

# A time series analysis of government expenditure and health outcomes in Nigeria

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## Abstract

**Background.** Despite a significant share of Nigeria's budget in the health sector, the health status has not improved, as reflected by poor health indicators.

**Objective.** This study investigates the linkages between government expenditure and health outcomes in Nigeria.

**Methods.** The Autoregressive Distributed Lag technique was used to examine the short- and long-run effects of government health expenditure on health outcomes separately. The health outcome was captured by life expectancy at birth and mortality rate.

**Results.** Findings show a negative relationship exists between health expenditure and mortality rate, implying that a rise in health expenditure leads to a decrease in mortality rate, while life expectancy at birth positively responds to the changes in health expenditure.

**Conclusions.** As a policy recommendation from this study, the

government should pursue increasing health expenditure and partner with the private sector in the form of Public-Private Partnerships to improve the health sector and outcomes.

## Introduction

Over the last two decades, Nigeria's health expenditure has frequently been described as insufficient, with average health provision barely exceeding 3%.<sup>1,2</sup> Between 2000 and 2019, government-funded health expenditure per capita was \$11.2, while private expenditure was \$49.8, which were significantly lower than the \$86, approximating the minimum amount required to ensure universal health coverage for essential services. Similarly, public health expenditure as a share of gross domestic product (GDP) was low at 0.65%, less than the 4-5 percent of GDP suggested for achieving universal health coverage. The percentage of government health expenditure as a share of gross government expenditure, at 4.2 percent, remains far below the 15 percent target set in the Abuja Declaration in 2001.<sup>3</sup> Moreover, owing to volatile oil revenues resulting from fluctuations in global oil prices, both recurrent and capital expenditures have changed significantly over time. From 2000 to 2020, recurrent government spending on the health sector increased from 15.2 billion Naira, or less than 4 percent of the overall budget, to 369.4 billion Naira, or less than 5 percent. However, the capital expenditure fluctuated and reached less than 195 billion Naira in 2020.<sup>4</sup> This shows that the Nigerian government has been spending more on healthcare goods and services than on health-related buildings and equipment. Public expenditure on health is expected to improve access to healthcare for the poor and lower catastrophic healthcare costs for households. Household out-of-pocket expenditure burden rose slightly from 60.2% in 2000 to 70.5% in 2019.<sup>1</sup> While public health expenditures account for about 15% to 20% of total health expenditures, private expenditure accounts for 70-75% of total health expenditure, with external health expenditure accounting for 10-15%. The dominance of private expenditure is through out-of-pocket with more than 90% of private health expenditure. Nigeria's health financing indicators were below the mark, indicating a high health spending burden on Nigeria's private sector and households.

Amid shrinking health budgets, most public health institutions lack professional personnel and modern facilities to provide quality service to the general public. Inadequate funding and bureaucratic barriers threaten the few existing public health facilities.<sup>5</sup> Despite the country's growing population, the Nigerian Bureau of Statistics reports that no new hospitals have been added to the approximately 3,500 secondary and tertiary health facilities since 2004. Fewer health facilities and insufficient funding may hinder the improvement of healthcare services and reduce the population's access to affordable healthcare while increasing the produc-

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tion of lower-quality healthcare services. Health care of a lower standard often leads to unsatisfactory healthcare, which deteriorates the health status of patients, resulting in complications that may support millions of premature deaths and contribute to an adverse health outcome for the country<sup>5</sup>. Because of low public health expenditures, the average citizen's health has not improved; instead, it has remained consistently low. Between 2000 and 2019, the average life expectancy at birth in Nigeria was around 51 years. This was significantly less than the global average of 70 years during the same time period.<sup>1</sup> Infant and child mortality rates in Nigeria are among the world's highest. This demonstrates the need to improve the healthcare sector and outcomes. Health outcomes also influence economic growth. Poor health conditions reduce productivity and worsen economic performance, whereas better health has the opposite effect.<sup>6,7</sup> Despite the importance of the health sector, most studies have assessed the relationship between health sector expenditures and economic growth, with only a few studies looking at the association between health expenditures and health outcomes. As a result, this research aims to look into the effects of government spending on health outcomes, specifically life expectancy and mortality rates.

