PUBLIC HEALTH EXPENDITURE AND LIFE EXPECTANCY IN NIGERIA

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ABSTRACT
This study examined the impact of public health expenditure on life expectancy in Nigeria. Data was sourced from CBN and World Bank Development Index for the period of 1985-2022. The study used Descriptive Statistics, ARDL model and Granger causality test for data analysis. The study found a long-run relationship between public health expenditure and life expectancy in Nigeria. The findings also revealed that there is non-causal relationship between public health expenditure and life expectancy in Nigeria. The study recommends that Nigerian government should intensify efforts in ensuring the increase of public health expenditure based on the 2001 Abuja declaration standard of 15% of the annual national budget in other to enhance health conditions of her citizens, ensure efficient allocation of resources to targeted public health sector, focusing on preventive measures, disease control, and health education.
Key words: Life expectancy, under-five mortality, public health expenditure
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1. INTRODUCTION
Life expectancy is a vital determining factor of a country's healthcare performance and quality of human capital development. This is because, increase public spending on healthcare services will improve health care service delivery and individual health levels. On the other hand, better health level can also increase production level and advancement in macroeconomic variables performance. Edeme, Emecheta and Omeje (2017) and Lawal, Opeloyeru and Omulanle (2023) confirmed that improved health conditions resulting from government healthcare spending have the potential to increasing economic growth be it developing or developed countries by improving life expectancy rate, since excellent health enable productive work participation. This implies that the share of budgetary allocation to health sector of any country is an important determinant to the country's level of life expectancy and social wellbeing. As reported by Effiong and Bassey (2020) that sufficient expenditure on health infrastructure is crucial to improving quality of life. The availability of healthcare amenities alongside other infrastructure is not only important, but to a large extent, people's socioeconomic status is a product of healthcare institutional quality and the rate of its infrastructural maintenance.
The major issue of concern is that, while these life expectancy rates are higher in some part of the world signifying high quality of life and workforce, they are unacceptably low in some continents. For instance, Life expectancy rate in Europe and Oceania are 81 years for females, while 76 and 75 years for men respectively. On the other hand, the rates for Africa are 65 years for female and 61 years for males. In respect to country level, Nigeria life expectancy rate Averaged 53 years for both sexes compared to Japan and Norway with the average of 84 years and 83 years respectively (World Health Organization, 2023). This reveals the poor health levels in the country through life expectancy rate, which could result from poor health

infrastructure, health care delivery and individual health levels. The Nigeria Health Sector Market Study Report [HSMSR] (2022), confirmed that Nigeria health sector is grossly underdeveloped with higher number of its infrastructure concentrating in the urban areas characterized by inability to meets local need. The report added that the epidemiological profile is propelled by parasitic and infectious diseases that are preventable and treatable. This is an indication that with quality health care provision, these drivers of low life expectancy rate can be combated.

Despite government continuous campaign of providing quality care for Nigerian citizens, spending on the health sector has not seen to significantly improve over the years. For instance, healthcare expenditure in relation to Gross Domestic Product (GDP), was averaged at 4% between 2000 to 2020 with the exception of 5% in 2003 (HSMSR, 2022). In figures, the total budgetary allocation on health was N547 billion, N826.9 billion and N1.17 trillion in 2021, 2022 and 2023 respectively, the highest figure for 2023 was 5.3% of the total budget which is far below the 15% objective of the African Unions (UNICEF, 2023). The question of concern is whether there is a significant association between government's health expenditure and life expectancy rate in Nigeria so that increase health care spending leads to increase life expectation rate. Several papers examine the association between health level indicators and government health expenditure including life expectancy rate of which different results were reported as discussed in section 2.0 below. This paper therefore, studied the extent to which governments health expenditure influence life expectancy rate in Nigeria with modification to years of study and models of analysis to ascertain the extend of the relationship. This study addressed two major objectives: the relationship between government expenditure on health and life expectancy rate in Nigeria, and to investigate the causal link between the two variables to allow for clear policy direction. This paper is structure into five sections which include: Introduction, literature review, methodology, results and discussion of findings and Conclusion.

