (CBN) spanning from 1986 – 2023. The study employed econometrics tools for data analysis to achieve its objectives. The econometrics tools include; Augmented Dickey Fuller (ADF) test to examine the stationarity properties of the data set in order to avoid spurious regression estimates. In addition, Autoregressive Distributed Lag Model (ARDL) Bound test technique was employed to examine the impact and long-run relationship. ARDL Bound test technique is a dynamic single-equation and standard least squares regressions that include lags of both the dependent variable and explanatory variables as regressors

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The study model is in accordance with theoretical postulation of Grossman health demand theory developed by Michael Grossman (1972) which support that, Investment in health takes the form of medical care purchases and other inputs and depreciation is interpreted as natural deterioration of health over time. The variables included in the model of this study are; Gross Domestic Product (GDP) which is the endogenous variable. The exogenous variables of the study are; Malaria (MLRI) and tuberculosis (TBC) incidence was considered as outcome of a deteriorating health system over time. The study also include health literacy (HLR) used to measure social variables that have the potential of influencing malaria and tuberculosis incidence in the economy. The functional form of the model is expressed as thus;

GDP = f(MLRI, TBC, HLR,)…….....…….....(3.1)

The model is restated in stochastic form for estimation in accorance to ARDL model as thus;

$$\text{LogGDP}_t = \beta_0 + \sum_{i=1}^{p} \beta_1 \text{LogGDP}_{t-i} + \sum_{i=0}^{p} \beta_2 \text{MLRI}_{t-i} + \sum_{i=0}^{p} \beta_3 \text{TBC}_{t-i} + \sum_{i=0}^{p} \beta_4 \text{HLR}_{t-i} + \sum_{i=1}^{q} \alpha_1 \Delta\text{LogGDP}_{t-i} + \sum_{i=0}^{q} \alpha_2 \Delta\text{MLRI}_{t-i} + \sum_{i=0}^{q} \alpha_3 \Delta\text{TBC}_{t-i} + \sum_{i=0}^{q} \alpha_4 \Delta\text{HLR}_{t-i} + \varepsilon_t \quad \ldots\ldots(3.2)$$

GDP = Economic Growth (Proxied as annual GDP Per Capita Income)

MLRI = Malaria Incidence (proxied as number of new malaria cases per 1000 population at risk per year)

TBC = Tuberculosis (Proxied as number of new case of population reported annual for infectious TB disease)

HLR = Health literacy (proxied as percentage of women and men age 15-24 years who are able to read a short simple statement about everyday life or who attended secondary or higher education)

β_o = intercept

$\beta_1 - \beta_4$ = Long-Run Parameters

α_1-α_4 = Short-Run Parameters

$\in$ = Error term.

4. RESULT AND DISCUSSION OF FINDINGS

Unit Root Test

The variables of the study were subjected to unit root tests using the Augmented Dickey-Fuller (ADF) test to determine the stationarity levels of the series. The results of the tests are presented in Table 1.

Table1: ADF Unit Root Test

Variables	ADF Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	Prob.	Order of Integration
GDP	-5.210599	-3.646342	-2.954021	-2.615817	0.0002	I(1)
TBC	-3.901844	-3.632900	-2.948404	-2.612874	0.0055	I(0)
MLRI	-4.448222	-3.653730	-2.957110	-2.617434	0.0013	I(0)
HLR	-6.410520	-3.699871	-2.976263	-2.627420	0.0000	I(1)

Source: Authors' Computation using E-Views 9.0 Version

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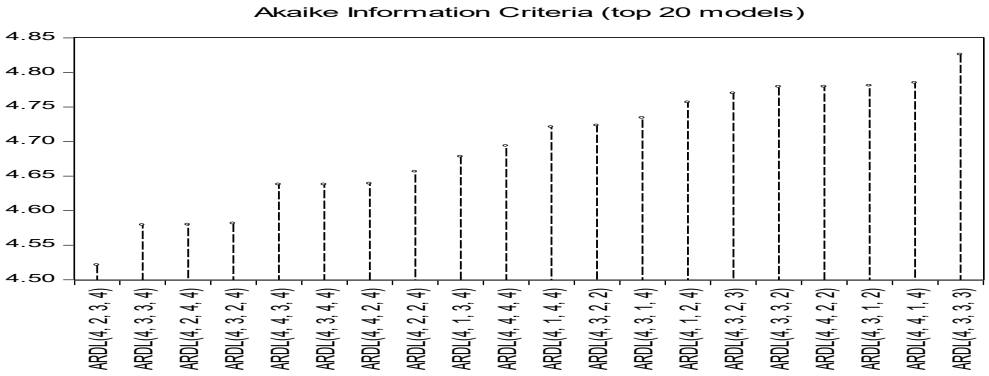
Table 1 indicates that the series for GDP and HLR variables are integrated at order one I(1) while the series for TBC and MLRI are integrated at levels to be stationary at level I(0). This condition warrants the application of ARDL methods which accommodates series that are either I(1) or I(0) process or the mixture of both. The stationarity tests are necessary to guard against spurious regression and to ensure no variable is integrated of order two. The test was based on Akaike Information Criterion (AIC) which was selected automatically.