## Literature review

### Overview of health system in Nigeria

The private and public sectors offer health services in Nigeria, including non-governmental, private healthcare providers, religious-affiliated institutions, and traditional institutions operating privately. In practice, the government serves as the provider of primary, secondary, and tertiary health care services. The accessible health facilities at the primary level include health clinics, health centers, and dispensaries. Medical and laboratory services are also provided by secondary health facilities, including gynecological and obstetrical services. Meanwhile, the country's tertiary level of healthcare is the most comprehensive. Specialists, teaching hospitals, and federal medical centers are among the facilities. They are equipped with cutting-edge medical technology and act as hubs for generating new ideas and information. Doctors, nurses, midwives, laboratory scientists, and pharmacists work in secondary and tertiary health facilities. The local, state, and federal governments provide the primary, secondary, and tertiary levels of health care. The Nigerian Constitution of 1999 places health on the concurrent list, which means that every level of government has a specific role in meeting the health needs of the populace to achieve good health for all. The achievement of this goal is contingent on the health system's performance in terms of increasing healthcare service provision and financing. The Nigerian health sector has not met this goal due to a lack of clarity in roles and responsibilities among various levels of government and inadequate funding.<sup>8</sup> The consequences are reflected in poor healthcare service delivery and health outcomes.

### Health status and indicators of health outcomes

Health is a state of complete physical, mental, and social well-being; ranking health status by health experts or organizations can provide a foundation for comparison and improvement. Nigerian's health status ranks low when compared to other emerging nations in the same category. Chronic and infectious disease burdens exacerbate poor health status in Nigeria. The constant threat of epidemics of cholera, meningitis, and other communicable diseases have all contributed to Nigeria's poor health conditions.<sup>2</sup> Nigeria currently has the world's highest under-five mortality rate, with 117.2 infant deaths per 1000 live births.<sup>1</sup> The trend analysis of

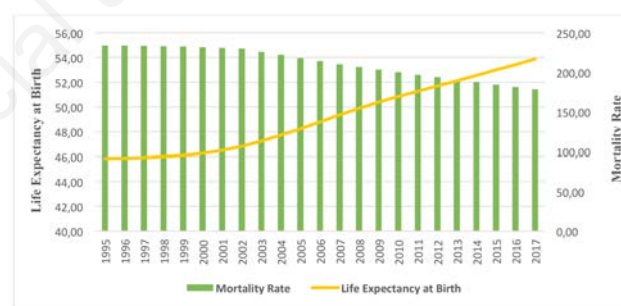
selected health outcomes and health expenditures indicates the mortality rate was 231.7 deaths per 1000 people, and the life expectancy was 46 years in 2000. During this period, the expenditure pattern shows Nigerians spend a small amount on health.

From Figures 1 and 2, the public and private health expenditures as a ratio of GDP were 0.95% and 1.89%, respectively, in the year 2000. In 2007, the public and private health expenditure rose to 1.47% and 3.0 % of GDP, respectively; the infant mortality was reduced to 210.7 deaths per 1000, indicating a 21 percent decrease, and life expectancy rose to 49.36 years. However, the government expenditure on the health sector in Nigeria was reduced in 2017 to 0.72% of the GDP, while private health spending mitigated the effect of the fall in public health spending and rose to 3.57% of GDP. The mortality rate reduced to 187.7, while life expectancy rose to 53.87 years in 2017. These figures likely indicate poor funding for the health sector. The trends reflect that as health spending rises, infant mortality rates reduce, and life expectancy increases. However, there was a significant instability in life expectancy annually with fluctuations in government spending. This shows that Nigeria's health challenges require massive investment in the health sector and a comprehensive approach from the government and society to improve health status.

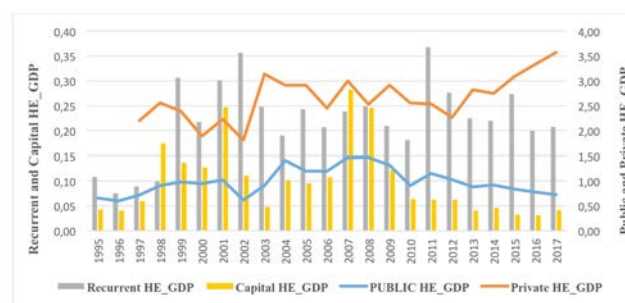
## Theoretical issue

### Human capital theory

The theory demonstrates that health is critical to overall well-being and is required for a fulfilling life. It emphasizes that invest-



**Figure 1.** The trend of health outcome in Nigeria. Source: World Bank, World Development Indicator Database, Central Bank of Nigeria statistical bulletin and report.



