ANALYSIS OF PUBLIC HEALTH SPENDING, PER CAPITA INCOME AND LIFE EXPECTANCY AT BIRTH IN NIGERIA

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ABSTRACT
Living a healthy, earning a living income and long-life have been a general concern in Nigeria hence, the increasing government expenditure on health. This study investigates the individual effect of public health spending, and per capita income on life expectancy rate in Nigeria. Nigeria's life expectancy is still low when compared to the world due to the insufficient government spending on health. In addition, the Nigeria populace lack adequate income for improved nutrition and healthy lifestyle. The study employs the Auto-Regressive Distributed Lag (ARDL) technique based on the unit root test result that found all variables integrated at level and first difference. The ARDL bounds test statistic of about 17.384 indicate that a significant long-term relationship exists among the variables of the study. The ARDL long-term result indicate that increase in per capita income and government funding to the health sector can resort to rising life expectancy at birth in Nigeria to about 0.146% and 0.0056% respectively. The study concludes that life expectancy at birth will improve with the increase in per capita income likewise, the rise in public health expenditure, leading to a sustainable growth in output. The study recommends that more percentage of the national budget should be channel to funding the health sector in Nigeria- construction of new healthcare facilities having 24/7 electricity supply in the rural areas. The government of Nigeria should raise per capita income such that the people of Nigeria can afford better nutrition.

Keywords*: Government Health Expenditure, Life Expectancy, Per Capita Income*

JEL Classification Code: C32, H1, H51, I15

1. INTRODUCTION
An input that is regarded as being essential in the health production function is healthcare. This is on the basis that efficient healthcare is one of the important means to reduce the number deaths towards welfare improvement. Studies have indicated that low per capita income restricts access to medical care, particularly for the low-income earners. Awoyemi *et al.* (2023) reveals that a sufficient public spending on health can triggers life expectancy rate. In achieving this, apart from individual to access healthcare, high per capita income of the populace has a positive role to play in the life expectancy of persons.

An increase in government spending on health not only leads to longer life, but do reinforces faster economic growth in a country (Akinbode, *et al.* 2021, Taofik & Ditep, 2022). This is to say that a healthy person not only works efficiently but is also able to devote more time to productive activities. Moreover, it is estimated that health improvements accounts for one-third increase in GDP growth and its impact on health status improves human capital development (Kurt, 2015).

The improvement in health status, especially in developing countries possesses huge challenge and the prevalence of large-scale health problems, such as high infant mortality rate and low life expectancy, are as a result of the scarce health resources and infrastructure. Available statistics reveal that Nigeria's health expenditure barely exceeds 3% between 2008 and 2021. The health expenditure as a share of GDP reached its peak in 2021with 4.08%, less than the 5% of GDP suggested for achieving universal health coverage. From the year 2000 to 2020, there was a skyrocket rise in the recurrent spending of the government on the health sector from ₦15.2 billion to ₦364.4 billion.

However, the capital expenditure fluctuated and reached less than ₦195 billion in 2020 (CBN, 2022). This shows that the Nigerian government health expenditure largely focuses on healthcare goods and services than on health infrastructures comprising of buildings and equipment. Moreover, the healthcare budgets are far below from countries in the world, and the few health infrastructures available are unbalanced between urban-rural areas in Nigeria. The availability of and access to improved healthcare services reduces mortality, while addressing poverty issues among the population. In this regard, adequate and efficient health spending alongside with high per capita income remain crucial in improving health status.

The World Bank in the year 2022 asserted that per capita income is a widely used indicator of a country's economic well-being and is defined as the total income of a country divided by its population. According to statistics, Nigeria's per capita income of $2,040 is far lower than the global average of $10,940 (World Bank, 2022). For the year 2023 the per capita income of $1,597 showcased a decremental figure compared to the previous year, and in 2024 the per capita in Nigeria was estimated as $2,464; which reflects that Nigeria's economy has grown at an average growth rate of 3.2% (World Bank, 2023; 2024).

Theoretically, the concept of "health- income gradient" explains the relationship between per capita income and health outcomes including the life expectancy rate. This concept suggests that as income increases, individuals are more likely to invest in health-enhancing goods and services, leading to improved healthy life (Case & Deaton, 2015). This shows that per capita income can also improve health outcomes by increasing access to healthcare services, improving the quality of care, and reducing health inequalities.

As noted by Amedari and Ejidike (2021), a high proportion of the poor and of those living in rural areas is not reached by the primary healthcare services and forcing them to rely on home remedies and traditional healers, exacerbating health inequalities and hindering efforts to improve the health outcomes in Nigeria specifically the life expectancy at birth.

