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RESEARCH ARTICLE

Governments Healthcare Expenditure and Malaria Incidences in African Countries

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Abstract

Background: Malaria stands a chance of wrecking irreparable losses to mankind if it is not checked This study investigated the effects of Government Healthcare Expenditure (GHE) on Malaria Incidence (MI) in 30 selected African countries from 2000- 2021.

Methods: The study used Investment and Health Capital Model and Estimated Generalized Least Square and Pooled Ordinary Least Square techniques.

Results: Domestic general government health expenditure negatively impacted MI, at 1% (-0.7602; and -0.6600). Out-of-pocket health expenditure impacted MI positively (2.6082; and 2.6761) at 1%. External health expenditure showed negative and positive insignificant results (-0.3645; and 0.3541). However, people with basic sanitation services negatively impacted MI (-1.1329; and -1.2838) at 1%. Finally, government effectiveness impacted MI positively (27.8434; and 23.8889) at 1%.

Conclusions: Increased and well-monitored GHE should be embraced by all the African governments.

Originality: Its genuineness stems from the new variables employed and the findings.

Keywords: Africa, Government Healthcare Expenditure, Malaria Incidence, Domestic General Government Health Expenditure.

1 Introduction

African continent puts up with the substantial malaria affliction in the world despite its significant investment and combative fight against the endemic. Climate, economic factors, geographical location, human intervention and unstable security have been identified or noticed as the factors responsible for its spread (Li, Docile, et.al. 2024; Akinloye, 2025). It (malaria) has been classified as a devastating disease with nearly forty (40) percent of global population at risk each day. At every thirty (30) seconds, a child's life is lost, and almost three (3) million people paid supreme price of death yearly because of this dreaded disease, of which the large majority of it occurred in the poorest countries of sub-Saharan Africa.

Similarly, National Institute for Communicable Diseases (2024) reports that almost 94 percent of the global 249 million cases are in African region and this dreaded disease disproportionately affected children under five, pregnant women, itinerant populations and refugees and tackling this burden requires African leaders to committed and accelerated fight against malaria and reduction in malaria-related deaths by raising locally sourced malaria financing and to ensure equal accessibility to high-quality important malaria services.

This deadly disease is regularly addressed as the epidemic of the poor while the disease is largely determined basically by climate and ecology, and not actually poverty, malaria impact takes its

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serious negative consequences on the poorest i.e those vulnerable that could not afford the preventive measures and medical treatment. Malaria and poverty are linked closely. Malaria, being both a root cause and a repercussion of poverty is most uncontrollable for the impoverished countries and communities in the world that confront vicious cycle of poverty and bad health status. The consequences of malaria endemic are not felt in terms of human suffering and deaths it causes only, but by the important economic cost and burden also.

Economic growth and development are stagnated by malaria and it fans vicious cycle of abject poverty (European Alliance Against Malaria, 2007). Malaria causes economic tsunamis (lower economic growth) for those countries with high malaria spread while it bolsters substantial growth and enhanced prosperity for those countries that have reduced malaria spread. European Alliance Against Malaria (2007) reported that malaria retarded orstagnated economic growth in Africa by 1.3 percent yearly as a result of lost lives and reduced productivity (growth penalty) and estimation of this growth penalty was put at US$ 12 billion. World Health Organization (1988) gave further explanation on growth penalty stating that presence of malaria in one particular territory or country results in impediment of individual and national prosperity as a result of its influence on social and economic decisions.

WHO (1988) further states that the likelihood of contracting malaria in endemic areas can discourage the deployment of capital resources from within and outside the country, and thereby result into negative aftermaths on economic productivity and growth. The latest data released by World Health Organization (WHO) indicate that an estimated two billion and 200 million (2.2 billion) cases of malaria and twelve million and seven hundred thousand (12.7m) deaths have been prevented since year 2000, but this life-threatening disease continues to be a dangerous universal health menace, especially in African region. Similarly, SpeakUpAfrica (2023) also states that unprecedented and essential progress has been recorded in an effort to control malaria spread via combined efforts of global actors and national programs, through staunch citation of the statistics made available by WHO that 185 million cases and almost one million deaths were averted worldwide in 2021.Statistically, evidence showed that recorded malaria cases and deaths globally were 263 million and 597,000 in 2023, 249 million and 608,000 in 2022, 244 million and 610,000 in 2021 (World Health Organization, 2025).

WHO (2023) states that in 2022, African region was accounted for 94% of global malaria cases (233 million) and equally responsible for 95% (580,000) of malaria deaths globally and furthermore reports that children under-five years were responsible for 80% of all malaria deaths in Africa. It concludes that where large number of people in danger of this disease is Africa, because they lack access to the services require to prevent, detect and diagnose the illness or disease. UNICEF (2024) emphasizes that malaria is an urgent general health priority because the disease and the costs of its treatment hooks families in a cycle of illness, suffering and poverty-stricken situation. It further states that in spite of malaria serious toll on health and economy, major breakthroughs were made against the disease from 2000 to 2019 because of the stepped-up funding and various programmes. Malaria mortality, between 2000-2019 fell from 28.8% to 14.1% per 100,000 populations at risk.

In 2020, due to the disruptions in access to malaria prevention and cases management caused by the COVID-19, malaria mortality rate increased to 15.2% per 100,000 populations at risk, and later decreased slightly to 14.5% in 2021 and also further decreased to 14.3% in 2022. However, this cheering news is being down-played by enormous challenges that are surfacing in the fight against this dreaded disease in Africa, the challenges include climate change, destitution (poverty), substandard health services and coverage, increased outdoor spread, the sudden appearance of latest vectors, increasing threat of remonstrance to malaria preventive-drugs and insecticides, local overspending (domestic deficit financing).