**Figure 2.** The trend of health expenditure (as % of gross domestic product) in Nigeria. Source: World Bank, World Development Indicator Database, Central Bank of Nigeria statistical Bulletin and report.

ment in health and healthcare policy is critical to improving human capital.<sup>9</sup> It is fundamental for the expanded human capability that lies at the core of economic development and is a necessary precondition for increased productivity. As argued by Bloom *et al.* (2004),<sup>10</sup> quality education and good health are a catalyst for high labor productivity that in turn, stimulates economic growth. A healthier workforce is likely to raise better wages by minimizing inefficiencies. Improving the workforce's health increases productivity and raises the minimum wage through presenteeism at work and overtime incentives while reducing potential losses. More recently, the effect of health as measured by life expectancy at birth on economic growth portrays that health's elasticity of growth is positive and significant.<sup>11</sup> High government expenditure on the health sector stimulates economic production because a healthy person is more likely to produce at a higher rate than an unhealthy person. Increased income would lead to high human capital via an increase in health expenditure which in turn, lead to increased productivity.

### Linking theory with empirical evidence

A study assessing an existing correlation between health outcomes and economic growth in Nigeria by employing the Ordinary Least Squares (OLS) method findings indicated a significant and positive relationship between health sector expenditure and economic growth.<sup>12</sup> Also, it was found that economic growth significantly influenced health indicators in the long run and health indicators granger caused the per capita GDP in Nigeria.<sup>13</sup> In Nigeria, the relationship between health financing, utilization of health facilities, and health outcomes was observed. According to the findings, high infant mortality and morbidity rates were associated with an increased incidence of out-of-pocket payments and income disparities.<sup>14</sup> In addition, a correlation analysis between government health spending and health outcomes in developed countries was conducted. The findings show that government spending on health outcomes is statistically and significantly correlated. Specifically, government health spending is linked to lower infant mortality rates, but it is also linked to longer life expectancy.<sup>15</sup> According to these findings, adequate government spending on medical supplies and healthcare services can lead to better health outcomes.

The impact of government and external health spending on economic growth in Sub-Saharan African countries was investigated using random panel effects of the OLS, and a negative impact of public and external health spending on infant and neonatal mortality was discovered.<sup>16</sup> This implies that allocating more resources to the health sector reduces infant and child mortality. Similarly, increasing government health funding has a significant and indirect effect on mortality rates in West Africa; a percentage increase

in health expenditure reduces maternal mortality by 4.9% in West Africa.<sup>17</sup> Also, the Granger causality test indicates a bi-directional relationship between health spending and economic growth.<sup>18</sup> This implies that increased health spending improves economic performance and improves economic growth, promoting public spending on health. In Nigeria, increasing government health expenditure improves life expectancy and decreases the death rate.<sup>19–21</sup> Summarily, improvement in health performance stimulates health outcomes.

## Methodology

The Augmented Dickey-Fuller (ADF) and Philip Perron (PP) tests were conducted to test for a unit root in the data series. A bound cointegration test was employed to assess cointegration among the series. The autoregressive distributed lag technique was used to examine the short- and long-term effects of government health expenditure on health outcomes separately. The health outcome was captured by life expectancy and mortality rate. The data spanned from 1995 to 2018 and were extracted from the World Development Indicator, World Bank Database, and Central Bank of Nigeria statistical bulletin. The mortality rate and life expectancy at birth models were expressed as:

$$MR_t = f(PHE\_GDP_t, PRHE\_GDP_t, CHE\_GDP_t, RHE\_GDP_t, RGDP_t, \varepsilon_t) \quad (1a)$$

Using life expectancy as an indicator of health outcome is given by:

$$\ln MR_t = \alpha_0 + \alpha_1 PHE\_GDP_t + \alpha_2 PRHE\_GDP_t + \alpha_3 CHE\_GDP_t + \alpha_4 RHE\_GDP_t + \alpha_5 \ln RGDP_t + \varepsilon_t$$

Using life expectancy as an indicator of health outcome is given by:

$$LEB_t = f(PHE\_GDP_t, PRHE\_GDP_t, CHE\_GDP_t, RHE\_GDP_t, RGDP_t, \varepsilon_t) \quad (1b)$$

$$\ln LEB_t = \alpha_0 + \alpha_1 PHE\_GDP_t + \alpha_2 PRHE\_GDP_t + \alpha_3 CHE\_GDP_t + \alpha_4 RHE\_GDP_t + \alpha_5 \ln RGDP_t + \varepsilon_t$$

Where LEB denotes Life Expectancy at Birth; MR denotes Mortality Rate; PHE\_GDP is the Public Health Expenditure as % of GDP; PRHE\_GDP stands for Private Health Expenditure; CHE\_GDP is the capital health expenditure, RHE\_GDP represents Recurrent Health Expenditure. RGDP is the Real Gross Domestic Product and is the Error Term.