The availability of adequate healthcare services and high per capita income broadly determines the health status and generally the quality of life which reflects on the welfare of an individual. That is, if a country wants to develop economically, a fair amount of money should be spent on healthcare. In fact, Nigeria still has one of the low life expectancy at birth when compared with other African countries as well as in the World. In 2023, life expectancy at birth in Nigeria was about 62 years which is significantly lower than the global average of 70 years. More specifically, this figure equaled 60 and 64 years for males and females respectively (World Bank, 2023). This explains the need to improve the healthcare sector and per capita income in Nigeria. Per capita income also influences life expectancy rate by enhancing longevity, whereas low income has the opposite effect. Despite the importance of public health

expenditure in improving health outcomes, only few studies assessed the relationship among public health expenditure, per capita income and health outcomes in Nigeria (Aderopo, 2019; David, 2018).

Given this background, it becomes imperative to assess how public health spending and per capita income contribute to the improvements in life expectancy at birth. This study contributes to existing studies by employing the Autoregressive Distributed Lag technique to examine the short- and long-run effects of government spending on health and per capita income on life expectancy in Nigeria spanning over the period of 1990- 2023.

2. LITERATURE REVIEW

2.1 Theoretical Literature

The Health-Income Gradient: The health- income gradient states the difference in health outcome between people with different income such that persons with high per capita have their life expectancy improve. That is, as incomes increase, health risks decrease and life expectancy improve. It suggests that individuals with higher incomes tend to have better health outcomes- high life expectancy, while those with lower incomes tend to have poorer health outcomes. This is due to the fact that persons with higher income can afford better healthcare services, leading to improved health outcomes. This is to say that the health- income gradient is a description of a positive correlation between income and health outcomes. By implication, the health- income gradient can inform policy interventions aimed at reducing health inequalities and improving health outcomes for disadvantaged populations.

Health Production Function: The health production function describes the combination of various inputs such as income, healthcare services, and the choice of lifestyle to produce health outcomes including life expectancy at birth. For instance, safe living conditions, increasing access c to doctors and prompt medical bookings, medications and preventative care- healthy eating, exercise, and shun to smoking and alcohol intake can improve life expectancy at birth.

Human Capital Theory: The human capital theory is rooted in the work of Adam Smith, and it suggests that investments in education, training of healthcare personnel increases life expectancy at birth via their productivity and earning potential. The theory indicates that individuals with higher levels of education and training are more productive and efficient

2.2 Empirical Literature

Public Health Spending and Life Expectancy

A study (Van-Baal, *et al* 2013) based on the review of the literature concluded that the relationship between healthcare expenditures and health outcome (life expectancy) is difficult to establish, while some researchers found an insignificant association between health expenditures and health status (Deshpande, *et al.* 2014). However, it has been globally acknowledged that a viable healthcare system is important to every economy; this therefore prompts increase in health expenditure over time (Anwar, et al. 2023).

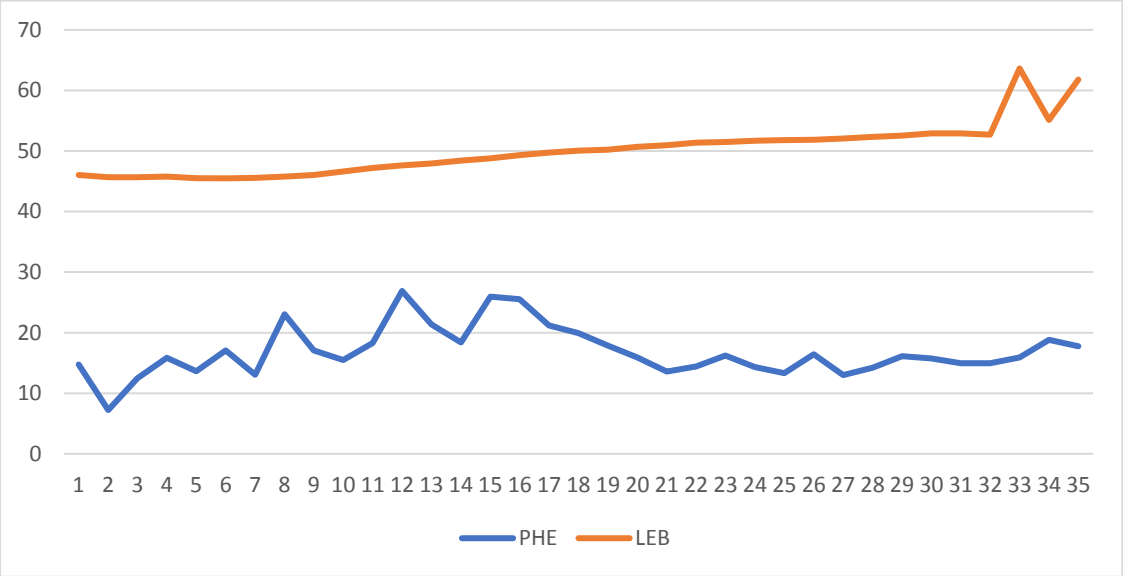
Iyakwari, Awujola and Ogwuche (2023) examined the effect of health expenditure on life expectancy in Nigeria using time series data from 1990 to 2021 and employed the ARDL and ECM models. The study found a negative long-run relationship between health capital expenditure, health recurrent expenditure with life expectancy. The study further recommends that the Nigerian government should take action to address the negative correlation between health capital expenditure and life expectancy by allocating sufficient funding to the health sector and implementing policies such as tax incentives and subsidies to enhance life expectancy in Nigeria.