Finally, Coronavirus Disease 2019 pandemic which makes a mess of the global supply chain affecting malaria diagnostics and drugs (Priya, 2024). All these factors may be responsible for the back-tracking and halt of recordedprogress experienced in thirteen (13) countries of Africa and some others, particularly since 2015 as reported by World Health Organization (2023). Regarding funding, UNICEF (2024) states that success in the battle against malaria weak and nearly tied to sustained investment. In 2022, the aggregate of international and domestic funding for malaria control and elimination stood at $4.1 billion compared to $3.5 billion investment made in 2021. On a contrary note, the invested amount in 2022 fell short of the projected $7.8 billion required to remain on track for the Global Technical Strategy targets.

World Health Organization (2020) states that to expand and sustain the current malaria interventions between

2016-2030 and make sure coverage is up to 90% of the affected population in the most frequently occurring 29 countries that are answerable for 95% of the global burden in 2016 requires US$ 34 billion. It further states that, if the prediction is carefully executed, it would prevent an extra 2 billion malaria cases and 4 million deaths that maybe expected tohappen between 2016-2030. To buttress the explanation of challenge of domestic overspending (deficit financing), National Institute for Communicable Diseases (2024) reports that the political dedication by African governments has not translated into increase in domestic investment in malaria control because funding for malaria control dropped by $4.8 billion immensely between 2021-2023 thus constraining the breadth of control measures that can be effectively implemented.

On the global front, available fund for anti-malaria in 2021 was put at US$3.5 billion and this was less than US$7.3 billion that the WHO estimated was required to assist national anti-malaria efforts in Africa (SpeakUpAfrica, 2023). Aside rising funding paucity (domestic and external), competing wellness priorities and perception that malaria needs less funding are among the factors that are threatening the hope of eliminating plasmodium disease (malaria) in Africa. SpeakUpAfrica (2023) suggests that to guide against the back-tacking of the progress realized so far in the recent decades, there is need to come up with innovative approaches not only in the implementation of interventions strategies aiming at the most exposed inhabitants, in the development of innovative tools for malaria elimination, but also in the quest for funding to stuff the financial gaps and allow feasible investment that will end malaria in Africa.

On the economic analysis front of malaria eradication and its gains, Jaana, Matt and Aditi (2020), and WHO (2020) emphasized that certain percentage invested funds in the reduction of malaria incidence yielded economic gains in the areas of certain percentage increase in Gross Domestic Product (GDP). So, a larger and healthier labour force translates into substantial economic benefits across all countries of the world. The study, therefore, emphasized that prioritizing wellness can be a catalyst for a broader virtuous cycle of growth.

Towards this end, WHO (2020) reports that the world will be in a stronger position to make last and reasonable push for eradication of malaria when these essential cornerstones are carefully laid: a renewed drive for research and development (R&D) on vector control, chemotherapy and vaccines so as to fashion-out the transformative tools and knowledge base essential for the attainment of eradication in the highest burden areas, a political leadership that makes effective and judicious usage of additional funding from both national government and international agencies or organizations, tailored national and subnational blueprints guided by enhanced utilization of data and stronger delivery systems to provide the appropriate mix of services to all those in need, without financial hardship and finally, there is a need for strengthened cross-border, regional and international cooperation on malaria control and removal efforts globally.

Countries in Africa that have been officially certified malaria-free by the World Health Organization are: Algeria, Cape Verde, Mauritius, Morocco, and Republic of Egypt (African Union, 2025) while some of the countries where 70% of the global malaria-burden are concentrated in Africa are: Burkina Faso, Cameroon, the Democratic Republic of Congo, Ghana, Mali, Mozambique, Niger, Nigeria, Uganda and, Tanzania (WHO, 2025). Finally, European Alliance Against Malaria (2007) posits that tackling malaria in endemic countries especially African countries will definitely spur the attainments of the following Millenium Development Goals (MDGs): Eradicate extreme poverty and hunger (MDG 1), Achieve universal primary education (MDG 2), Reduce child mortality (MDG 4), Improve maternal health (MDG 5), Combat malaria and other diseases (MDG 6), and Global partnership for development and access to affordable essential drugs (MDG 8).

2 Theoretical Framework and Empirical Review of Literature

2.1 Investment and Health Capital Model

Cropper (1977) developed a model which states that an individual invests in health capital when the motive for investing in health is to reduce or decrease the probability of illness. It assumes that whether a person is well or ill rests on events such as changes in climate, exposure to germs and viruses. To explain differently, an individual is sick if at any specified time the value taking on by the illness threshold is above his/her health stock while if it falls below his/her health stock he/she is healthy. Investment in health increases the health capital stock. So, one increases his/her chances of being well by maintaining a high health capital stock or to decrease the probability of illness as long as the illness threshold remains constant over time or the health stock should always be above the illness threshold the two rise or fall.

She treated the relationship between health capital and illness as random rather than as deterministic.

She further explains this that an individual cannot guarantee that illness will not happen for at every point in time, one of the two states–illness or un-illness will happen. The probability of either state (illness or un-illness) happening rests on the health stock which is determined by investment. This latter statement means that illness is as well deterministic so far, the health stock, which is determined by investment, determines the probability of whether or not illness will happen. She concludes, that illness is partly deterministic and partly random with events like industrial accidents constituting the random aspect of it.

Continued malaria endemics occurring in most of the mosquitoes-ridden African countries couples with the huge domestic and external funding disbursed to control, eliminate or eradicate has been a source of concern to global health experts. To this end, careful examination of the disbursed domestic and external funding to malaria issues in African region becomes a paramount concern. To be candid, there are paucity of empirical researches geared towards its examination, both at the micro and macro levels. Even among those that examined it, there seems not to be a unison in the findings of the literatures on the government health spending and malaria incidences in the continent. More researches into its examination in the continent are needed so as to make available the updated findings for African governments and other concerned organizations.

Study by Jeremiah, John and Gertrude (2024) employed ARDL estimation technique to examine the relationship between public spending and malaria incidence in Uganda. The time frame spanned from 2000-2019. The result indicated that in the long-run, an increase in public spending by 1% resulted into 0.196% reduction in malaria incidence. Katushabe, Nnyanzi, and Muwanga (2024) employed an auto-regressive distributed lag approach on collected data that covered time period 2000-2019 from Uganda. The study revealed that public health expenditures significantly affected malaria incidence in the long and short run but the magnitude of the effects was marginal in the long run. Similarly, Ian, Emile, Paola, Yingxi, Golsum, Joseph and Angela (2022) investigated into new malaria cases across the 106 malaria-endemic countries worldwide and domestic spending spanning from 2000-2019. The study employed panel regression methods. Finding revealed a negative relationship between domestic spending and new malaria cases.

