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Life Expectancy, Public Health Spending and Economic Growth in Nigeria

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Abstract: The paper examines the link between life expectancy, public health spending and economic development in Nigeria for the period 1995 to 2017. Data used were life expectancy at birth, public health expenditure and the gross domestic product (GDP) sourced from the World Bank data. Situational analysis, Ordinary Least Square and the granger causality test techniques were employed. The situational analysis showed that the trend of GDP and expectancy were upward while health expenditure had an irregular trend. The OLS result showed that both government spending on health and life expectancy impacted positively and significant on GDP. The granger causality result showed a unidirectional relationship between life expectancy and GDP as causality runs from GDP to life expectancy. Bidirectional relationship exists between life expectancy and health care spending while there was no causality between health expenditure and GDP. The study therefore recommends that government should increase spending on health so as to improve the health status of individuals in terms of their life expectancy. This will in turn lead to an increase in productivity and help increase the country's national income so as to prepare the nation for the attainment of sustainable development, come 2030.

Keywords: Life Expectancy, Health Care Spending, Economic Development, Government, Granger Causality Test

1. Introduction

One of the most appealing topics in public health is the connection between life expectancy, health care expenditure and annual GDP rate. Health, a nation's first wealth, greatly enhances a nation's economic development and vice versa. Therefore, health systems goals include efficiency, effectiveness, equity, and quality. To achieve this relies on a nation's health policy, spending on health, national income, and access to health facilities. The World Health Organization (WHO) ranks Nigeria 187th out of the 191 member countries based on its results in the health system. Some literature blamed this achievement on health expenditure, prices and incomes, while others believe that some low-income countries have improved health results based on political will [1-3].

An average Nigerian is anticipated to live for about 55.2 years from birth, according to the World Health Organization. This figure is significantly below the global average of 72 years and Africa's average of 61.2 years target of the SDGs cumulating in Nigeria being ranked 6th lowest in the world. It is also observed that the budget distribution of the country to the health industry is exceptionally small at a rate of $4.7 per capita compared to more than $1,000 per individual in high life expectancy nations. An elevated incidence of ailments such as influenza, pneumonia, tuberculosis, diarrhoea, stroke, HIV / AIDS incidence and coronary heart illness has been ascribed to bad health spending results and low life expectancy. Nigeria records the largest amount of tuberculosis fatalities in the globe and ranks fourth highest in terms of diarrhoea however, Nigeria's health spending pattern continues substantially small. For example, 4.6% of GDP was spent on health care in 1997. In 2005, the figure grew to 6.6% and subsequently dropped to 5.8 in 2009. The complete 1997, 2005 and 2009 spending amounted to 134,522, 972,921, 1,596,573 (in a million naira), respectively. The figure is an indication of the nation's bad engagement during these periods to enhanced health care and deliveries [4]

In addition, the Federal Government allocated N304

billion to the health of over 180 million Nigerians in the 2017 budget, amounting to N1.688 per citizen throughout the year, while the Government allocated N340.45 billion to the health sector in 2018, representing 3.9 per cent of N8.6 trillion spending plans. The distribution in the budgets for 2017 and 2016 is less than the 4.16% and 4.23% produced by the administration to the health industry. These numbers indicate that the Nigerian government is not allocating sufficient resources for health interventions because their priority is not regarded. No wonder Nigeria is still finding alternatives to most of the country's health challenges, such as the ongoing outbreaks of Lassa fever, elevated maternal and infant fatalities, bad main health equipment, absence of functioning radiotherapy devices, HIV prevalence, malnutrition, bad response to health emergencies, etc. [5, 6]

In terms of the impact of health spending on economic growth and life expectancy on economic development, there are conflicting outcomes. For instance, a positive relationship between health spending and economic growth was found in some research [7-9]. Others found a negative effect [10-12]. There are also conflicting outcomes in the literature in terms of causality, whereas some have discovered bidirectional causality between health spending and economic growth [13, 11]. Others observed that causality was unidirectional [14-16] and some no causality exists between both [17, 18]. Some studies also found in the literature a positive relationship between life expectancy and economic growth in the area of life expectancy and economic growth [19, 2, 20] while Hansen and Lonstrup found a negative effect [21]. There are also conflicting outcomes on the grounds of causality in the literature- while some discovered bidirectional causality between life expectancy and economic growth [22] others discovered unidirectional causality [23-25] and some report that there is no direction of causality between the two [26].