Paul and Agada (2024) examined the impact of public health expenditure on life expectancy in Nigeria for the period of 1985 – 2022, using ARDL and Granger Causality statistical techniques. The study found a long- run relationship between public health expenditure and life expectancy in Nigeria. The study also revealed that there is non- causal relationship between public health expenditure and life expectancy in Nigeria. The study further recommended that the government in Nigeria 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 the Nigeria populace. Aderopo (2019) found that public health expenditure has a positive impact on life expectancy in Nigeria. A similar study by David (2018) found that public health expenditure is a significant determinant of life expectancy in Nigeria. In terms of policy implications, increasing public expenditure on health can lead to improved life expectancy in Nigeria. However, the relationship between public expenditure and life expectancy is complex and influenced by various factors, including access to healthcare, education, and environmental factors (WHO, 2022).

In the specific context of Nigeria, Ezeani and Efobi (2018) used the ARDL model to analyze health expenditure impact on life expectancy in Nigeria from 1981 to 2015. Their findings showed that while the short-run coefficient estimate for health expenditure was positive, it was statistically insignificant, implying that the effect of health expenditure on life expectancy is not immediate. However, in the long run, the coefficient estimate for expenditure on health was positive and statistically significant, indicating that increasing expenditure on health is connected to higher life expectancy. Therefore, the study recommends that policymakers prioritize healthcare spending to enhance the health outcomes of the Nigerian population.
Ojo *et al.* (2020) employed ARDL technique to examine the impact of health expenditure on life expectancy in Nigeria from 1981 to 2018. The result revealed that health expenditure had insignificant impact on life expectancy. It was concluding that health expenditure had insignificant impact in enhancing life expectancy in Nigeria. Similarly, using under-5 mortality per 1000 birth and Life expectancy as proxies for health outcomes, Orji et al. (2021) examined the impact of public health expenditure on health outcomes in Nigeria from 1985- 2019. The study used the Augmented Dickey Fuller technique to test for unit root of the variables. Findings from their analysis showed that health expenditure by the government has a significant impact on the under-5 mortality rate and life expectancy. The study recommends that the federal government of Nigeria should increase the annual allocation to health sector to improve the health status of its populace.

Accordingly, Taofik and Ditep (2022) used ECM framework to investigate the relationship between public health expenditure and health indicators in Nigeria. The study reveal that expenditure on health is never a waste and so healthcare spending is paramount for improving the quality of life in Nigeria. Hosokawa *et al.* (2020) examine the relationship among healthcare spending and healthy life expectancy at birth using descriptive statistics and correlation analysis across all Japan's secondary medical areas. The result revealed significant regional disparities and that the number of medical personnel support clinics for home healthcare delivery facilities and home visit treatments, also expenditure per capita has positive relation with both life expectancy and healthy life expectancy.

Figure 1: Public Health Expenditure (PHE) and Life Expectancy at Birth (LEB) 1990 – 2023.



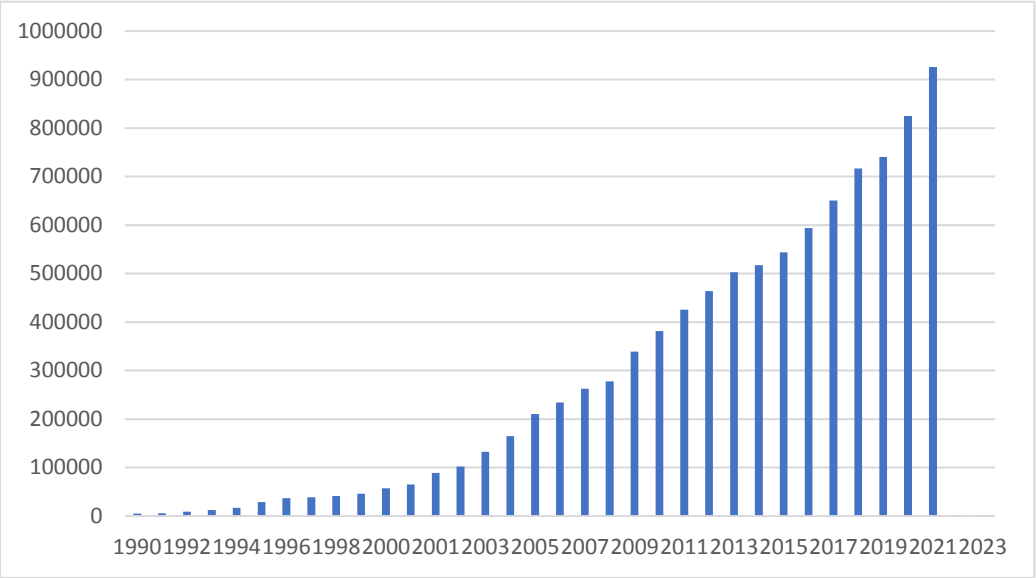
Source: Authors' estimation using the data set from World Development Indicator and Central Bank of Nigeria databases