In the same vein, Peter and Nosakhare (2018) mainly beamed their research on Nigeria from 1990 to 2013, using secondary data-set for the study. The finding showed that effective government health expenditure significantly reduced malaria deaths in the country. In the same vein, Sede (2017) examined government health expenditure and malaria in Nigeria using co-integration and error correction mechanism estimation techniques between 1990-2013. Finding indicated that government health expenditure was significant in reducing malaria deaths in Nigeria. Trailing behind, Bello (2004) adopted gross transfer models to examine the relationship between deaths from malaria, public health expenditure, per capita income and non-public health in Nigeria. The study time frame ranged from 1975-2001. The study found a negative relationship between deaths from malaria and public health expenditure, per capita income and non-public health, but a positive relationship occurred between deaths from malaria and political instability.

Contrarily, Alfred and Aderonke (2023) examined the impact of healthcare expenditure and access to basic sanitation services on malaria incidence in 28 selected African countries from 2000-2019 using General panel linear model. Finding of the study revealed that healthcare expenditure had a positive relationship with malaria incidence while sanitation services indicated an inverse relationship with malaria incidence. Eboh and Adebayo (2023) beamed their searchlight onsub-Saharan (SSA)countriesemploying the general panel linear model on data between 2000-2019 on 28 SSA countries. Finding revealed that public health expenditure did not have a significant decreasing effect on malaria controls in the region.

Also, Oladosu (2022) carried-out cross-country research by scrutinizing the effect of public health expenditure on health outcomes in Nigeria and Ghana with the use of linear regression analysis. The finding revealed that public health expenditure had a significant positive effect on malaria deaths in Nigeria. Ibrahim (2021) examined the effect of malaria incidence and malaria control on health outcome and human capital development in Nigeria for the period of 1991-2017. The study employed Vector Error Correction Model (VECM). The study examined the effect of malaria incidence on adult mortality rate, under-five mortality rate, and human per capita income in Nigeria. Finding revealed that government health expenditure had a positive but minimal effect on adult mortality rate, under-five mortality rate and human per capita income.

Similarly, Mohammad, Godwin and Adams (2023) investigated of government health expenditure in Nigeria with the use of time series data between 1988 and 2021, and the usage of Autoregressive

Distributed Lagged Model. The finding revealed that government health spending on malaria incidence has an insignificant inverse effect on MI.Trailing, Oladosu (2022) carried-out cross-country research by scrutinizing the effect of public health expenditure on health outcomes in Nigeria and Ghana with the use of linear regression analysis. The finding revealed that public health expenditure had aninsignificant negative effect on malaria deaths in Ghana.

Corroborating, Isah (2019) investigated into whether under-five malaria mortality responds significantly to public health expenditures shocks in Nigeria between 1990-2017.the study employed modified Vector Autoregressive Model (VAR). Finding revealed that when public health expenditure was not disaggregated, it did not have significant effect on under-five malaria mortality. In the same vein, Aigbovo and Ezuem (2018) assessed the effect of public and private expenditure on health malaria cases in Nigeria employing Ordinary Least Square regression (OLS) and Error Correction Model (ECM) for the period 1990-2014. The study found a negative relationship between government expenditure on healthcare and malaria cases in the short-run while in the long-run the relationship was positive.

Trailing behind, Tomer and Majumder (2018) conducted research into the relationship between government health expenditure and malaria incidence. It was found that government health expenditure had a positive impact on malaria prevalence. Finally, Nwanosike, Anthony, Joan and Sam (2015) investigated the progressive implication of malaria incidence and malaria spending on Nigeria health outcomes. The study employed the production function health model with macroeconomic variables between 1970-2013.

Careful observation of the above reviewed literatures shows some identified criticisms which include among others restricted time-frame in terms of chosen periods, few or limited selected countries. Also, lack of well-grounded theoretical framework to support the reviewed literature, inadequate estimation techniques and others, this present study is carefully carried-out to rectify some of the identified criticisms of the earlier works and to extend the frontier of knowledge in the literature.

3 Model Specification

In terms of econometric engagement, the model was fashioned after Alfred and Aderonke (2023) in the literature.

lnMalaria Incidence = f(Explanatory, control variables) ……..…….. 1

The above equation. is adopted and government effectiveness (institutional quality) included.

lnMalaria Incidence = f(lnDGGHE, lnOOPHE, lnEHE, lnPBSS, GE) ……2

Equation (2) is specified to achieve the objective of this study

Econometrically,

$$lnMI_{it} = \beta_0 + \beta_1 DGGHE_{it},+ \beta_2 OOPHE_{it},+\beta_3 EHE_{it},+ \beta_4 PBSS_{it},+\beta_5 GE_{it}) + \varepsilon_{it} \ldots\ldots\ldots\ldots 3$$

The dependent variable is represented with lnMI (log of Malaria Incidence), while independent variables are represented with DGGHE (Domestic General Government Expenditure proxy for Government Healthcare Expenditure), OOPHE (Out of Pocket Health Expenditure), EHE (External Health Expenditure), PBSS (People with Basic Sanitary Services) and GE (Government Effectiveness) in country iat year t. εsignifies error term while t =1……T denotes time, while i= 1……N stands for country. β_0 is an intercept, β_1 - β_5 are a priori estimated expectations of parameters of the independent variables. β_1 - β_5 are expected to be negative values because the higher the DGGHE, OOPHE, EHE, PBSS and GE, the lower the MI in the selected countries ought to be.