4.2 ARDL Results

The Akaike information Criterion was used to select the optimal lag for the models. The graph of the optimal model selection summary is presented in figure 1.



Source: Extraction from E-Views

Figure 1: AIC Graph Showing Optimal Model Selection Summary

Figure1 shows that, top 20 ARDL model specifications were considered. Although an ARDL (4,2,3,4) was finally selected. However, it can also be seen how well some other specifications performed in terms of minimizing AIC.

ARDL Bounds Test

The Autoregressive Distributed Lag (ARDL) Bounds test approach to cointegration was employed to investigate if the variables used for the study converge in the long-run. The ARDL Bound test result is presented in Table2.

Table 2: ARDL Bound Test to Co-integration

Test Statistic	Value	K
F-statistic	4.56545	3
	Critical Value Bounds	
Significance	I0 Bound	I1 Bound
10%	2.72	3.77
5%	3.23	4.35
2.5%	3.69	4.89
1%	4.29	5.61

Source: Authors' computation using E-Views 9.0 Version

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Table 3 shows that long-run relationships exist among the variables of the study because the F-Statistic (4.56545) is greater than the lower I(0) and upper I(1) bounds of the critical values at 5% critical value.

ARDL Long Run Coefficients

The ARDL long-run coefficients were estimated to examine the long-run impact of the independent variables on the endogenous variable having established that, long run relationship exists among the variables. The estimated result of the ARDL long-run coefficients are presented in Table 3.

Table 3: ARDL Long-Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TBC	-0.202099	1.677225	-1.193697	0.0249
MLRI	0.415299	2.374945	1.747535	0.0486
HLR	0.129230	8.882213	1.455302	0.0163
C	-0.632476	7.172949	-0.881752	0.3902

Source: Authors' Computation using E-Views 9.0 Version

Table 3 above shows that in the long run, if all other things were held constant, tuberculosis (TBC) has a significant negative impact on economic growth (GDP). A unit increase in the incidence of tuberculosis (TBC) would reduce the economic growth (GDP) by about 20 units. Given the decision criteria to reject null hypothesis (H_O) if the probability value is < 0.05, it shows that probability values for tuberculosis (TBC) (0.0249) is statistically significant to reject the null hypothesis that, tuberculosis (TBC) has significant impact on economic growth in Nigeria. Hence, we conclude that, tuberculosis (TBC) has long-run negative impact on economic growth in Nigeria for the period of the study.

On the contrary, everything been equal, malaria (MLRI) has a significant positive long-run impact on economic growth (GDP) for the period of the study. This means that a unit increases in the incidence malaria (MLRI) would increase the economic growth (GDP) in Nigeria by about 42 units. Given the decision criteria to reject null hypothesis (H_O) if the probability value is < 0.05, the result indicated that, the probability value for malaria (MLRI) (0.0486) is statistically significant to reject the null hypothesis that, malaria (MLRI) has a significant impact on economic growth in Nigeria. Hence, we conclude that, malaria (MLRI) has a significant long-run positive impact on economic growth in Nigeria for the period of the study.

Similarly, the result indicated that, healthcare literacy (HLR) has a significant long-run positive impact on the economic growth in Nigeria. A unit increase in the healthcare literacy (HLR) rate would increase the economic growth (GDP) by 13 units approximately. Given the decision criteria to reject null hypothesis (H_O) if the probability value is < 0.05, the result indicated that, the probability value for healthcare literacy (HLR) (0.0163) is statistically significant to reject the null hypothesis that; healthcare literacy has no significant impact on economic growth in Nigeria. Hence, we conclude that, healthcare literacy (HLR) has a significant negative impact on economic growth in Nigeria for the period of the study.

The negative sign of the intercept (Constant) in the result indicates that, if all the regressors are held constant, the dependent variable (GDP) would be reduced by approximately 63 units in the long-run for the period of the study.

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ARDL Short-Run Coefficients

ARDL short-run coefficients were further examined to establish the short-run dynamics and to ascertain the speed of converges to the long-run equilibrium. The result of ARDL short-run dynamics is presented in Table 4.