2. LITERATURE REVIEW

2.1 Theoretical Literature

2.1.1 Grossman Theory of Health Demand

The theory of health demand was propounded by Michael Grossman in 1972. The major assumption of the theory is that, health is viewed both as consumption and investment commodity. The theory also asserted that there is a trade-off between current consumption and investment in health. Therefore, individuals can influence the production of their health by investing in medical services and health promoting activities. This means that time spend in good health can be produce, using inputs or resources such as time and money spend on medical services. Health is hereby considered as a form of capital such as physical and human capital. The theory of health demand is summarized in the model below:

$$H = F(X) \quad (2.1)$$

Where H indicate the level of individual health output while, X represent a vector of inputs termed individual input used to produce health. The function F comprise of factors such as time devoted to health related procedures, nutrient intake, consumption of public goods, income, and medical services. This theory will serve as basis and is modified to fit the model of analysis used in this study.

2.1.2 Wagner's Law of Increasing State Activity

According to Wagner's law, there is a causal link between an economy's growth and the expansion of government activities. Wagner's law, which was first developed in 1917, states that a nation's public spending should increase in tandem with its economic growth. The idea went on to say that an economy's relative size of the public sector will increase in tandem with growth in per capita income. Wagner (1917) further assumes that increase in per capita income will lead to increase healthcare demand. In another way, as income rises the government ability including other stakeholders to provide quality healthcare services will also increase. Therefore, an increase in government health care expenditure should lead to increase in life expectancy rate of the same economy, thus improving the health outcome of the citizens. Thus, this theory contributes to the explanation of the association between life expectancy rate and government health spending.

2.2 Empirical Review

Various studies have looked into the association between public health spending and health indices, particularly life expectancy. This has expanded understanding of the topic and sparked additional discussion regarding the factors affecting Nigeria's life expectancy rate. Some of the empirical studies that examine the relationship between life expectancy rate and public health spending are reviewed below.

Bankole, Ajayi and Oladapo (2021) studied the association between health expenditure and life expectancy in Nigeria from 1986 to 2016. They used autoregressive distributed lag technique (ARDL) as method of analysis and discovered that total health expenditure which include capital and recurrent expenditure, significantly influence life expectancy rate in both the short and long run. The study recommended that to improve the rate of life expectancy in Nigeria, government should be deliberate in increasing the rate of its expenditure on health care.

On the other hand, Musa (2021) also examine the relationship between government spending and life expectancy rate in Nigeria. The study reported a positive effect of capital health expenditure on life expectancy, and found positive but insignificant effect of health capital recurrent expenditure on life expectancy rate in Nigeria. Adeoti, Adeoti and Adeoye (2020) also investigated similar topic and method of regression analysis, but reported positive and significant impact of capital healthcare expenditure on life expectancy rate, on the contrary, reported a negative and significant association between recurrent expenditure and life expectancy rate. The study also added a variable out of pocket health spending which was found to positively influence life expectancy in Nigeria.

Some studies also investigated the association between government spending and other health indices. For example, Amponsah (2019) examined the fundamental macroeconomic and social factors that influence health spending as well as how these factors affect some important health outcomes in Sub-Saharan Africa (SSA): life expectancy, maternal mortality and children under five mortality. The study used panel data to investigate the stated goal, and the findings indicated that SSA health outcomes tend to improve with a steady increase in health spending over time.

Akintunde and Olaniran (2022) investigated the relationship between financial developments, government spending on health and health indicators in Nigeria. Data from CBN statistical bulletin and World Bank were analyzed using ARDL method of estimation and reported negative association between government spending on health and life expectancy rate in the short run, while positive association were established in the long run. The study explained that, the intuition behind a negative association in the short run may result from the fact that

investment in health is a long run mechanism that might not yield positive result in a short term. The finding is in agreement with the result of Omotayo and Kelechi (2023) and Ifunanyachukwu and Dauda (2019) the authors reported long-term effectiveness of health expenditure in promoting per capita income growth. Consequently, they recommended that the Nigerian government budget structure meets the United Nations' mandated allocation for health expenditures in its annual budget.