Review on Income and Life Expectancy

The understanding of how income influences life expectancy has generated views from studies with the ultimate aim to seek as improve health outcomes for people. Accordingly, Ussif *et al.* (2025) investigate the relationship between per capita income, and life expectancy in Ghana using the annual time-series data from 2000 to 2022 being provided by the World Development Indicators. The study found that per capita income has a positive impact on life expectancy of persons. The study recommends policies focusing on strategies to increase individual incomes since high per capita income typically enables better access to healthcare and better living conditions which are important for increasing life expectancy. Moreover, individuals with higher income levels tend to be more health conscious and can spend more on their health thus raising their lifespan (Kehinde & Temitope, 2020). Similarly, Lynch, et al. 2017 revealed that the relationship between per capita income and life expectancy is evident in Ghana, as economic growth in recent decades has led to some improvements in health outcomes, but income inequality continues to hinder equitable access to healthcare. Per capita income serves as a primary metric for assessing the nation's population economic well-being by measuring the average income earned per person within a specified period.

In the case of Nigeria, per capita income reflects the average earnings of its residents, illustrating economic development and living standards. The graph below showcases the gradual progression of Nigeria's per capita and later falling at the later years. By implication, the standard of living is drastically at a low level in the later years of the study.

Figure 2: Nigeria's Falling Per Capita Income



Source: Authors' Estimation using the data set from World Development Indicator and Central Bank of Nigeria databases

Nigeria's per capita income was recorded at $2,416.36 USD, which is equivalent to 19% of the world's average thereby indicating its position within the global economic landscape (World Bank, 2023) According to Case and Deaton (2015), it was found that higher income correlates with longer life expectancy, as it allows individuals to afford better healthcare services and maintain healthier life.

From the review conducted, this study authenticates that there has so far been a mixed results on the relationship between public health spending - life expectancy and per capita income-public health spending. Therefore, this study differs from previous studies in the literature by incorporating the role of per capita income alongside public spending on health to improve the life expectancy of Nigeria populace; thus, in a single study. This indicates that a significant portion of healthcare costs in Nigeria is still being paid for directly by individuals and families.

3. METHODOLOGY

The study employed the Augmented Dickey- Fuller (ADF) technique to test for a unit root in the data series. A bound cointegration test was conducted to assess cointegration among the series. The autoregressive distributed lag technique was utilized to examine the short- and long-run effects of public health expenditure and per capita income on life expectancy rate. The data for the study spanned from 1990 to 2023 and were extracted from the World Development Indicator and Central Bank of Nigeria databases. The period of study used was based on the constraints on the availability of data. The life expectancy at birth model was expressed as:

LEB = f(PHE, PRHE, CAPHE, RHE, PCI) ---------- (1)

Where:

LEB = Life Expectancy Rate at Birth

PHE = Public Health Expenditure

PRHE = Private Health Expenditure

CAPHE = Capital Health Expenditure

RHE = Recurrent Health Expenditure

PCI = Per Capita Income

The econometric model is given as:

$In\ LEB = \beta_0 + \beta_1 PHE + \beta_2 PRHE + \beta_3 CAPHE + \beta_4 RHE + \beta_5 In\ PCI + \mu_t$ ---------- (2)

Where;

lnLEB = Natural Logarithm of Life Expectancy Rate at Birth

lnPCI = Natural Logarithm of Per Capita Income

β denotes Coefficients of the independent variables; and μ_t is the error term.

In accordance with the assertions of Gujarati (2022) the Autoregressive Distributed Lagged (ARDL) model for this study is specified as:

$$\Delta lnLEB_t = \beta_0 + \sum_{g=1}^{m} \beta_{1i} \Delta lnLEB_{t-i} + \sum_{h=1}^{m} \beta_{2i} \Delta + \sum_{i=1}^{m} \beta_{3i} \Delta PRHE_{t-i} \sum_{j=1}^{m} \beta_{4i} \Delta CAPHE_{t-i} + \sum_{k=1}^{m} \beta_{5i} \Delta RHE_{t-1} + \sum_{l=1}^{m} \beta_{6i} \Delta lnPCI_{t-i} + \beta_7 lnLEB_{t-i} + \beta_8 PHE_{t-i} + \beta_9 PHRE_{t-i} + \beta_{10} CAPHE_{t-i} + \beta_{11} RHE_{t-i} + \beta_{12} lnPCI_{t-i} + \epsilon_t$$

---------- (3)

The ARDL method statistically assess the relationship between two or more variables in both long- and short-term using the ARDL Bounds test of cointegration (Pesaran et al., 2001). This study investigates the short-run and long-run relationships, as well as the effect of health expenditure and per capita income on life expectancy in Nigeria. The ARDL bounds test justify the essence of performing the Error Correction Model (ECM) (Altaee, et al. 2016).