Table 4: ARDL Short-Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	0.015077	0.257516	0.058549	0.9540
D(GDP(-2))	-0.297747	0.207294	-1.436352	0.1691
D(GDP(-3))	-0.826755	0.175209	-4.718673	0.0002
D(TBC)	0.601207	6.371532	0.943583	0.3586
D(TBC(-1))	0.103763	5.131289	2.022163	0.0592
D(MLRI)	-0.427506	9.114854	-0.469021	0.6450
D(MLRI(-1))	-0.260924	13.123101	-0.198828	0.8448
D(MLRI(-2))	-0.107012	5.611377	-1.907059	0.0736
D(HLR)	0.727057	0.263947	2.754553	0.0135
D(HLR(-1))	-0.142576	0.366305	-3.892276	0.0012
D(HLR(-2))	-0.318360	0.348559	-0.913359	0.3738
D(HLR(-3))	-0.109971	0.368828	-2.981652	0.0084
CointEq(-1)	-0.305466	0.249473	-1.224446	0.0237

Source: Authors' Computation using E-Views 9.0 Version

The short-run coefficients of the ARDL estimated model presented in Table 4 showed that, the short-run coefficient for 1 year lag GDP was positive and statistically insignificant while 2 and 3 year lag GDP were found to be negative. The short-run negative coefficient for the 2 year lag GDP indicated an insignificant coefficient while the 3 year lag GDP indicated statistically significant. Hence, we conclude that 3 year lags GDP has negative short-run impact on current year GDP in Nigeria for the period of the study.

Moreover, the short-run coefficients of the ARDL estimated model shown in Table 5 revealed that, current year TBC and 1 year TBC exhibit positive short-run impact on the current year GDP in Nigeria. The probability values for current and 1 year lag TBC were found to be statistically insignificant to conclude that, current and 1 year lag TBC has significant short-run positive impact on GDP in Nigeria for the period of the study.

Furthermore, ARDL estimated model presented in Table 5 indicated that current year, 1 and 2 year lag MLRI exhibited short-run negative impact on GDP in Nigeria. The probability values for the current year, 1 and 2 year lag MLRI have however shown statistically insignificant to conclude that, current year, 1 and 2 year lag MLRI have negative significant short-run impact on current year GDP in Nigeria for the period.

It was also revealed that current year healthcare literacy (HLR) indicated positive impact on GDP in the short-run. The probability value for the current year HLR (0.0135) is statistically significant to conclude that, current year HLR has short-run positive impact on GDP in Nigeria. On the contrary, 1, 2 and 3 years lag healthcare literacy (HLR) indicated negative impact on GDP in the short-run. However, the probability values for 1 year and 3 year lags healthcare literacy (HLR) have shown to be statistically significant to conclude that 1 and 3 year lags have a significant negative impact on GDP in the short-run for Nigeria within

the period of the study while the probability value for 2 year lag healthcare literacy (HLR) (0.3738) has shown to be statistically insignificant to conclude that, 2 year lag HLRI has a significant short-run impact on GDP in Nigeria for the period of the study.

The estimated co-integrating error correction term (ECT) is negative and statistically significant indicating that, the speed of adjustment at which the previous year's shock of the explanatory variables converging back to the long-run equilibrium in the current year is approximately 31%.

Diagnostic Test Results

The study employed post-estimation test to diagnose the residuals of the estimated model for valid and reliable outcomes. The test of serial correlation, Heteroskedasticity, Stability and normality test were conducted, and the results presented in Table 5

Table 5: Diagnostic Test Results

Test	Null Hypothesis	F-statistics	Prob. Value
Beusch Godfrey Serial Correlation LM Test	No Serial Autocorrelation	9.424555	0.2022
Breusch-Pagan Godfrey	No Hetroscedasticity	0.731926	0.7313
Jarque-Bera	series residuals are normally distributed	3.054758	0.217104
Ramsey Reset	No Misspecification	1.122340	0.3051

Source: Authors' computation using E-Views 9.0 Version

Table 5 indicated the result of Breusch-Godfrey Serial Correlation LM Tests for the estimated model which reveals the acceptance of null hypothesis of no Serial Correlation as the F-statistic probability values for the estimated models is significance at 5% level.

In the same vein, the Breusch-Pagan-Godfrey heteroscedasticity Test reveals the acceptance of the null hypothesis that disturbance terms exhibit the equal variance assumption of homoscedasticity for the estimated model. This is because the probabilitiy of F-statistic is statistically significant at 5% level.
Similarly, JB statistic which reveals that, the null hypothesis of the series residuals are normally distribution is accepted because the p-values is greater than 5% significant level.

Also, the estimated result of the Ramsey RESET Test for model specification reveals the acceptance of the null hypotheses that, the model has no omitted variables as F-statistic for the estimated model is significant at 5% level.