Adejoh, Adofu and Salami (2023) studied comparative analysis of public health expenditure and post-natal mortality in some selected South African Countries. Using Poison regression model reported that public health financing significantly reduced neonatal mortality. This finding is similar to the result of Eboh et al (2018) who examine the relationship between child mortality and government health expenditure in Nigeria. The paper employ the ex-post facto research design while, Ordinary Least Squares (OLS) technique was used to analyzed time series data for the period of 1994 to 2017. The result shows a strong and negative association between HRE, HCE and child Mortality Rate (IMR) in Nigeria. These findings also supported the result of Ogunjimi and Adedeji (2018)

Lawan, Opeloyeru and Adegbola (2023) examine the association between life expectancy, government health expenditure and economic growth in Nigeria. The result of the ARDL used as estimation technique reported a positive association between life expectancy rate and government health expenditure. On the other hand, a negative relationship was established between life expectancy and economic growth. Edeme, Emecheta and Omeje (2017) investigated the impact of government health spending on health indicators in Nigeria over the period of 1981 to 2014. Using ordinary least squares estimation technique, the findings indicate that spending more on public health increases life expectancy and lowers infant mortality rates. Furthermore, per capita income has no effect on health outcomes, but urban population and HIV prevalence rate have a major impact in Nigeria. The results imply that spending on public health is still essential to enhancing health outcomes in Nigeria. The findings of Eneji, Dickson, and Onabe (2013) and Ibrahim and Ditep (2022) also agrees to the previous result. They reported a positive relationship between government health spending, health status, and economic development. This shows that individual health levels are prerequisite to the economic growth and development of a nation.

Bashir (2016) employed Pearson Product Moment Correlation to examine the effect of government health spending on health outcomes in Nigeria. According to the study, government spending in Nigeria has a positive effect on life expectancy but a negative relationship with infant mortality rate. The study therefore concludes that Nigeria's infant mortality rate was considerably lowered with increase in government spending during the period of the study. This study agrees to the findings of Taofik and Ditep (2022) who studied the effect of government spending on health and health indicators in Nigeria employing Error Correction Mechanism and reported a positive association between life expectancy rate and child mortality rate in Nigeria, both in the short and the long run period.

3. METHODOLOGY

This paper employed time series data between the period of 1985-2022 to analyze the relationship between life expectancy rate, government health care spending, GDP (per capita), under5 mortality rate and literacy rate in Nigeria. This data was collected from World development indicators, as well as from Central Bank of Nigeria (CBN).

3.1 Model Specification

The model specification for this research work is tailored after the Grossman theory of health demand. The model of the theory is specified as

$$H = F(X) - (3.1)$$

Where H is an indicator of individual health level (output) and X is a vector comprising individual factors which are used as input in health production function F. X as a vector contains variables such as individual income, educational level, nutrient intake, time devoted to health improving activities, consumption of public goods, initial individual endowment (genetic make-up) and medical services. Oluwatoyin, Folasade and Fagbeminiyi (2015) summarized and modified Grossman model, by rearranging the factors of X which are represented by per capita income variables into sub-sectoral vectors of economic, environmental and social factors as:

$$H = F(Y, S, V) \quad (3.2)$$

where Y is a vector containing per capita economic variables, S is a vector of per capita social variables and V is a vector of per capita environmental factors.