## Empirical results

### Descriptive analysis and unit root (stationary) test

The descriptive analysis, as reflected by the standard deviation,

**Table 1. Descriptive analysis.**

	MR	LEB	PHE_GDP	PRHE_GDP	CHE_GDP	RHE_GDP	RGDP
Mean	211.9272	49.11997	0.985435	2.621739	0.100933	0.221318	43200.05
Median	214.1496	48.80200	0.920000	2.560000	0.064088	0.220091	40703.68
Maximum	233.8264	53.86633	1.470000	3.573333	0.282354	0.368051	69023.93
Minimum	178.7266	45.85200	0.600000	1.810000	0.031235	0.074746	21660.49
Std. Dev.	19.43855	2.781543	0.262079	0.450215	0.073475	0.077348	17236.54
Skewness	-0.296193	0.267492	0.447842	0.160881	1.235236	-0.169765	0.224717
Kurtosis	1.613429	1.617486	2.253135	2.444155	3.477496	2.743786	1.566265
Jarque-Bera	2.178770	2.105989	1.303388	0.395306	6.067432	0.173388	2.163519
Probability	0.336423	0.348891	0.521162	0.820654	0.048136	0.916958	0.338999

Source: Author's Computation 2020, underlying data from World Development Indicator Database, Central Bank of Nigeria statistical Bulletin and Central Bank of Nigeria annual report.



mean, kurtosis, and skewness, is presented in Table 1. The average MR is 211.92 within the ranges of 178.73-233.83 and skewness and kurtosis of -0.29 and 1.61 respectively. Life expectancy has a mean of 49 years with minimum and maximum of 46 and 54 respectively and a standard deviation of 2.78. This implies that a newborn in Nigeria is expected to live on average 49 years. Also, PHE\_GDP has an average of 0.985% of GDP within the range of 0.60 and 1.47% and with skewness and kurtosis of 0.44 and 2.25. Furthermore, PRHE\_GDP recorded an average of 2.62% of GDP, which ranges between 1.81 and 3.57% with skewness and kurtosis of 0.16 and 2.44. The Capital Health Expenditure (CHE\_GDP) ranges between 0.03 and 0.28% of GDP, with an average of 0.10%. The skewness and kurtosis are 1.23 and 3.47 respectively. The Recurrent Expenditure has an average of 0.22% of GDP with skewness and kurtosis of -0.16 and 2.74. The Real GDP has an average of N43200.05 billion within the ranges of N69023.93 billion and N21660.49 billion, with a standard deviation of N17236.54 billion and skewness and kurtosis of 0.22 and 1.56. Overall, most of the variables were positively skewed with a high value of kurtosis. The ADF and PP unit root tests were conducted, as shown in Table 2. Mortality Rate and Life Expectancy are non-stationary at level, meaning they are integrated of order;<sup>1</sup> they become stationary at first differencing. The remaining variables are stationary at either level or first difference.

#### Bounds co-integration test for model 1a and 1b

The analysis was classified into different models: model 1a examines the effect of government expenditure on health outcomes using Mortality Rate as an indicator, and model 1b uses Life Expectancy at Birth (LEB). Following the unit root result, the study employed a bounds test to investigate the existence of long-run cointegration among the variables as presented in Table 3; the F-statistic values for model 1a and b are 8.204 and 27.580 respectively, which are above upper bound values at 1 percent level. This

suggests that the H0 of no cointegration can be rejected at a 1% significance level and conclude that there is cointegration. Alternatively, this implies that a long-run relationship exists among the variables.