There is divergence in the impact of health spending on economic growth and development from the empirical evidence above. In both advanced, emerging and advanced countries, there is also a divergence in outcomes between life expectancy and economic growth and development. These studies also indicate divergence in outcomes of causality direction between spending on health and economic growth as well as life expectancy and economic growth. All these opinions of divergence placed policymakers at a crossroads and raise a multitude of questions as to what impact does life expectancy and public health spending have on economic growth and what is the direction of causality between life expectancy, health spending and economic growth in Nigeria? The aim of this paper is therefore to determine the impact of life expectancy and health expenditure on the economic growth of Nigeria and also to study the direction of causality among the variables.

The rest of the research is organized as follows: the literature review and the theoretical framework are presented in section two. The study's methodology is discussed in section three. Data analysis and outcome interpretation are the primary thrust of chapter four, while section five outlines policy implications, conclusions and suggestions.

2. Literature Review

Studying the connection between expenditure on health care and economic growth is a rather fresh phenomenon in economic literature; in recent times it has gained much attention. Health as human capital directly impacts growth, its effects on labor productivity and economic development [27]. Yaqub, Ojapinwa and Yusuff examine the effect of governance on public health spending and health results in Nigeria using the ordinary least square and the two-stage methodology. Their results show that when government indicators are included, spending on public health has an adverse impact on infant mortality and under-5 mortality [12]. Ogungbenle, Olawumi and Obasuyi use a vector-autogressive (VAR) model strategy to examine life expectancy, government health spending and economic growth in Nigeria [13]. Their research shows that between public health spending and life expectancy, and also between economic growth and life expectancy, there is no bidirectional causality. They reported, however, that there is a bidirectional causality between public health spending and Nigeria's economic growth. Between 1975–2013, Taskaya and Demirkiran explored health care resources and expenditure on health care in Turkey using a larger technique of testing causality. Their results indicate a one-way connection between GDP and expenditure on health as causality ranges from GDP to expenditure on health and not vice versa. The same outcome was discovered between spending on health and number of doctors as causality ranges from spending on health to number of doctors. There was no causality in their research, however, between health expenditure and amount of hospital beds [28].

Furthermore, between 1999 and 2012 in Nigeria, Mathais, Dickspom and Bisong examined health care spending, health status and domestic productivity. They concluded that there is a weak causal impact between the status of health care and economic development and that features of health determine the nature and direction of sustainable human development [29]. In the same vein, Nwanosike, Orji, Okafor, and Umesiobi, use descriptive assessment and General Method of Moments (GMM) testing methods to examine health care spending and economic growth in Nigeria [30]. They discovered a beneficial connection between spending on health care and economic growth. Bakare and Sanmi also look at spending on health care and economic growth using multiple regression of the Ordinary Least Square. Their outcome demonstrates a favorable and substantial connection between Nigeria's spending on health care and economic growth [31].

Moreover, Onisanwa used granger causality testing methods to investigate the effect of health on economic growth from 1999 to 2009. A long-term connection between health spending and economic growth was

discovered in the research. However, causality runs from health expenditure to economic growth and not vice versa, there is a unidirectional causality between both [7]. Similarly, in developing nations from 1995 to 2013, Bedir, using Toda Yamamoto granger causality test, discovered a bidirectional causality between health spending and economic growth in the Czech Republic and the Russian Federation. Causality, however, ranges from health spending to economic growth in Egypt, Hungary, the Korean Republic, South Africa, and the Philippines, while causality ranges from economic growth to health spending in Greece, Poland, the United Arab Emirates, China, Indonesia, and the Korean Republic [32]. Maduka, Chekwube and Chukwunonso used Toda and Yamamoto (TY) causality study to examine Nigeria's healthcare spending, health outcomes, and economic growth nexus between 1970 and 2013. The TY causality test disclosed that government spending on health does not directly affect economic growth, but indirectly through health results such as mortality and life expectancy [8].