In line with the objectives of this study, vector of per capital environmental factor is excluded from the model. The research work was modified into a model that includes variables aim to provide a robust analysis of the subject matter in Nigeria. The model specification is as follows:

$$LER = f(HEXP, GDP, U5M, LR) \quad (3.3)$$

$HEXP$, $U5M$ and LR are desegregated from the vector of per capita social variable which represent health expenditure, under-five mortality rate and life expectancy rates respectively. GDP is a proxy for vector of per capita economic variable,

The mathematical form of this model is represented as

$$LER_t = \beta_0 + \beta_1 HEXP_t + \beta_2 GDP_t - \beta_3 U5M_t + \beta_4 LR_t \quad (3.4)$$

Therefore, the explicit model is as follows:

$$LER_t = \beta_0 + \beta_1 HEXP_t + \beta_2 GDP_t - \beta_3 U5M_t + \beta_4 LR + \varepsilon_t \quad (3.5)$$

Where:

LER = Life Expectancy Rate
$HEXP$ = Public Health Expenditure
β_0 = Constant
GDP = Gross Domestic Product (per capita)
$U5M$ = Under5 Mortality Rate
LR = Literacy Rate
$\beta 1, \beta 2, \beta_3 \beta_1$, are parameter estimates and ε_t = Error term

3.2 Method of Analysis

Method of analysis used include descriptive statistics to show the raw distribution of the data, stationarity level of the series were tested through unit root test, co-integration analysis was used to check if the data are cointegrated to affirm the possibility of a long term relationship. The main method of analysis is the ARDL model which is used in determining the relationship between variables in the study testing both short term and long run relationship with different order of integration. Granger causality was also employed to test the causal link between life expectancy rate and government healthcare expenditure in order to have a guide in making recommendations in respect to the findings. To ascertain whether the regression's error term is normally distributed, a normality test was performed. This assumption is checked using the Jacque-Bera test. If it is confirmed that the data is taken from a normally distributed population, then the variables are said to be normally distributed.

4. RESULTS AND DISCUSSION OF FINDINGS

4.1 Descriptive Statistics

Table 4.1: Descriptive Statistics

	LER	LOGHEXP	GDP	U5M	LR
Mean	48.72000	4.407626	4.234610	166.1054	33.24942
Median	48.44100	4.961865	4.230061	165.8000	31.52674
Maximum	52.91000	6.879736	15.32916	209.6000	54.88297
Minimum	45.48700	0.887891	-2.035120	110.8000	23.34280
Std. Dev.	2.752617	2.012124	3.861565	36.01536	9.355956
Skewness	0.187341	-0.490233	0.458959	-0.058752	0.499707
Kurtosis	1.402805	1.893509	3.397275	1.389690	1.880077
Jarque-Bera	4.149269	3.369522	1.542282	4.018980	3.473463
Probability	0.125602	0.185489	0.462485	0.134057	0.176095
Sum	1802.640	163.0821	156.6806	6145.900	1230.229
Sum Sq. Dev.	272.7685	145.7512	536.8207	46695.82	3151.221
Observations	37	37	37	37	37

Source: Authors' computation using E views 10.

Table 4.1 presents descriptive statistics of series employed in the study. The mean value tells us the average value for each of the variables. The values indicated that while, GDP had the lowest mean value of 4.41%, under five mortality had the highest mean value of 166.11%.

The median tells us the middle value for each of the variables, On the other hand, values of maximum and minimum indicated that the change ranges from lower to higher values for the variables. Meaning the variables values have been on the increase over the duration of the study. All the variables have a normal distribution because their respective skewness values are approximately zero (0) with the exception of LOGHEXP and U5M which are negatively skewed. The Jarque-Bera (JB) probability values are not statistically significant, implying that the series are normally distributed.

4.2 Unit Root Test

Unit root test was carried out in order to check if the series are stationary.

Table 4.2 ADF Unit Root Results

Variables	At Level (5%)		1st Difference (5%)		Order of integration	
	ADF Stat.	Critical V.	ADF Stat.	Critical V		
LER	1.5655020	-2.945842	-4.037935		-2.954021	I(1)
LOGHEXP	-2.368677	-2.945842	-4.429025	-2.948404	I(1)	
GDP	-4.102128	-2.943427			I(0)	
U5M	-3.876267	-2.960411			I(0)	
LR	-0.523655	-2.9453427	-6.957245	-2.945842	I(1)	

Source: Authors' computation using E views 10.