4. Estimated Techniques

To estimate the model in this study, Estimated Generalized Least Square (EGLS) and Pooled Ordinary Least Square estimation techniques were used to achieve the objective of this study.Estimated Generalized Least Square (EGLS) is justified because it provides a more accurate and unbiased estimate of the regression coefficients.It is also more flexible and efficient estimator. The justification of Pooled Ordinary Least Square is premised on its ability to simplify the examination of panel data by treating it as a large cross-sectional dataset and its efficiency in handling large dataset.

5. Data and Measurement of Variables

In order to examine the effects of government health spending and other health spendings in malaria ridden countries of Africa, malaria incidence is choosing as a dependent variable. The simple justification for selecting this dependent variable is to determine whether the healthcare spending (both domestic and others) channeled to these malarias ridden countries is reducing or increasing malaria endemics in the continent. The data of the chosen variables in

this study were sourced from World Development Indicators (2023), and Worldwide Governance Indicators (2023).

5.1 Malaria Incidence

It is defined as the number of new cases of malaria in a country in a year. It is measured as new cases of malaria occurrence per 1,000 people at risk each year.

5.2 Domestic General Government Health Expenditure

It is expressed by comparing the size of current health expenditure from government domestic sources relative to the total size of government expenditure. It is measured as the percentage of current health expenditure.

5.3 Out of Pocket Health Expenditure

It is the payment expenditure borne directly by a patient where insurance does not cover the full cost of the health good or service. They include cost-sharing, self-medication and other expenditure paid directly by private households. It is measured as the percentage of current health expenditure.

5.4 External Health Expenditure

It is defined as the compositions of direct foreign transfers and foreign transfers distributed by government encompassing all financial inflows into the national system from outside the country. It is measured as the percentage of current health expenditure.

5.5 People with Basic Sanitary Services

It is defined as the percentage of people using at least basic sanitation services, that is, improved sanitation facilities that are not shared with other households. It is measured as the percentage of population of a country.

5.6 Government Effectiveness

It reflects the perceptions of the quality of public service, the quality of civil service and the degree of its independence from political pressure, the quality of policy formulation and implementation and the credibility of government's commitment to such policies. Its measure ranges from -2.5 (weak) to 2.5 (strong) governance performance.

6. Scope of the Study

The study covered the time frame of 2000-2021 and made used of cross-sectional and annually time series data consequently for 30 selected African countries. The countries selected are Papua New Guinea, Chad, Equatorial Guinea, Gabon, DR Congo, Ethiopia, Kenya, Madagascar, Malawi, Tanzania, Angola, Botswana, Liberia, South Sudan, Zambia, Benin Republic, Cote D'ivoire, Ghana, Nigeria, Senegal, Congo Republic, Uganda, Zimbabwe, Mali, Togo, Sudan, Rwanda, Mozambique, Niger and Guinea.

7. Results and Discussion

Results in Table 1 presents the summary of the descriptive statistics of the study variables of the panel data collected from various organizations' databases covering 30 selected African countries. Table 1 indicates that an average malaria incidence of 269.7 cases per 1000 population at risk in the 30 selected African countries over a 22-year period (2000–2021).Also, the maximum malaria incidence was 709.8. Meanwhile, domestic government health expenditure (% of current health expenditure), Out-of-Pocket Health Expenditure (% of current health expenditure), External Health Expenditure (% of current health expenditure), People with at least Basic Sanitation Service (% of population), and Government Effectiveness (ranges between -2.5 to 2.5) averaged 23.7%, 39.6%, 9.5%, 26.8% and -0.7%, respectively.

Table 1. *Descriptive statistics of Variables*

Variable Variable	Obs	Mean	Std. Dev.	Max	Min
MI	660	269.7367	133.1640	709.7933	0.156283
DGGHE	660	23.70181	43.94955	336.3493	0.000000
OOPHE	660	39.61343	21.12608	84.18211	0.000000
EHE	660	9.548218	9.001537	73.41230	0.000000
PBSS	660	26.78987	16.88543	80.29223	0.000000
GE	660	-0.744616	0.609363	1.150494	-1.879460

Abbreviations: *MI= Malaria Incidence (malaria occurrence per 1,000 people at risk each year); DGGHE = Domestic General Government Health Expenditure (% of Current Health Expenditure); OOPHE= Out of Pocket Health Expenditure (% of Current* Health Expenditure); EHE = External Health Expenditure (% of Current Health Expenditure); PBSS = People with Basic Sanitary Services (% of Population of a country); GE = Government Effectiveness (ranges between -2.5 to 2.5).

Spanning the same time period, the respective maximums domestic government general health expenditure, out of-pocket health expenditure, external health expenditure, people with access to basic sanitation services and government effectiveness were 336.3%, 84.1%, 73.4%, 80.3% and 1.15%. Moreover, the minimums values for DGGHE, OOPE, EHE, PBSS and GE amounted to 0.000, 0.000, 0.000, 0.000 and -1.8794 accordingly. The Results of the pairwise correlation coefficients of all variables included in this study suggests that a moderate negative relationship of -0.40 exists between Domestic General Government Health Expenditure (DGGHE) and Malaria Incidence (MI). Meanwhile, except OOPHE that shows a moderate positive correlation of 0.4, EHE and GE were weakly and negatively correlated with MI as reveal in the coefficients of -0.28, 0. and 0.13 respectively while PBSS shows a moderately negative correlation of -0.38 with MI. Also, OOPHE and DGGHE shows a weakly negative correlational relationship as revealed by − 0.29. Contrarily, there is a moderate positive relationship between EHE and DGGHE, PBSS and DGGHE as suggested by the correlation coefficient of 0.33 and 0.57 while there is a weakly positive relationship between GE and DGGHE as indicated by 0.21. Moreover, EHE, PBSS and GE have moderate relationships with OOPHE as indicated by -0.47, -0.30 and -0.38. The relationships between PBSS and EHE, and GE and EHE are moderately and weakly positive as implied by 0.34 and 0.23 coefficients while that of GE and PBSS has a weak positive one as implied by 0.21.