3. Model and Data

There were two objectives in this study, the first was to test the impact on economic development of health expenditure and life expectancy, and the second was to test the direction of causality between capital expenditure on health, recurrent expenditure on health, and economic growth. This study follows after Ercelik model with a slight change. In order to attain the study's first objective; the regression model takes shape [9]:

$$GDP_t = f(HT_t, LE_t) \quad (1)$$

Where:
GDP = Gross Domestic Product
HE = Public Health Expenditure
LE = Life Expectancy
The model is then specified in an econometric form as

$$GDP_t = \gamma_0 + \gamma_1 HE_t + \gamma_2 LE_t + \varepsilon_t \quad (2)$$

Equation 2 is transformed into a logarithm form

$$InGDP_t = \gamma_0 + \gamma_1 InHE_t + \gamma_2 InLE_t + \varepsilon_t \quad (3)$$

$$\gamma_1 > 0, \gamma_2 > 0$$

To achieve the second objective, the Granger causality test was employed and the model takes the form:

$$GDP_t = \alpha_0 + \sum_{i=1}^{k} \alpha_1 LE_{t-i} + \sum_{i=1}^{k} \alpha_2 HE_{t-i} + \sum_{i=1}^{k} \beta_1 GDP_{t-i} + \varepsilon_{1t} \quad (4)$$

$$LE_t = \alpha_0 + \sum_{i=1}^{k} \alpha_1 HE_{t-i} + \sum_{i=1}^{k} \alpha_2 GDP_{t-i} + \sum_{i=1}^{k} \beta_1 LE_{t-i} + \varepsilon_{2t} \quad (5)$$

$$HE_t = \alpha_0 + \sum_{i=1}^{k} \alpha_1 GDP_{t-i} + \sum_{i=1}^{k} \alpha_2 LE_{t-i} + \sum_{i=1}^{k} \beta_1 HE_{t-i} + \varepsilon_{3t} \quad (6)$$

Where, it is assumed that ε_{1t}, ε_{2t} and ε_{3t} are uncorrelated. In the above specification, according to Granger, X is said to Granger-cause Y if βi is not equal to zero and Y will also Granger-cause X if δi is not equal to zero [33]. If these two situations simultaneously exist, then there is bi-directional causality between X and Y. As pointed out by Gujarati, a causality test is sensitive to model specification and the number of lags such that it would reveal different results if a variable was relevant and was not included in the model [44]. Second, economic time series are often non-stationary and thus prone to spurious regression. Gujarati also pointed out that when the variables are integrated, the F-test procedure is not valid as the test statistics do not have a standard normal distribution. In order to deal with the problem of spurious regression arising from non – stationarity of data, the Augmented Dickey Fuller unit root test was employed.

Data requirements, Source and Estimation Techniques.

The data used for the study are the gross domestic product (GDP) at constant price, life expectancy at birth and the public health expenditure for the period 1995 to 2017. The data were sourced from the World Bank data. In order to estimate the model specified above, multiple regression was used to estimate equation 3 in order to achieve the first objective of the paper while the granger causality test was used to estimate equations 4 to 6.

4. Results and Discussions

Table 1. *Summary Statistics of the Variables Used.*

	GDP	HE	LE
Mean	244784.8	3.534762	48.90423
Median	212988.6	3.560000	48.52400
Maximum	601925.0	4.470000	53.42800
Minimum	28702.83	2.430000	45.85200
Std. Dev.	194700.4	0.552979	2.642704
Skewness	0.457485	-0.158688	0.295984
Kurtosis	1.761751	2.246783	1.621875
Jarque-Bera	2.271665	0.584555	2.062185
Probability	0.321155	0.746561	0.356617
Sum	5630051.	74.23000	1075.893
Sum Sq. Dev.	8.34E+11	6.115724	146.6616
Observations	23	23	23

Source: Author's computation 2019

The summary statistics presented in Table 1 shows that the average public health spending during the period of analysis is 3.53 percent of the overall income in the economy while the maximum during that period is 4.47 and the minimum is 2.50. The mean Life expectancy is 48.5 years on the average during the period of analysis. The average gross domestic product is 244784.8. This indicates that the country is not spending more in the aspect of health compared to its income during the period of analysis.

4.1. Trend Analysis

The trend analysis of all the variables are presented below.