And the ECM employed in this study is as follows:

$$\Delta lnLEB_t = \alpha_0 + \sum_{g=1}^{l} \alpha_{1i}\ \Delta lnLEB_{t-i} + \sum_{h=1}^{m} \alpha_{2i}\, \Delta PHE_{t-i} + \sum_{i=1}^{n} \alpha_{3i}\, \Delta PHRE_{t-i} + \sum_{j=1}^{o} \alpha_{4i}\, \Delta CAPHE_{t-i} + \sum_{k=1}^{p} \alpha_{5i}\, \Delta RHE_{t-i} + \sum_{l=1}^{q} \alpha_{6i}\, \Delta lnPCI_{t-i} + \curlywedge\, ECT_{t-1} + \in_t$$

--------- (4)

The coefficient of ECT_{t-1} is represented by ⍀ and this implies the adjustment coefficient, which must be negatively significant in order to confirm the cointegration relationship and the long run speed of adjustment.

Thus, the study employed the optimal lag length, lag length of 2 based on the different lag length criteria (AIC), Schwarz Information Criteria (SC), Final Prediction Error (FPE), and the Hannan Quinn (HQ) Information Criteria.

Table 1. Variables Measurement and Apriori Expectations

Variable Name	Notation	Definition	Expected Sign
Life Expectancy Birth	LEB	Number of years a person is expected to live based on birth rate prevailing in a population	Positive (+)
Public Health Expenditure	PHE	Public health expenditure as a percentage of Gross Domestic Product	Positive (+)
Private Health Expenditure	PRHE	Private health expenditure as a percentage of Gross Domestic Product	Positive (+)
Capital Health Expenditure	CAPHE	Capital public spending on health as a percentage of Gross Domestic Product.	Positive (+)
Recurrent Health Expenditure	RHE	Recurrent government spending on health as a percentage of Gross Domestic Product.	Positive (+)
Per Capita Income	PCI	A measure of the average income earned by residents in a given country. The naira ₦ is its metric in this study.	Positive (+)

Source: Authors' Compilation, 2024

4. RESULTS AND DISCUSSION OF FINDINGS

Descriptive Analysis and Stationary Test

Table 2 displays the descriptive analysis result. The findings from the descriptive analysis revealed that the life expectancy at birth has a mean of 49 year with minimum and maximum of about 46 and 55 respectively and a standard deviation of 3.4. This is to say that newborns in Nigeria are expected to live on average 49 years. The PHE has an average of 0.813% of GDP within the range of 0.57 and 1.43%, with a skewness of 0.42 and kurtosis of about 2.94. Also, the PRHE indicated an average of 1.569% of GDP, with minimum and maximum of 0.60% and 2.10% alongside a skewness and kurtosis of 0.46 and 3.25 respectively. 333. The Capital Health Expenditure (CAPHE) has an average of 2.193% and ranges between 2.04% and 2.18% of GDP, with skewness and kurtosis of 0.04 and 1.63 respectively. Furthermore, the Recurrent Expenditure on health ranges between 0.07% and 0.39% of GDP, with an average of 0.221%. The skewness and kurtosis are about 0.16 and 2.48 respectively. The PCI has an average of 3.246751 million within the ranges of ₦ 3.078094 million and ₦ 3.3381032 million with a standard deviation of ₦0.096784 million. Skewness and kurtosis were revealed as 0.296 and 1.682 respectively.

Overall, the findings reported in Table 2 shows that all the variables in the study were positively skewed with a high value of kurtosis. The Jarque-Bera statistics reveal that the residuals are normally distributed. This is because, their p-value are higher than 5% level of significance.

Table 2. Descriptive Analysis Result

	LEB	PHE	PRHE	CAPHE	RHE	PCI
Mean	49.35438	0.813235	1.568750	2.193042	0.221318	3.246751
Median	48.53000	0.701628	1.600000	2.183708	0.220091	3.269032
Maximum	55.35000	1.429614	2.100000	2.321008	0.386051	3.381296
Minimum	45.84000	0.568742	0.600000	2.044985	0.074647	3.078094
Std. Dev.	3.400730	0.110974	0.343077	0.093531	0.073487	0.096784
Skewness	0.408039	0.422729	0.460157	0.046043	0.158756	0.296147
Kurtosis	1.639779	2.940005	3.235533	1.534375	2.477368	1.681978
Jarque-Bera	3.354910	5.971224	1.203271	2.875382	0.1573387	2.783992
Probability	0.186849	0.050509	0.547915	0.237475	0.916958	0.248579

Source: Authors' Computation 2024, underlying data from World Development Indicator and Central Bank of Nigeria Databases.