#### Autoregressive distributed lag analysis and error correction model for model 1a

The dependent variable in this model is Mortality Rate (MR), and the R2 (coefficient of determination) is 0.999, implying that the explanatory variables explain 99.9% of the variation in MR. As shown in Table 4, the F-statistics (163333.51; P=0.000) is highly significant at the 1% level. This validates the usefulness of the model. The Durbin-Watson statistics of 1.90 indicates the absence of serial correlation in the error term of each of the variables. After the co-integration test, the dynamic short-run model indicates that ECT (-1) value is -0.0096. The ECT (-1) value is negative and significant at the 1% level. This negative and significant value confirms the stability of the model, implying the underlying series are co-integrated and perfectly adjust towards long-run equilibrium at the rate of about 0.96 percent. Focusing on the coefficient of the explanatory variables, in the short run, Public Health Expenditure as % of GDP (PHE\_GDP), Private Health Expenditure proportion of GDP (PRHE\_GDP), Capital Health expenditure % of GDP (CHE\_GDP), and Real Gross Domestic Product (RGDP) negatively and significantly affect mortality rate at 1% and 5% level with coefficients of -0.0118, -0.0059, -0.0207 and -0.0422 respectively. The long-run coefficients also show that PHE\_GDP, PRHE\_GDP, CHE\_GDP, and RGDP negatively and significantly influence the mortality rate in Nigeria. These results indicate that increasing health spending and economic outputs measured via RGDP would reduce the mortality rate both in the long and short run.

**Table 2. Stationarity test.**

Variable	Test	@Level	@ First Diff.	Order
MR	ADF	-2.491	-3.205*	I(1)
	PP	-0.165	-3.241*	I(1)
LEB	ADF	-0.757	-2.738*	I(1)
	PP	-0.360	-40.575***	I(1)
CHE_GDP	ADF	-1.123	-6.162***	I(1)
	PP	-1.128	-6.165***	I(1)
RHE_GDP	ADF	-3.386**	-8.161***	I(0)
	PP	-1.039	-8.161***	I(1)
RGDP	ADF	-0.509	-3.748***	I(1)
	PP	-1.039	-3.748***	I(1)
PHE_GDP	ADF	-1.069	-8.161***	I(1)
	PP	-1.039	-8.161***	I(1)
PRHE_GDP	ADF	-3.556**	-5.716***	I(0)
	PP	-3.738**	-6.021***	I(0)

Source: Author's Computation 2020, underlying data from World Development Indicator Database, Central Bank of Nigeria statistical Bulletin, and report. \*, \*\* and \*\*\* imply statistical significance at 1%, 5% and 10% levels respectively.

**Table 3. Autoregressive distributed lag bounds test.**

Models	F-statistics	10%	5%	1%	Remark
Model 1a	8.204	3.17 (4.14)	3.79 (4.85)	5.15 (6.36)	H0 is rejected
Model 1b	27.58087	3.17 (4.14)	3.79 (4.85)	5.15 (6.36)	H0 is rejected

The upper bound value in parenthesis.

## Autoregressive distributed lag analysis and error correction model for model 1b

In this model, the dependent variable is the LEB, from the result in Table 5, the  $R^2$  is 0.999, indicating that the explanatory variables explicate about 99.9% of the variation in LEB. The F-statistics (10574.95;  $P=0.000$ ) is highly significant at a 1% level of significance. This supports the efficacy of the model. The ECT (-1) value is -0.002, negative and significant at a 10 percent level. The negative and significant value of the ECT specifies that the model is relatively stable. Focusing on the coefficient of the

explanatory variables, the result shows in the short run, PRHE\_GDP, CHE\_GDP, and RGDP have a positive and significant effect on LEB at 1% and 10% levels with coefficients of 0.0022, 0.0086, and 0.0240 respectively. Also, in the long run, these variables have a positive and significant impact on LEB. Overall, the findings suggest that increasing health spending is anticipated to boost life expectancy. This finding is similar to the evidence provided by Orji *et al.* (2021)<sup>19</sup>, which reveals that public health expenditure improves life expectancy. Our findings also support evidence from 2019 that health spending, whether public or private, improves life expectancy and lowers the death rate.<sup>20,21</sup>

**Table 4. Autoregressive distributed lag co-integrating and Long Run Form.**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(PHE_GDP)	-0.011894	0.002986	-3.982752	0.0018
D(PRHE_GDP)	-0.005921	0.001492	-3.967600	0.0019
D(CHE_GDP)	-0.020734	0.009437	-2.197056	0.0484
D(RHE_GDP)	-0.005451	0.007470	-0.729773	0.4795
DLOG(RGDP)	-0.042244	0.017370	-2.432058	0.0316
CointEq(-1)	0.009614	0.002474	3.886713	0.0022

$$\text{Cointeq} = \text{LOG}(\text{MR}) - (1.7662 \cdot \text{PHE\_GDP} + 0.6158 \cdot \text{PRHE\_GDP} - 3.9365 \cdot \text{CHE\_GDP} + 2.1215 \cdot \text{RHE\_GDP} + 0.2782 \cdot \text{LOG}(\text{RGDP}))$$