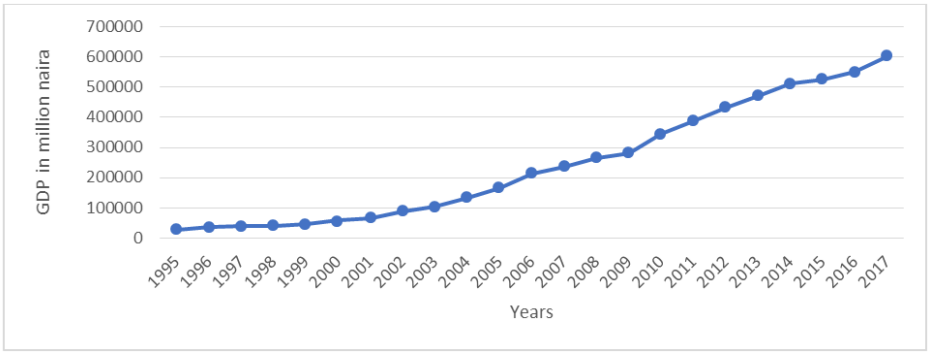

Figure 1. *Trend of GDP in Nigeria.*

Figure 1 demonstrates the gross domestic product trend between 1995 and 2017 in Nigeria. From the figure, the country's gross domestic product grew over the year. Although the value of GDP began to rise sharply in 2004, the rise is due to the elevated export rate in that era and a decrease in huge import and capital flight. The trend has not been on the high side in 2015 to 2017, although it has been rising. The reasons may be due to huge unemployment and elevated corruption rates in conjunction with capital flight that lowered the economy's productivity and development.

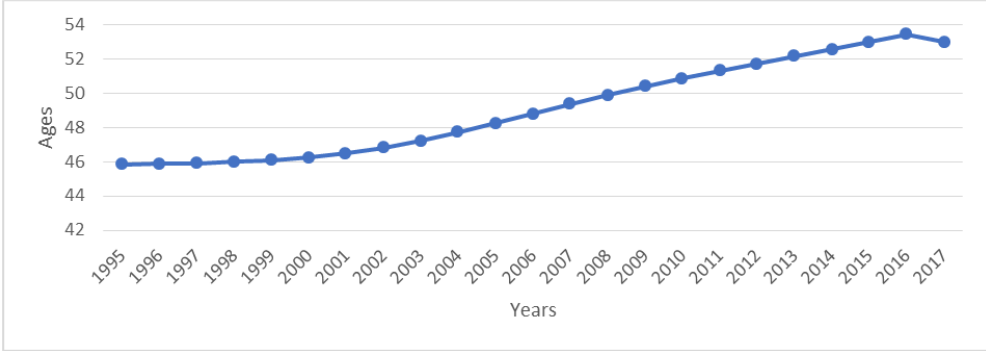

Figure 2. *Trend of life Expectancy in Nigeria (Total).*

Figure 2 shows life expectancy, which is a statistical measure of the average moment an individual is supposed to live based on birth year, present age and other demographic variables including gender. The figure indicates that Nigeria's life expectancy has improved over the period; it has risen all the way up to 2016 and dropped slightly in 2017. Although life expectancy is not consistent with the 71-year goal for sustainable development. The slight drop in 2017 resulted from a high poverty rate, an increase in illnesses, war and a dramatic drop in health spending as a big percentage of cash was channeled to other non-health industries.

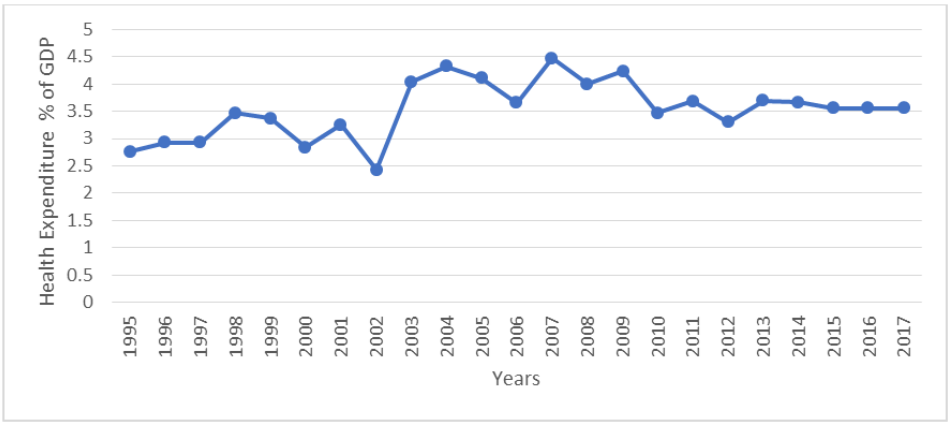

Figure 3. *Trend of Health Expenditure% of GDP in Nigeria.*

Government spending on health shows a non-stable trend over time. The government spending was not stable, as shown in the figure. The year 2002 indicates a dramatic drop in spending on health, but in 2003 it increases again. This may be the result of the country's recession over this era. Government health spending's upswing and downswing indicates that the nation is still lagging behind in its quest to achieve goal 3 of the objectives of sustainable development in the region of efficient health for all.