Stationarity Test Findings

This study employed the Augmented Dickey-Fuller technique (ADF) to determine the stationarity status of the variables in the study. The ADF unit root results as shown in Table 3 reveal that the natural logarithm of life expectancy rate at birth (ln LEB), private expenditure on health (PRHE), capital expenditure on health (CAPHE), recurrent expenditure on health (RHE) are nonstationary at level, meaning they were stationary at first difference. The remaining variables- public health expenditure (PHE) and natural logarithm of per capita income (ln PCI) are stationary at level.

Table 3. ADF Unit Root Test Result

Variable	**@ Level**	**@First Difference**	**Order**	**Remarks**
ln LEB	-9.089	-8.161**	I(1)	Stationary
PHE	-2.931**	-6.010***	I(0)	Stationary
PRHE	-4.483	-3.748*	I(1)	Stationary
CAPHE	-9.949	-5.716**	I(1)	Stationary

RHE	-0.165	-3.836**	I(1)	Stationary
ln PCI	-3.205*	-4.561	I(0)	Stationary

Source: Authors' Computation 2024 underlying data from World Development Indicator and Central Bank of Nigeria Databases. *, **, and *** imply statistical significance at 1%, 5% and 10% levels respectively.

It is, therefore, worth concluding that the variables are integrated of order zero I(0) and one I(1), that is, all the variables are stationary at their level and first difference. By implication the required statistical method of analysis for the study is the ARDL. Hence, the ARDL bounds test was conducted to test the relationship existence among the variables in the study.

Autoregressive Distributed Lag Analysis and Error Correction Model

Following the unit root test result, the study conducted a bounds test to investigate the existence of long run cointegration among the variables as presented in Table 4. The F- statistic value for the model is about 17.384, which is higher than the upper bound value at 1 percent level. This implies that the null hypothesis (H_0) of no cointegration can be rejected at a 1% significance level and that there is a cointegration among variables in the study. In addition, a long-term relationship exists among the variables in the study.

Table 4. Autoregressive Distributed Lag (ARDL) Bounds Test Result

F- statistic	10%	5%	1%	Remark
17.383951	3.17 (4.14)	4.59 (4.85)	5.13 (6.36)	H_0 is rejected

Source: Authors' Computation 2024, underlying data from World Development Indicator and Central Bank of Nigeria Databases.

Note: The upper bound value in parenthesis.

Table 5. Autoregressive Distributed Lag Co-integrating and Long- term Form

Cointegrating Form Variable	**Coefficient**	**Std. Error**	**t- Statistic**	**Prob.**
D(PHE)	-0.000146	0.001566	0.093231	0.3672
D(PRHE)	0.000705	0.000246	2.865854	0.0032**
D(CAPHE)	0.008619	0.004245	2.030389	0.0821***
D(RHE)	0.000217	0.003101	0.069977	0.7601
D LOG(PCI)	0.024055	0.009429	2.551172	0.0601***
CointEq(-1)	**-0. 07954**	**0.019607**	**-4.056714**	**0.0001***

S**ource:** Authors' Computation 2024, underlying data from World Development Indicator and Central Bank of Nigeria Databases. *, ** and *** imply statistical significance at 1%, 5% and 10% levels respectively.

The result in Table 5 reveals that the ECT(-1) statistic of about -0.0795 is negative and significant at a 10% level of significance. This also implies that the model is relatively stable, and that it will take about 79% adjustment speed for the model to move from short-run to long-run, indicating that it will take a longer period for life expectancy to relatively improve upon due to the low percentage of the national income is being devoted to the health sector.

Table 6. **Autoregressive Distributed Lag Short- Term Co-integrating Result**
$Cointeq = LOG(LEB) - (0{,}0055 * PHE + 0.0231 * PRHE + 0.0540 * CAPHE + 0.0675 * RHE + 0.1455 * LOG(PCI) + 3.3771)$

Short-term Coefficients Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
PHE	0.005468	0.111725	0.048942	0.0073***
PRHE	0.023124	0.002620	8.825954	0.0001*
CAPHE	0.054010	0.029588	1.825402	0.0655***
RHE	0.067495	0.039766	1.697304	0.1255
LOG(PCI)	0.145497	0.005532	26.300976	0.0000*
C	3.377085	0.2529642	13.006698	0.0000*
R- squared	0.889		Durbin-Watson	1.621
Adjusted R- squared	0.873			
F- statistic	10746.95		Prob, (F-statistic)	0.000

S**ource:** Authors' Computation 2024, underlying data from World Development Indicator and Central Bank of Nigeria Databases. *, ** and *** imply statistical significance at 1%, 5% and 10% levels respectively.