7.1 Correlation Coefficient

Table 2. *Pairwise correlation analysis*

Variable	MI	DGGHE	OOPHE	EHE	PBSS	GE
MI	1.00000					
DGGHE	-0.403224	1.000000				
OOPHE	0.483708	-0.29038	1.0000			
EHE	-0.28151	0.339235	-0.471	1.00000		
PBSS	-0.385121	0.573838	-0.305	0.34983	1.00000	
GE	-0.132162	0.212128	-0.388	0.23222	0.21929	1.00000

Source: *Researcher's computation*

Based on the estimated regression results (EGLS and POLS) in Table 3, the findings in relation to the effects of different factors on Malaria Incidence (MI) in the selected countries are interpreted thus: under EGLS, the coefficient for DGGHE is -0.7602, indicating a negative relationship with MI and the coefficient is statistically significant at 1%, suggesting that the effect of DGGHE is statistically reliable. The coefficient for OOPHE is 2.6082, implying a positive relationship with MI and is statistically significant at 1%. It indicates that a percent increase in OOPHE results in an increase in MI by 2.6082 in the selected countries of African region. The coefficient for EHE is -0.3645, indicating a negative relationship with MI but the coefficient is statistically insignificant, suggesting that a reduction in MI as a result of an increase in EHE is statistically unreliable.

The coefficient for PBSS is -1.1329, suggesting a negative relationship with MI. Additionally, the coefficient is statistically significant at 1%, indicating that an increase in the usage of basic sanitation services is associated with lower MI in the selected countries. The coefficient for GE is 27.8434, suggesting a positive relationship with MI and the coefficient is statistically significant. This suggests that government ineffectiveness resulted into an increase in MI and is statistically significant. Turning to the results of POLS, the coefficient for DGGHE is -0.6600 at 1%, also indicating a negative relationship with MI and that the coefficient is statistically reliable in the selected countries of African region. On the other way round, the coefficient for OOPHE is 2.6761, also implying a positive relationship with MI. In addition, the coefficient is statistically significant at 1%, indicating that an increase in OOPHE is associated with a higher MI in the selected countries.

The coefficient for EHE is 0.3541 and statistically insignificant in the selected countries of African region. The coefficient of PBSS is -1.2838 and is statistically significant, suggesting a negative relationship with MI and the coefficient is statistically reliable. This also suggests that an increase in the usage of basic sanitation services is associated with a lower MI in the selected countries. Finally, the coefficient for GE is 23.8899 and is statistically significant. This indicates that that government ineffectiveness resulted into an increase in MI and is statistically reliable. The statistical significance of DGGHE and a negative relationship with MI could be attributed to similarity in healthcare system effectiveness and the allocation of

health funds in the selected countries. The statistically significant positive relationship between OOPHE and MI underscores the critical role financial barriers play in malaria prevention and control. This finding aligns with the theoretical concept that out-of-pocket health expenses can prevent individuals from accessing necessary prevention measures and treatment.

The study suggests that addressing financial barriers should be a priority in malaria control strategies. The statistically insignificant negative and positive relationship between EHE and MI posits that external funding is not effective in reducing malaria incidence, this may be as a result of unsustainability or improper coordination of these funds. The negative relationship between basic sanitation services and MI, in conjunction with statistical significance, is align with the understanding that improving sanitation and environmental conditions can result into a reduction in malaria transmission. This highlights the importance of integrated public health approaches, addressing not only healthcare but also environmental factors in malaria control efforts. The presence of statistical significance for GE suggests that while there was a positive relationship between government effectiveness and MI, this relationship may not vary widely across different region or countries. This positive relationship could have occurred because of ineffectiveness of some governments in the continent.

Table 3. *Summary of Panel Regression Model Result for Malaria Incidence*

Variable	EGLS	POLS
DGGHE	-0.7602*** (0.0890)	-0.6600*** (0.1140)
OOPHE	2.6082*** (0.1456)	2.6761*** (0.2021)
EHE	-0.3645 (0.3581)	0.3541 (0.5014)
PBSS	-1.1329*** (0.2366)	-1.2838*** (0.3980)
GE	27.8434*** (4.6002)	23.8889*** (6.4395)
constant	250.7949*** (10.0101)	228.1744*** (16.4819)

Note: *standard error in bracket. *** p < 1%, ** p < 5%, * p < 10%*

Source: *Author's computation.*

7.2 Discussion

In contrast to the previous studies, this study observes a presence of statistical significance for the coefficients related to DGGHE in its effect on Malaria Incidence (MI). This current observation is in contrast with the finding of Ssozi and Amlani (2015). Toward this, the presence of statistical significance in the current study suggests that the effect of DGGHE on MI is statistically reliable. To summarize, the current finding of a negative coefficient for DGGHE, with statistical significance in relation to MI, aligns with some previous studies like Jeremiah, John and Gertrude (2024), Awoyemi, Makanju, Mpapalika and Ekpeyo (2023), Ian, Emile, Paola, Yingxi, Golsum, Joseph and Angela (2022), Umaru, Rotimi, and John (2022), Orji (2021), Nketiah-Amponsah (2019), Olatunde, Adebayo and Fagbemi (2019), Edeme, Emecheta and Omeje (2017), Nwanosike, Agu, Nwanya, Ogbu, Raymond, Mbachu, and Sede (2017),Matthew (2015), and Yaqub (2012) that found a negative and significant relationship. However, it contradicts studies like (Nwanosike, Anthony, Joan & Sam (2015), Isah (2019); Alfred and Aderonke (2023).

The current study also found a positive relationship between out-of-pocket health expenditure (OOPHE) and Malaria Incidence (MI) in the selected countries. An increase in OOPHE was associated with a higher MI, and this relationship is statistically significant. This finding is in tandem with previous research. The World Health Organization (WHO) realizes the impact of OOPHE on malaria incidence emphasizing that it is an important factor that can affect the incidence and management of the disease. The literature consistently showed a strong association between OOPHE and MI. High out-of-pocket expenses act as an obstacle to accessing suitable prevention and treatment measures, resulting into delayed diagnosis and inadequate treatment. Several studies have highlighted how OOPHE impedes the implementation and effectiveness of preventive measures such as insecticide-treated

bed nets (ITNs), Indoor Residual Spraying (IRS), and antimalarial medication distribution programmes.