4.2. Correlation Analysis

This section presents the correlation coefficients of the relationship between government health expenditure and each of the health statuses considered in this study. This was carried out to determine the relationship among the variables. The respective p-value are presented below the correlation coefficients to see the significance of each of the relationships.

Table 2. *Correlation Matrix of Variables.*

Variables	LOG (GDP)	LOG (LE)	LOG (HE)
LOG (GDP)	1.000000	0.973528	0.550518
LOG (LE)	0.973528	1.000000	0.464165
LOG (HE)	0.550518	0.464165	1.000000

Source: Author's Computation, 2019

Table 2 shows the relationship between gross domestic product, government health spending and health status. The correlation coefficients of the relationships show that government health spending is positively related to GDP and life expectancy and these relationships are statistically significant. This is shown by the negative signs and their respective p-values being less than 0.05. These relationships can also be said to be strong since each of them is greater than 0.5 which is an average correlation coefficient. This is in conformity with expectation. On the other hand, the relationship between government health expenditure and life expectancy is seen to be positive and also statistically significant. This also conforms to expectation. The result therefore indicates rejection of the null hypothesis that government health expenditure does not have a significant relationship with health status in Nigeria.

Pre-Estimation Tests

Unit Root Test

The unit root test presented in this work follows the Augmented Dickey-Fuller procedure. The test was carried out to examine the stationary nature of each of the variables used in the models of this paper in order to avoid the consequence of having a spurious regression result arising from conducting Ordinary Least Squares method with non-stationary series.

Table 3. *Augmented Dickey Fuller Unit Root Test.*

Variable	Critical Values	ADF at Levels	ADF at 1st Diff.	ADF at 2nd Diff.	Order of Integration
Log (GDP)	1% = -4.467895 5% = -3.644963 10% = -3.261454	-1.113732	-3.824481		I (1)
Log (HE)	1% = -4.498307 5% = -3.658446 10% = -3.268973	-2.175939	-6.890402		I (1)
Log (LE)	1% = -4.571559 5% = -3.690814 10% = -3.286909	-4.173735			I (0)

Source: Author's computation 2019

Presented in Table 3 is a test for the presence of unit root in each of the variables used in the model. Unit Root Test is a test to ascertain if the variables used in this model are stationary or non-stationary series. The unit root tests are conducted in this study following the Augmented Dickey-Fuller (ADF) procedure. As seen in Figures 1, 2 and 3, some of the variables exhibit trends (either downward or upward) over time, hence, the trend and intercept option were chosen while conducting unit root test for such variables. The intercept is chosen for other variables that are not trending with time. The ADF results reveal that all the variables are not stationary at level at 5% significance level. Health expenditure was stationary at 1% with p <.001. This is indicated by each of their p-values being greater than 0.05 and each of their ADF test statistics being less than the 5% critical value. Since the decision rule is to reject the null hypothesis that a variable has unit root (i.e. the variable is a non-stationary series) if p-value is less than significance level (or if t-statistic is greater than the 5% critical value) and accept null hypothesis if otherwise, the result clearly suggests a failure to reject null hypothesis at level for all variables. However, the result reveals each of the variables became stationary at first difference (i.e. when each of them is differenced once). Except for life expectancy, however, all other variables were integrated after their first difference.

4.3. Regression Analysis

This section presents the regression analysis to examine the impact of government health expenditure and life expectancy on the economic development of Nigeria. The dependent variable in the model is the log of GDP while the independent variables are log of health expenditure and the log of life expectancy respectively. The findings here capture the first objective of the paper.