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PHE_GDP	1.766196	0.653871	2.701137	0.0193
PRHE_GDP	0.615810	0.270188	2.279187	0.0417
CHE_GDP	-3.936549	1.982134	-1.986016	0.0704
RHE_GDP	2.121472	1.309520	1.620038	0.1312
LOG(RGDP)	-0.278231	0.100558	-2.766877	0.0171

Source: Author's Computation 2020, underlying data from World Bank, World Development Indicator Database, Central Bank of Nigeria statistical Bulletin and Central Bank of Nigeria annual report. \*, \*\* and \*\*\* imply statistical significance at 1%, 5% and 10% levels respectively. R-squared = 0.999, Adjusted R-squared = 0.999, F-statistic = 16333.51, Prob. (F-statistic) = 0.000 Durbin-Watson.

**Table 5. Autoregressive distributed lag co-integrating and Long Run Form.**

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(PHE_GDP)	-0.000814	0.001499	-0.542836	0.5972
D(PRHE_GDP)	0.002207	0.000629	3.510591	0.0043
D(CHE_GDP)	0.008619	0.004542	1.897726	0.0820
D(RHE_GDP)	0.001267	0.003101	0.408518	0.6901
DLOG(RGDP)	0.024055	0.004201	5.726039	0.0001
CointEq(-1)	-0.162585	0.029067	-5.593393	0.0001

$$\text{Cointeq} = \text{LOG}(\text{LEB}) - (0.0056 \cdot \text{PHE\_GDP} + 0.0242 \cdot \text{PRHE\_GDP} + 0.0530 \cdot \text{CHE\_GDP} + 0.0477 \cdot \text{RHE\_GDP} + 0.1480 \cdot \text{LOG}(\text{RGDP}) + 2.2771)$$

Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
PHE_GDP	0.005648	0.011715	0.482106	0.6384
PRHE_GDP	0.024231	0.006224	3.893406	0.0021
CHE_GDP	0.053010	0.024934	2.126065	0.0549
RHE_GDP	0.047695	0.029799	1.600572	0.1355
LOG(RGDP)	0.147954	0.005520	26.804050	0.0000
C	2.277085	0.052691	43.215696	0.0000

Source: Author's Computation 2020, underlying data from World Bank, World Development Indicator Database, Central Bank of Nigeria statistical Bulletin and Central Bank of Nigeria annual report. \*, \*\* and \*\*\* imply statistical significance at 1%, 5% and 10% levels respectively. Note: R-squared = 0.999, Adjusted R-squared = 0.999, F-statistic = 10574.95, Prob. (F-statistic) = 0.000 Durbin-Watson stat = 1.612.

## Conclusions and recommendations

This study investigates the responses of health outcome indicators to changes in government spending on health in Nigeria. An important observation is that increased government funding to the health sector contributes to improved health outcomes and the general welfare of the people. In particular, our findings show that rising government health-sector spending has resulted in a decrease in infant mortality rates and an increase in longevity in Nigeria. Moreover, the study emphasizes that as health expenditure to GDP rises, the mortality rate declines. A percentage of health expenditure to GDP increases and life expectancy also increases. Specifically, increasing public, private, and capital health expenditure reduces the death rate. Also, a rise in economic growth reduced the death rate. Likewise, life expectancy at birth would improve with the increase in capital and private health expenditures and economic growth. Increased health spending would improve healthcare delivery and boost productivity, leading to output growth. According to the WHO (2021), countries worldwide have increased health spending and the importance of public health expenditure has increased, although there are still enormous disparities across country income groups. From the findings and conclusion of this study, the Nigerian government should also step up and reallocate more resources to the health sector to reduce the mortality rate and increase life expectancy at birth. Government should also partner with the private sector in the form of public-private partnerships, which is a common health financing method in developed countries. A step in this direction would aid the government to mobilize funds and allow the participation of the private sector in health financing, it would also allow for more efficient use of public funds for health, improve health care services and health outcomes.

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