From result indicated in Table 6, the R^2 value of 0.889 shows that the model is of good-fit, and hence the independent variables in the study explains about 89% of the variation in the dependent variable LEB. The F-statistics (10746.95; P= 0.000) is highly significant at a 1% level of significance. This supports the efficacy of the model.

The ARDL short-run result also shows that the explanatory variables- PHE, PRHE, CAPHE, and LOG(PCI) all have positive and significant effect on LEB at 1% and 10% levels with coefficients of 0.0055, 0.0231, 0.0540, 0.0675, and 0.1455 respectively. Also, the ARDL long-run result reveals that these variables all have positive and significant effect on LEB. The findings therefore indicate that increasing per capita income and the naira (₦) spending on health whether public or private are anticipated to boost life expectancy in Nigeria. These findings corroborate the evidence provided by (Taofik & Ditep, 2022; Awoyemi *et al.* 2023), which reveals that public health expenditure is beneficial to life expectancy.

Nevertheless, the findings revealed that the variable RHE was found to be statistically insignificant possible due to the heavy reliance on spending directly from individuals for instance, patients purchasing mentholated spirit, hand glove before being granted access to medical services. By implication, Nigerians become vulnerable to infectious diseases whenever there is an outbreak that can distort the quality of life.

Table 7. Results of the Diagnostic Test

Test	Probability
Breusch- Godfrey Serial Correlation LM Test	0.243
Normality Test	0.8793
Heteroskedasticity using ARCH	0. 4759

S**ource:** Authors' Computation 2024, underlying data from World Development Indicator and Central Bank of Nigeria Databases.

From the results in Table 7, the model of the study is correctly specified, with the diagnostic tests results showcased the data is normally distributed. Also, there is absence of serial

correlation or Heteroskedasticity among the residuals, as evidenced by the non- significant probability statistics of the tests. By implication, the model can be relied upon on issues related to public health spending, per capita income and life expectancy at birth in Nigeria.

5. CONCLUSION AND RECOMMENDATIONS

This study examines the effect of public health spending and per capita income on life expectancy in Nigeria. One important revelation is that increase in per capita income and government funding to the health sector is crucial to improve life expectancy and the overall welfare of Nigerian people. Emphatically, the findings show that rising public health spending and per capita income have resulted in longevity of people in Nigeria. The study concludes that life expectancy at birth will improve with the increase in per capita income likewise, the rise in public health expenditure, private and capital health spending.

In line with the findings and conclusion the study recommendations are as follows:

i. A minimum of 15% of national budget as per Abuja declaration should be channel to funding the health sector in Nigeria such that, there should be healthcare facilities development- construction of new healthcare facilities having 24/7 electricity supply, and the upgrade of operating ones.
ii. Government should increase the presence of healthcare services at all levels of government, particularly for vulnerable populations such as the poor and those living the grassroot areas.
iii. Lastly, the government of Nigeria should increase per capita income such that the people of Nigeria can afford better nutrition and healthy lifestyles. The implication is that rising health spending and per capita income will improve welfare and boost productivity of people, leading to a sustainable growth in Nigeria's output.

Conflict of interest

No conflicting interest.

Data Availability

The data used in this paper can be feely and publicly accessed at https://data. Worldbank.org/indicator/SP.DYN.LE00.IN?locations=NG
https:// www.cbn.gov.ng/documents/Starbulltin.asp

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REFERENCES

Aboubacar, B. and Xu, D. (2017). The Impact of Health Expenditure on the Economic Growth in Sub -Saharan Africa. *Theoretical Economics Letters*, 7, 615 – 622.

Akinbode, S.O., Dipeolu, A.O., Bolarinwa, T.M., and Olukowi, O.B. (2021). Effect of Health Outcome on Economic Growth in Sub-Saharan Africa: A System Generated Method of Moment Approach. *Journal of Economic Development*, 6(3), 27 – 32.

Altaee, H., Al-Jafari, M. and Khalid, M. (2016). Determinants of Economic Growth in the Kingdom of Saudi-Arabia: An Application of Autoregressive Distributed Lag Model. *Applied Economics\and Finance*, 3(1), 83- 92.

Anwar A, Hyder S, Mohamed Nor N and Younis M., (2023). Government Health Expenditures and Health Outcome Nexus: A Study on OECD Countries. *Frontier in Public Health* 11(1), 123-759. Doi: 10.3389/fpubh.2023.1123759

Awoyemi, B.O., Makanju, A.A., Mpapalika, J. and Ekpeyo, R.S. (2023). A Time Series Analysis of Government Expenditure and Health Outcomes in Nigeria. *Journal of Public Health in Africa*, 14(7), 1409. Doi: 10.4801/jphia.2023.1409.