Financial constraints hinder individuals from affording these interventions, raising their chance of contracting malaria. This finding is in accordance with a study that stressed that low uptake of preventive measures as a result of financial constraints sabotages community-wide protection and perpetuates the cycle of malaria transmission (Takemura, Fukuda, &Shimada, 2016, Nureni, Adebayo, Abdullrahmo & Moshood 2024). In addition, the impact of OOPHE on timely and correct malaria diagnosis is discussed in the literature. Individuals encountering financial constraints may seek for cheaper or incorrect diagnostic methods or delay seeking diagnosis altogether, resulting in delayed treatment initiation and higher morbidity and mortality rates as pointed-out by Masuet-Aumatell, Del Val, and Castells (2021). Different study emphasized how out of pocket health expenditure worsening existing healthcare access inequalities, in particular among poverty-strickenpopulations. Resource-confronted households, rural areas, and marginalized communities face greater financial loads or burdenswhen trying to access malaria-related healthcare services.

Ohene, Fondjo, Nyarko, and Kumi-Kyereme (2020) emphasized that this keeps up health disparities and socioeconomic inequities. The positive relationship between out-of-pocket health expenditure and malaria incidence, in conjunctions with the associated obstacles to assess prevention, treatment, and timely diagnosis, are in tandem with the existing literature. These findings deepen the importance of tackling financial obstacles and advancing equitable access to healthcare services so as to effectively control and manage malaria incidence.The findings that an increase in External Health Expenditure (EHE) are associated with negative and positive values that are statistically insignificant from both estimation techniques employed is a testament to the fact that EHE fails to be effective in reducing malaria incidence in the selected countries.

This failure could have resulted because of any of these: unsustainability or improper coordination of these funds, diversions, misallocations, misappropriations, embezzlements, lootings, thefts, political instability, fragmented interventions, neglect of healthcare infrastructure and absence of capacity-building and others. In situation like this, Roll Back Malaria (RBM) partnership (a global initiative supported by external health expenditure) is seriously needed in African continent to play a crucial role of coordinating and implementing malaria control efforts, so that invested funds can be effective in the areas of interventions such as prevention, control, treatment and diagnosis of malaria incidences.

The findings that an increase in the usage of basic sanitation services is associated with a lower malaria incidence (MI) is in agreement with the existing literature like Alfred and Aderonke (2023). Some of the previous works that found that poor sanitary conditions were a major factor responsible for high malaria incidence includeNkuo-Akenji. Ntonifor, Ndukum, Kimbi, Abongwa, Nkwescheu, Anong, Songmbe, Boyo, Ndamukong, Titanji (2006),Ajani and Ashagidigbi (2008), Amoran, Onwumbe, Salami and Mautin (2014),Yang, He, Wu, andet al (2020), Adeniran, Olorunfemi, Akinsehinwa and Abdullahi (2021), and Akinsehinwa, Adeniran, Olorunfemi and Aina (2022).All these findings reinforce the importance of basic sanitation services in pruning malaria incidence. The findings that government effectiveness has a positive association with malaria incidence that is statistically significant is proven evidence that the activities of the governments in the selected countries are to no avail reducing malaria incidence. This situation of an increase in MI as a result of government ineffectiveness informs the concerned authorities that all the constraints (bottlenecks) that prevent government effectiveness towards malaria incidence reduction should be seriously identified, attended to and removed.

8. Conclusion and Recommendations

The study has been able to bring to limelight the powerful effect of adequate and sufficient GHE in African countries has on malaria incidences in the continent, this manifests in the significant effectiveness of DGGHE. It is evident that out-of-pocket health expenditure (OOPHE) presents an important obstacle to effective malaria prevention, treatment, and diagnosis in the region. In addition, the unestablished role of External Health Expenditure is discouraging because of its insignificance, towards this end, all the barriers that stand on its effectiveness should be identified and removed. The negative relationship (displayed by the results of the estimation techniques) between people with basic sanitation services and Malaria Incidence (MI) emphasizes the significance of tackling environmental factors in malaria control efforts. The positive relationship (displayed by the results of the estimation techniques) between GE and MI shows evidently that GE poses a significant barrier to effective malaria control efforts in the continent.

This study, therefore, puts forward some invaluable insights and feasible implications for African

governments, different donor agencies, and other stakeholders involved in eradicating malaria incidence in the selected African countries. While this study suggests that increasing Domestic Government General Health Expenditure (DGGHE) have a statistically significant impact on reducing Malaria Incidence (MI), it remains essential for the governments of the selected countries to maintain or continue to improve investment in DGGHE. An increased investment in DGGHE no doubt will continue to prune MI and a well-funded healthcare system that guarantees comprehensive health services for the overall well-being of the population should be carefully pursued. Given the positive and statistically significant relationship between out-of-pocket health expenditure (OOPHE) and malaria incidence, policy-makers and health agencies or organizations in African countries should classify efforts to minimize the dependence on out-of-pocket health expenditure (OOPHE). Attainment of this is possible through the implementation of health insurance schemes or social protection measures to lighten or mitigate financial burdens on individuals seeking malaria treatment. Guaranteeing cheap and at fingertips healthcare services is essential.

The statistically insignificant coefficients for external health expenditure suggest that governments of African countries should look inward, identify and remove those barriers that hinder the effectiveness of external health expenditure directed towards malaria prevention, control, and treatment. International organizations, and donor agencies should not only be concerned about the disbursement of external funds for health but should see to the proper monitoring, implementation and accountability of these funds also so that the goal of continued reduction in malaria incidence in the region will not be defeated.

This study recommends that the concerned governments of African countries, in partnership with their respective private sectors should make provisions for proper, sufficient and adequate government health spending devoid of corruption to eradicate malaria incidence in African continent. While adequate, proper and sufficient government health spending is paramount and important to eradicate malaria incidence in African countries, it is equally important to classify benchmarks to lower financial obstacles, also, in the face of decreasing external funding for malaria control and prevention, African governments should ensure that all barriers handicapping external funding from impacting MI negatively and significantly are identified and completely removed. Similarly, investments should be geared towards the improvement of sanitation infrastructure, promotion of proper waste management, and ensuring access to clean water sources.