Discussion of Findings

The findings of the study are discussed in line with the objectives and the tested hypotheses of the study. The first objective of the study was to examine the impact of malaria incidence on economic growth in Nigeria. The correspondent hypothesis for this objective was to test the assumption that, malaria incidence has a significance impact on economic growth in Nigeria. The result of the ARDL Bound test of Co integration revealed a long-run relationship among the variables included for the study. The long-run ARDL coefficients further revealed that, malaria incidence has a positive impact on economic growth in Nigeria. The result

indicated that 1% increase in malaria incidence increases economic growth by 42 units for the period of the study. This is possible since, the curative cost of treatment for malaria depletes average household income, however, malaria curative healthcare costs incurred by households on aggregate increase pharmaceutical sector income which could result to the positive impact on economic growth in Nigeria. The finding is in tune with the study by Mohammed, Adewumi and Mokuolu (2016) who found that, the cost of treatment and prevention had significant and positive effect on economic growth. It also agreed with Sede (2016) who reveals that malaria significantly impact on economic growth in Nigeria. The result is however at variance with as well as Judy (2016) as well as Rolle and Iseghohi (2018) who indicate that malaria leads to a decline in economic growth and constituted drag on labour productivity respectively.

The second objective of the study was to determine the impact of tuberculosis on economic growth in Nigeria. In line with this objective, the null hypothesis that, tuberculosis has no significant impact on economic growth was tested. The result of the ARDL long-run coefficient revealed that, tuberculosis (TBC) has a significant negative impact on economic growth (GDP). A unit increase in the incidence of tuberculosis (TBC) would reduce the economic growth (GDP) by about 20 units. The result has shown statistical evidence to reject the null hypothesis that, tuberculosis has no significance impact on economic growth in Nigeria. the findings concord to similar results obtained by Joses and Rosenabi (2016), Owoeye and Olaniyan (2015) who concluded that, million tuberculosis deaths that occurred in the African Region would be expected to decrease the future non-health GDP and the high cost of the disease can be catastrophic for individuals from poor households.

The objective three of the study investigate the influence of health literacy on economic growth in Nigeria while the corresponding null hypothesis was to validate the assumption that, health literacy has no significance impact on economic growth in Nigeria. The result obtained by ARDL long-run coefficient revealed that, healthcare literacy (HLR) has a significant long-run positive impact on the economic growth in Nigeria. A unit increase in the healthcare literacy (HLR) rate would increase the economic growth (GDP) by 13 units approximately. Based on the statistically significant of the estimated coefficient for the healthcare literacy (HLR), it was concluded that, healthcare literacy (HLR) has a significance impact on economic growth in Nigeria at long-run. The finding suggests that, an improvement in healthcare literacy among the household is potential for diseases which will translate to increase productivity. The finding support similar study by Nweze (2016*)* whose results obtained had showed that there was a positive relationship between health literacy programmes and economic growth in Nigeria. it is also in consonance with Okunlola, Sani and Ayetigbo (2023) who founds that socio-economic policies aimed at increasing investment in education are crucial for Nigeria's long-term economic growth due to its ability to improve literacy level of the people.

5. CONCLUSIONS AND RECOMMENDATIONS

In line with findings of the study, the study concluded that, there is long-run relationship among; malaria incidence, tuberculosis, healthcare literacy and economic growth in Nigeria. It was further concludes that, the curative cost of treatment for malaria depletes average household income, however, malaria curative

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healthcare costs incurred by households on aggregate increase pharmaceutical sector income given rise to increase in economic growth in Nigeria. However, the cost constituted a drag on labor productivity, hence taking measure to curtail incidence of malaria could be more beneficial to economic growth in Nigeria at the long-run. It was further concluded that tuberculosis has potentials to deplete economic growth in Nigeria at long-run.

In line with findings of the study, the following recommendations were suggested as policy measures.

1. The government at all levels in Nigeria should ensure that, various strategies utilized for the combat of malaria should be sustained and government should make efforts to improve them. Treatment should be provided free of charge for the households seeking treatment that are confronted with challenges of out-of-pocket expenditures particularly in remote villages. This will relief of those curative costs for malaria which depletes average household income to enable them contributes in meaningfully in the production of goods and services in the economy.
2. There is need to control the spread of tuberculosis in the economy by identifying and treating latent TB infection. Latent TB infection occurs when individual has TB bacteria in the body, but that bacterium is essentially inactive. More sensitizations should be carried out by government and non-governmental organization to prevent the spread of the disease in the country especially among individual with certain factors that can increase their risk that a latent TB infection will develop into active TB disease. More vaccine should also be provided to eliminate the disease in the country considering it negative impact on economic growth.
3. Child education should be encouraged to improve literacy level among children. In addition, health literacy should be intensified among women during their ante natal visits as it is a crucial factor in a woman's self-care and self-efficacy, and the relationship between maternal health outcomes and health literacy deserves more attention and research. Improving maternal health literacy empower women to live a healthy life, be aware of measures for disease control and prevention as well as communicate better with their providers and take agency in decisions for the safety of themselves and their children.

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