Case, A., and Deaton, A. (2015). Broken Down by Income Group: A Decade of Stagnation in Life Expectancy in the United States. *The Journal of Economic Perspectives*, 29(4), 1-16. https://doi.org/10.1257/jep.29.4.1.

Central Bank of Nigeria, (2023). Annual Statistical Bulletin on Public Finance. 2023. Sourced from https:// www.cbn.gov.ng/documents/Starbulltin.asp

Chetty R, Stepner M, Abraham S, Lin S, Scuderi B, and Turner N. (2016). The Association between Income and Life Expectancy in the United States, 2001–2014. *JAMA* 315, 1750–66. Doi: 10.1001/jama.2016.4226.

Ezeani, I. C. and Efobi, U. R. (2018). Health Expenditure and Life Expectancy Nexus in Nigeria: A Tale of Two Models. *International Journal of Health Planning and Management*, 33(2), 461-476. https://doi.org/10.1002/hpm.2456

Gujarati D.N. (2022). Basic Econometrics. Hoboken: Prentice Hall.

Hosokawa R., Ojima, T., Myojin, T, Aida, J., Kondo K., and Kondo N. (2020). Associations between Healthcare Resource and Healthy Life Expectancy: A Descriptive Study Across Secondary Medical Areas in Japan. *Int. J. Environ. Res. Public Health*, 17(17), 6301. Doi: 10.3390/ijerph17176301.

Ibrahim, V. (2021). Effect of Malaria incidence and Malaria Control on Health Outcome and Human Capital Development in Nigeria: An Econometric Analysis. *Journal of Economics and Allied Research*, 6, 69- 89

Iyakwari, A.D.B., Awujola, A. and Ogwuche D.D. (2023). Effect of Health Expenditure on Life Expectancy in Nigeria. *Lafia Journal of Economics and Management Sciences* 8(1), 105- 118. ISSN: 2550- 732X.

Kehinde, I and Temitope ((2020. The Impact of Health Shocks on Poverty Level in Nigeria. *Journal of Economics and Allied Research*, 4, 16 – 37.

Kurt, S., (2015). Government Health Expenditures and Economic Growth: A Feder-Ram Approach for the Case of Turkey. *International Journal of Economic Financial Issues* 5, 441-7.

Lynch, J., Smith, G. D., Kaplan, G. A., and House, J. S. (2017). Income Inequality and Health: The Time Has Come to Consider the Context of the Question. *Journal of Health Politics, Policy and Law*, 42(5), 1-11. https://doi.org/10.1215/03616878-4265174

Ogunbadejo, H. and Zubair A. (2021). Interaction between Health and Agricultural Output on Economic Growth in Nigeria. *Journal of Economics and Allied Research*, 6, 98 – 108.

Orji, A., Ogbuabor, J. E., Mba, P. N., and Anthony-Orji, O.I. (2021). Are Wealthy Countries Always Healthy? Health Outcomes and Public Health Spending Nexus in Nigeria. *SAGE* Open 2021;11:21582440211040793.

Van-Baal P., Obulqasim P, Brouwer W, Nusselder W, and Mackenbach J (2013). The Influence of Health Care Spending on Life Expectancy.

Deshpande N, Kumar A, and Ramaswami R (2014). The Effect of National Healthcare Expenditure on Life Expectancy.

Pesaran, M. H. and Shin, Y. (1999). An Autoregressive Distributed Lag Modeling Approach to Cointegration Analysis. In S. Strom (Ed.), Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium 371-413. Cambridge University Press.

Pesaran, M. H., Shin, Y. and Smith, R. J. (2001). Bounds Testing Approaches to the Analysis of Level Relationships. *Journal of Applied Econometrics*, 16(3), 289-326.

Sunday, O.A. and Onisanwo, I. D. (2024). Income Inequality and Health Outcomes in Nigeria. *Journal of Applied Econometrics, 9 (3), 84- 96.*

Taofik, M.I.. and Ditep N.R. (2022). The Impact of Public Health Expenditure on Health Indicators in Nigeria. *Journal of Economics and Allied Research*, 7(1), 25 – 34.

Ussif, R., Musah I., Ussif A.S., and Ladime, J. (2025). The Nexus between Per Capita Income and Life Expectancy in Ghana. *Journal of Business and Economics Department*, 10(1), 27- 44. https://doi.org/10.11648/j.jbed.20251001.13

World Health Organization Global, (2022). Health Expenditure Database. http:// www.aps. who.int/nha/database.

World Bank (2023). Life Expectancy at Birth, Total (Years)– Nigeria. https://data. Worldbank.org/indicator/SP.DYN.LE00.IN?locations=NG