In addition, public health campaigns to educate communities about the importance of maintaining good sanitation practices should be encouraged regularly. Finally, to attain greater malaria incidences reductions in African countries, strengthening institutional frameworks (GE) within African health sectors for improved management of funding is imperative to enhance population health outcome in the continent. This measure will go a long way to establish effective checks and balances to bolster government effectiveness in the continent. Conclusively, effective malaria incidence reductions in the continent require concerted struggles that transverse the government health expenditure, external financing, and more expansive community participation. By providing practical means of accomplishing the stated recommendations in this study, concerned African governments and relevant parties involved can donate and collaborate for an all-inclusive and combined blueprint that tackles complicacies of malaria control in the continent, which can eventually result intoeradication of malaria prevalences (an improved health outcome)in the continent.

This study is limited by the following; employment of 30 African countries instead of the entire 54 countries of Africa, restricted time period (2000-2021) is identified as another limitation of the work, employment of only one primary variable of interest (dependent variable) (MI) is also another fingered limitation. Similarly, this study beams its' searchlight on Africancountries with the exclusion of countries from other continents. Also, the study made used of only one theoretical under-pinning, and on a final note, two estimated techniques wereemployed. Premised on these stated limitations, future researchers are encouraged to focus on the entire African countries, widening the time-period beyond 2021; as well as the employment of more dependent variables like Infant Mortality Rate (IMR), Maternal Mortality Rate (MMR) and other health outcome indicators. Additionally, the topic can be re-framed beyond African continent, additional theoretical under-pinning can be introduced, and lastly, if more countries are included, employments of estimation techniques like System Generalized Method of Moments, Panel Autoregressive Distributed Lags, Fixed and Random effects, and others can be

employed by the future researchers who are eager to fill the gaps identified in this work.

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Contributions

OA: Conceptualization, writing-original draft preparation, methodology, supervision, and resources.

OA: Data curation, review and editing, validation, and resources.

AN: Formal analysis, project administration, software, and resources.

Conflict of Interest

There is no conflict of interest.

Declaration Statement

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Data Availability Statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

9. References

1. Adeniran, A. O., Olorunfemi, S. O., Akinsehinwa, F. O., & Abdullahi, T. M. (2021). Nexus between urban mobility and the transmission of infectious diseases: evidence from empirical review. Insights into Regional Development, 3(3), 119-126. http://org/10.9770/IRD.2021.3.3(8).
2. Akinsehinwa, F. O., Adeniran, A. O., Olorunfemi, S. O., & Aina, S. (2022). Level of adherence to Covid-19 preventive measures: Case study FUTA Shuttle Bus. Annals of Bioethics & Clinical Applications, 5(1): 000219, doi: 10.23880/abca-16000219.
3. African Union (2025, February 16). African leaders call for urgent domestic investment and global financing to accelerate malaria elimination at high-level AU Press Briefing. 38th AU Summit.
4. Ajani, O. I. Y., & Ashagidigbi, W. M. (2008). Effect of malaria on rural households' farm income in Oyo State, Nigeria. African Journal BiomedRes;11:259–65.
5. Akinloye, D. N. (2025). Communication patterns and the influence of social media contents on young adults' wellbeing in Texas, United States of America. Journal of Communication, 6(2), 1-22. CARI Journals.
6. Alfred,E., &Aderonke, O. A. (2023). Addressing malaria incidence in Africa through healthcare expenditure and access to basic sanitation services, Discover Health Systems, 2(37).
7. Amoran, O. E., Onwumbe, O. O., Salami, O. M., & Mautin, G. B. (2014). The influence of environmental sanitation on prevalence of malaria in a rural town in South-Western Nigeria. Nigeria Journal of Medicine;23(3):254–62.
8. Awoyemi, B. O., Makanju, A. A.,Mpapalika, J.,&Ekpeyo, R. S. (2023).A time series analysis of government expenditure and health outcomes in Nigeria, Journal of Public Health Africa, 14(7):1409. doi: 10.4081/jphia.2023.1409
9. Bello, R. A.(2004). Costing the social-economic effects of malaria in Nigeria; Indian development review, An International Journal of Development Economics, 2(2), 131-140.
10. Cropper, M. L. (1977). Health, investment in health, and occupational choice, Journal of Political Economy, 85(6), 1273-1294.
11. Eboh, A, & Adebayo, A. O. (2023). "Addressing malaria incidence in Africa through healthcare expenditure and access to basic sanitation Services." Discover Health Systems 2 (1): 37. https://doi.org/10.1007/s44250-023-00052-8.
12. Edeme, R. K.,Emecheta, C.,&Omeje, M. O. (2017). Public health expenditure and health outcomes in Nigeria,American Journal of Biomedical and Life Sciences, 5(5):96, https://doi.org/10.11648/j.ajbls.20170505.13
13. European Alliance Against Malaria (September, 2007). Malaria & Poverty: Working for a malaria-free world.
14. Ian, C., Emile,M., Paola,P., Yingxi, Z., Golsum,T., Joseph, D., &Angela,M. (2022). Examining the relationship between malaria burden and domestic spending on malaria in 106 countries, 2000-2019, Clinical Medicine, University of Oxford, Oxford, UK.
15. Ibrahim, V.H. (2021). Effect of malaria incidence and malaria control on health outcome and human capital development in Nigeria: An Economy Analysis, Journal of Economics and Allied Research, 6(1), ISSN: 2536-7447.
16. Isah, I. P. (2019). Public health expenditure shocks and under-five malaria mortality in Nigeria between

1990-2017, Economic Update- Nigerian Journal of Contemporary Public Policy, 13(2).