Table 4. *Regression Result.*

Dependent Variable: LOG (GDP)			
Variable	**Coefficient**	**t-Stat**	**Sig**
Constant	-58.231	-15.161	0.000
LOG (LE)	17.780	17.230	0.000
LOG (HE)	0.771	2.367	0.029
R-Squared	0.960		
Adj. R-Squared	0.955		
F-Stat	216.89		
Prob.	0.000		
D. W	1.865		

Source: Author's computation 2019

Table 4 presents regression results of the impact of government health spending and life expectancy on economic growth in Nigeria. The reported R-squared of the model shows that life expectancy and government expenditure accounted for about 96% in the variations in GDP in Nigeria. This indicates that the model is in good fit. In the result above, log of LE have highly significant effect on GDP at 1% level of significance with $\rho < 0.01$. The effect is also found to be positive. This shows that a one-year increase in the life expectancy of workers in the economy will lead to about 178million increase in the gross domestic product in the economy. This result conforms with apriori expectation and aligns with credence to Grossman theory which states that good health status is a positive function of individual income level. in that health is seen as the wealth of a nation and significantly improves the nation's income via productivity and human capital development. Life expectancy therefore, is an important variable that determines economic development in Nigeria.

The outcome also showed positive signs respectively and substantially on account of government spending on health. The outcome is also in line with apriori expectations that public health spending should boost the country's GDP. The outcome was significant at a level of 5 percent significance; an increase in health expenditure of N1 million will result in an increase of about GDP with about N77 million in the country's GDP. This is justified on the ground that family health status tends to enhance as money is spent on accessing better quality health care service, and in turn improves productivity, which in turn improves the economy's revenue.

The F-statistics value of 216.8952 with Prob= 0.000000 indicate that the overall model is significant at 1%. The DW value of 1.86 indicates the absence of serial correlation in the model.

The Granger Causality Test

In order to achieve the third objective of the paper, the granger causality test was employed and the result is presented in Table 5.

Table 5. *Granger Causality Test Result.*

Null Hypothesis	F-Statistics	Prob	Decision	Remarks
Log (LE) does not Granger Cause Log (GDP)	4.78435	0.0247	Reject H_0	Unidirectional
Log (LE) does not Granger Cause Log (GDP)	1.13070	0.3488	Accept H_0	Causality
Log (HE) does not Granger Cause Log (GDP)	2.58676	0.1107	Accept H_0	No Causality
Log (GDP) does not Granger Cause Log (HE)	1.71169	0.2163	Accept H_0	
Log (LE) does not Granger Cause Log (HE)	2.85979	0.0909	Reject H_0	Bi-directional
Log (HE) does not Granger Cause Log (LE)	3.58507	0.0553	Reject H_0	Causality

Source: Author's computation 2019

There is no proof of causality in any direction between GDP and public health spending in Nigeria from the causality outcomes in Table 5. This demonstrates that GDP does not granger in Nigeria causes patterns of government spending on health care in Nigeria and vice versa. Therefore, the null hypothesis is dismissed as causality does not run from GDP to government spending on health and vice versa. The findings, on the other side, demonstrate proof of unidirectional causality from GDP to life expectancy rather than vice versa. The outcome implies that Nigeria's GDP variation is what gives rise to life expectancy and not vice versa. This means that despite the reality that no proof of causality has been discovered between GDP and government spending on health, it is secure to say that improving GDP in Nigeria will help boost the country's life expectancy. The policy implication of the above results is that any government attempts to enhance the health industry through health-related spending are anticipated to affect GDP (financial growth) through health-related results. There is, however, a bidirectional connection between Nigeria's health spending and life expectancy. This is true because increased government spending will lead to improved life expectancy and an increase in life expectancy will also lead to increased government spending on health.

5. Conclusion and Recommendations

In this paper, we investigated the impact on economic development of public health spending and life expectancy as well as the connection between them for the period from 1995 to 2017. The ordinary least squares and the methods of granger causality testing were used. It is disclosed from the study that spending on public health and life expectancy has a beneficial impact on economic development. There is also a unidirectional connection between life expectancy and economic development as more life expectancy leads to growth, not vice versa, whereas in Nigeria there is no causality between government spending on health and economic growth. There is, however, a bidirectional causality in Nigeria between expenditure on public health and life expectancy. This means that merely raising public health spending is likely to lead to improved health and, in turn, boost the economy's GDP. The policy implication of the results of this article is that if the amount of health expenditure is not improved, attaining the

sustainable development objective of increasing life expectancy in Nigeria may not be achievable. Therefore, the research proposes that government should increase its health expenditure in order to help enhance its citizens ' life expectancy as this in turn will enhance productivity, leading to economic growth.

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