ADF unit root test results in Table 4.2 indicated that GDP and U5M are stationary at level, but LER, LOGHEXP, and LR were stationary at first difference. But to achieve this, the ADF test statistics were compared to the corresponding critical values at the 5% level of significance. The variables' integration order indicates that they are mixed series [order I(0) and I(1)], suggesting that there might be both short and long term relationships between the variables. Furthermore, as the results indicate that two variables are stationary at level and others are stationary at first difference, the ADF statistics supported the Auto Regressive Distributed Lag (ARDL) approach.

4.3 ARDL: Co-integration Test

The co-integration test is estimated in order to check for the possibility of a long-run relationship between the variables of interest. The result of the F Bounds Test are presented in table 4.3 below.

Table 4.3: ARDL F-Bounds Test

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	77.36380	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source: Authors' computation using E views 10.

The F-Statistics shows a value of 77.36 which is higher than critical value of 3.49 presented by the upper bound at 5% level of significance. Therefore, the study reject the Ho (null hypothesis) and then conclude that there exist a co-integrating equation and hence a long run relationship.

4.4 ARDL Results

This study used Auto Regressive Distributed Lag (ARDL) Model to analyze the link between Nigerian government health expenditure and life expectancy rate.

Table 4.4: ARDL Result Dependent Variable: LER

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Long-Run Estimates				
C	34.96580	10.62147	3.291992	0.0302
LER(-1)	-0.883016	0.153584	-5.749396	0.0045
LOGHEXP	3.146260	0.675278	4.659208	0.0096
GDP	0.207247	0.031397	6.600775	0.0027
U5M	-0.032376	0.025698	1.259865	0.2762
LR	0.216932	0.043048	-5.039306	0.0073
Short-Run Estimates				
D(LOHEXP)	0.132711	0.033714	3.936387	0.0170
D(GDP)	0.019077	0.001912	9.977385	0.0006
D(U5M)	-0.792654	0.011569	-68.51750	0.0000
D(LR)	0.032525	0.002195	14.81801	0.0001
CointEq(-1)*	-0.883016	0.027323	-32.31735	0.0000
R-squared	0.999518		F-statistic	6801.951
Adjusted R-squared	0.998287		Prob(F-statistic)	0.000000
Durbin-Watson stat	2.348807			

Source: Authors' computation using E views 10.

Table 4.4 shows that the coefficient of constant C is 34.97, which implies that holding all the independent variables constant LER will increase by 34.96%, with a probability value of 0.0302.

The coefficient of life expectancy rate (LER) in the first lagged period is negative. The value is 0.88. In addition, LER is significant at 5% with a 0.0045 value of probability. This implies that life expectancy rate in the previous year affects life expectancy rate in the current period negatively in Nigeria.

The coefficient on LOGHEXP, indicate that 1% increase in public health spending led to an increase of 0.13% of LER in the short term period. The probability value confirm that the association is significant at 5%. On the other hand, 1% increase in public health spending is associated with a rise of 3.15% of LER in the long run which is also significant at 5%. This suggests that spending on public health raises Nigeria's life expectancy rate.

For GDP, a 1% rise in gross domestic product per capita is linked to an increase of 0.02% of LER in the short run. While, its probability value is significant at 5%. The estimation of the long time period shows a 1% increase in gross domestic product per capita is linked with an increase of 0.21% of LER, also significant at 5%. This implies that gross domestic product per capita improves life expectancy rate in Nigeria.

The short run result also reported that a 1% rise in under-5 mortality rate is linked to a 0.79% drop in LER, significant at 5%. The ARDL result also shows that a 1% rise in under five mortality is associated with a 0.03% drop in LER in the long run. On the contrary the relationship is not significant at 5% level. This suggests that Nigeria's life expectancy rate is not greatly impacted by under-five mortality rate.