17. Jaana,R., Matt, W., &Aditi,R. (2020). How investing in health has a significant economic payoff for developing economies.
18. Jeremiah,K., John, B. N.,&Gertrude, S. M. (2024). Exploring the role of spending on malaria incidence in Uganda using the auto-regressive distributed lag approach, Malaria Journal, 23(129).
19. Katushabe,J., Nnyanzi, J. B., &Muwanga, G. S.(2024). "Exploring the role of spending on malaria incidence in Uganda using the Auto-Regressive Distributed lag Approach." Malaria Journal 23 (1): 129. https://doi.org/10.1186/s12936-024-04929-8.
20. Li, J., Docile, H. J., Fisher,D.et.al. (2024). Current status of malaria control and elimination in Africa: Epidemiology, Diagnosis, Treatment, Progressand Challenges, Journal of Epidemiology and Global Health 14, 561-579.
21. Matthew, O. A., Adegboye, F, B., &Fasina, F. F. (2015). Public health expenditure and health outcomes in Nigeria. Journal of Public Health,4(1),45-56.
22. Masuet-Aumatell,C., Del Val,M., &Castells, X. (2021). Delay in diagnosis and treatment of malaria: a systematic review and meta-analysis. Malaria Journal;20(1):110.
23. National Institute for Communicable Diseases (2024). Malaria can't be beaten without political will and more funding.
24. Nketiah-Amponsah E. (2019). The impact of health expenditures on health outcomes in sub-Saharan, African Journal of Development Soc, 35:134-52. [Google Scholar]
25. Nkuo-Akenji,T., Ntonifor,N. N., Ndukum, M. B., Kimbi, H. K., Abongwa, E. L., Nkwescheu,A, among, D. N., Songmbe,M., Boyo, M. G., Ndamukong, K. N., &Titanji, V. P. N.(2006). Environmental factors affecting malaria parasite prevalence in rural. AfricanJournal of Health Science, 13:40–6.
26. Nureni, O. A., Adebayo, M. O.,Abdullrahmo, A. T., & Moshood, K. A.(2024). The impact of domestic and external state debt on state gross domestic product in Nigeria, Sri Lanka Journal of Social Sciences and Humanities, 4(2), 1-9.
27. Nwanosike, D.U., Agu,C., Nwanya, J. C.,Ogbu,O., Raymond, C. M., Mbachu, H. I., & Sede (2017). Constrained public care spending and steady state in health outcomes in Nigeria. International Journal of Academic Research in Business and Social Muhammad et al: AJEC, 12(11), 2571-2586.
28. Nwanosike, D. U., Anthony, O., Joan, C. O., & Sam, U. (2015). Progressive health spending and health outcomes in Nigeria: The case of malaria, International Journal of Academic Research in Business and Social Science, 5(12), ISSN: 2222-6990.
29. Mohammad, N., Godwin, F. O.,& Adams, O. P. (2023). Impact of government health expenditure on health outcomes in Nigeria, AJEC, 4(1).
30. Ohene,S. A., Fondjo, L. A., Nyarko,S. H,&Kumi-Kyereme, A. (2020). Expenditure on malaria and other illnesses in households in Ghana: an exploratory study. Malaria Journal;19(1):1
31. Oladosu, A. O., Chanimbe, T., &Anaduaka, U. S. (2022). Effect of public health expenditure on health outcomes in Nigeria and Ghana. Health Policy Open, 3, 100072.
32. Olatunde, O. S., Adebayo, A. A., &Fagbemi, F. (2019). Health expenditure and child health outcome in West Africa. International Journal of Social Science Perspective, 5:72-83.
33. Orji, A, Ogbuabor, J. E., Mba,P. N., &Anthony-Orji, O. I.(2021). Are wealthy countries always healthy? Health outcomes and public health spending nexus in Nigeria, SAGEOpen, 11(3), 21582440211040793.
34. Peter,I.P., &Nosakhare, I. (2018). Government health expenditure and malaria in Nigeria. Yobe Journal of Economics, (YOJE); 5: 19–172.
35. Priya,V. (2024). The 2023 WHO world malaria report, 5(3), Published by Elsevier Ltd.
36. Sede,I.P. (2017). Government health expenditure and malaria in Nigeria, Journal of Social and Management Sciences, 3(1).
37. SpeakUpAfrica (2023, 24 April). Innovative funding, a key strategy in the fight against malaria.
38. Ssozi,J., &Amlani, S. (2015). The effectiveness of health expenditure on the proximate and ultimate goals of healthcare in sub-Saharan Africa. World Development; 76:165–79.
39. Takemura, T., Fukuda, Y., &Shimada,M. (2016). Economic burden of malaria on households versus the cost of prevention and control in endemic districts of Myanmar. Trop Med Health, 44: 35.
40. Tomer, D., & Majumder, A. (2018). Impact of government healthcare expenditure on malaria prevalence.Knowledge Tank; Project Guru; https://www.projectguru.in/impact-government-healthcare-expenditure-malaria-prevalence/.
41. Umaru, A. P., Rotimi, M. E., &John,N.W. (2022). The link between government health expenditure and health outcome in Nigeria, 1981-2019. ABUAD Journal of Social and Management Sciences, 3(1), 12-29.
42. UNICEF (2024). Malaria: Nearly every minute, a child under 5 dies of malaria.

43. WHO (2025). World malaria report 2024: Addressing inequity in the global malaria response.

44. WHO (2023). Malaria: Key facts.

45. World Health Organization (2020). Malaria eradication: benefits, future scenarios & feasibility. A report of the Strategic Advisory Group on Malaria Eradication.

46. WHO (1988). 2001-2010 United Nations Decade to Roll Back Malaria.

47. Yang,D., He,Y.,Wu, B., et al(2020). Drinking water and sanitation conditions are associated with the risk of malaria among children under five years old in sub-Saharan Africa: a logistic regression model analysis of national survey data. Journal of Advance Research. 21:1– 13.

48. Yaqub, J. O., Ojapinwa, T.V, & Yussuff, R.O. (2012). Public health Expenditure and Health Outcome in Nigeria: The impact of governance. European Scientific Journal, 8(13), 189-201.