For LR, in the short-run, a 1% increase in literacy rate led to an increase of 0.03% of LER. The probability value is significant at 5%, implying a strong association. On the other hand, the long-run result shows that a 1% increase in literacy rate is linked with an increase of 0.22% of LER also significant at 5%. This implies that literacy rate significantly impact life expectancy rate in Nigeria.

The value of CointEq(-1) which represent Error Correction Term (ECT) was estimated to be -0.88 implying that the ECT previous periods deviation from long term equilibrium is adjusted at the speed of 88% within a year. This is because the value of CointEq(-1) must be between -1 and 0 to validate this result.

R-Square (R2) tells us the efficacy or capacity or efficiency of the explanatory variables to account for the changes that occur in the explained variable. A high valued R2 is usually appreciated as it gives a higher percentage of acceptability. Thus, the variations or changes that occur in the dependent variables can be explained accurately at a 99.95%.

The adjusted R-square perform the same task as the R2. In most instances it is used as a check on the trust worthiness of the R2. R2 0.998287

(Prob) F statistics value significant at 5% level was reported as 0.000000. This is typically used as a rough guideline to determine the overall significance in estimating the relationship of variables within the model (the model's goodness of fit). The probability value of 0.000000 is below 5% significance level indicating a good fit between the variables in the model.

The Durbin Watson usually is used to check for auto correlation in the model. A model becomes questionable if it has a Durbin Watson value that is less or higher than 2, and is not approaching 2 in closeness or proximity. This might lead to spurious regression and the results of the regression failing to explain the elasticity's of the variables involved in the study. The Durbin Watson of this study is 2.348807, thus our model is free from serial correlation.

4.1.5 Pair wise Granger Causality Test

Table 4.5 below shows the estimated result of the Granger causality test.

Table 4.5: Pair wise Granger Causality Test Result

Null Hypothesis:	Obs	F-Statistic	Prob.
LOGHEXP does not Granger Cause LER	36	1.34982	0.2741
LER does not Granger Cause LOGHEXP		0.34558	0.7105
GDP does not Granger Cause LER	36	1.21119	0.3115
LER does not Granger Cause GDP		1.44654	0.2508
U5M does not Granger Cause LER	36	5.06293	0.0125
LER does not Granger Cause U5M		2.15263	0.1332
LR does not Granger Cause LER	36	0.31365	0.7331
LER does not Granger Cause LR		5.33125	0.0102

Source: Authors' computation using E views 10.

The decision rule for estimating granger causality test stated that the null (H_O) hypothesis of no causal relationship between variables be rejected if the F-stat value is below 5%.

The first panel in the table 4.6 shows that there is no causal relationship between LOGHEXP and LER. Seeing that LOGHEXP has a probability value of 0.2741 which is not significant at 5% level while that of LER is 0.7105 also not significant at 5% (0.05). Therefore, we do not reject the H_O but confirm that there is no directional causal association linking LOGHEXP and LER in Nigeria.

5. CONCLUSION AND POLICY RECOMMENDATIONS

The study examine the impact of public health spending on life expectancy rate in Nigeria. With the aim of revealing the true nature of the effect between the variables involved. The estimate of the Auto-regressive Distributed Lag (ARDL) technique was used. The result reveals that the coefficient of LOGHEXP in the short and long term are positive. This implies that the impact of government health spending in Nigeria is significant to causing significant changes in life expectancy rate in the country. Agreeing to the fact that increased public health spending often leads to improved access to healthcare services. This includes preventive measures, vaccinations, and regular health check-ups, which contribute to early detection and treatment of diseases, ultimately enhancing life expectancy. These findings are in line with the reports of Bankole, Ajayi and Oladapo (2021) that health expenditure positively impacts life expectancy rate both in the short and long term. Other important variables that influence life expectancy rate includes: GDP and literacy rate which confirms to the finding of Musa (2021). This study therefore recommend that: Government should work out modalities to increase budget allocation to health sector of the economy, govern should also collaborate with health

organizations to sponsor policies targeted toward preventive health, disease control and healthcare education, policies that foster economic growth should be prioritize by government to increase per capita income which enable access to quality care.

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