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Effect of Health Expenditure on Life Expectancy in Nigeria

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Abstract
This paper examined the effect of health expenditure on life expectancy in Nigeria using time series data from 1990 to 2021 and the ARDL and ECM models. The short-run analysis revealed that it would take 71% adjustment speed for the model to move from the short run to the long-run, indicating that health expenditure may take time to have an impact on life expectancy. The study found a negative relationship between health capital expenditure, health recurrent expenditure in the long run, while out-of-pocket health expenditure had a positive relationship with life expectancy. The study 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 encourage citizens to invest more in their healthcare and reduce out-of-pocket expenses for essential healthcare service.

Keywords: Life Expectancy, Health Expenditure, Out of Pocket Health Expenditure
JEL Classification Codes: I10, H51, I19

1. Introduction

Effective health care funding has been a common strategy used by development-driven nations, organizations, leaders, and policymakers to improve the health of their citizens and life expectancy. However, an enhanced economic structure is largely responsible for an effective and efficient health care system. Similarly, health expenditure is seen as a very important aspect of a person's wellbeing and one of the key ways of investing and ensuring improved life expectancy as well as human capital development. According to Edeme, Emecheta and Omeje (2017), improved health conditions have the potential to increase economic growth in both developed and developing nations by improving not only life expectancy but also child mortality rates. Likewise, life expectancy and health spending are proportional.

Although, Nigeria has pledged to earmark 15 % of its annual budget to health sector but analysis of the federal ministry of health and its agencies between 2001 to 2021 revealed contrary. The highest the country has allocated to the Ministry is 6.08% in 2012. Thus, the average budgetary allocation to the Federal Ministry of Health (FMoH) in 20 years is 4.69%. This is below the 15% Abuja Declaration commitment, and a 10.31% shortfall of the threshold in contrast, Rwanda, Swaziland, Ethiopia, Malawi, the Central African Republic, and Togo have since kept to the promise of the Abuja declaration. Similarly, capital expenditure, which is expected to lead increased investment in the health sector, lags behind. For example, over a 20-year period, recurring costs account for 78% of overall health expenditure, while capital costs account for only 22% (Obi & Ozolua, 2021).

Nigeria's health recurrent expenditure as a percentage of overall government expenditure, according to the World Health Organization global (2022) was 63.7% in 2001. This percentage decreased to 48.8% in 2002 and further decreased to 37.8% in 2003. The percentage increased to 48.3% in 2004 and then decreased to 42.9% in 2005. While, Nigeria's health capital expenditure as a percentage of total government expenditure on health was 5.2% in 2001, this percentage decreased to 4.5% in 2002 and further decreased to 3.4% in 2003. The percentage increased to 4.2% in 2004 and then decreased to 3.5% in 2005. Between 2006 and 2010, Nigeria's health capital expenditure as a percentage of total government expenditure on health fluctuated between 2.4% and 4.2%. In 2011, it was 3.7%, and in 2012, it was 3.6%. In 2013, the percentage increased to 4.1%, and in 2014, it was 3.9%. In 2015, the percentage of health capital expenditure was 3.8%, and it decreased to 3.3% in 2016. In 2017, the percentage was 3.1%, and in 2018, it was 2.9%. In 2019, Nigeria's health capital expenditure as a percentage of total government expenditure on health was 3.2%. The huge gap in favor of recurrent expenditure demonstrates the government's preference for Human Resources for Health and office overhead expenses.

Statistics from World Bank (2021) showed that the life expectancy in Nigeria for both sexes stood at 54.49 years in 2019, revealing an insignificant improvement, Nigeria was Ranked 161 out of 195 countries in the world based on life expectancy in 2019 which is lower than .that of South Africa which stood at 61.46 years, Libya 70.61 years, Egypt 70.23 years, and India 69.16 years. Analysis of Nigeria's budgetary trends across time reveals that the Federal Government has regularly devoted between 5% and 6% of its budget to health, and has never exceeded that level at any time. Inadequate government leadership, fragmented healthcare delivery, limited budget, subpar health infrastructure, imbalanced personnel distribution, and

ineffective collaboration among key players hamper the health sector (Adedokun, Adekanmbi & Uthman, 2017).

It is therefore necessary to investigate whether health expenditures have significant effects on Nigerian life expectancy and to objectively examine the effect of health expenditures on life expectancy. Thus, the following are the specific objectives, and they are to:

i. examine the impact of health capital expenditures on life expectancy in Nigeria.

ii. evaluate the impact of health recurrent expenditures on life expectancy in Nigeria.

iii. investigate the impact of out-of-pocket health expenditure on life expectancy in Nigeria.

2. Literature Review

2.1 Conceptual Review

Health spending, which encompasses all health and healthcare expenses, is made up of health and health-related expenditures as stated by the World Health Organization [WHO], (2020). Medical care, prevention, rehabilitation, community health activities, health administration and regulation, and capital production are all included. In Nigeria, healthcare financing options include tax-based governmental health finance, out-of-pocket household health spending, private sector (donor fund), and health insurance are all examples of health financing, as stated by Olayiwola, Oloruntuyi and Abiodun (2017). Donor institutions such as the World Bank, the World Health Organization, and the European Union provide grants and loans to finance healthcare in the country.

Life expectancy is a measure that determines the average number of years an individual is projected to live based on current mortality rates. It is centered on a life table that describes the likelihood of death, death rates, and survival rates for various age groups. WHO (2006) defined life expectancy at birth as the average number of years a newborn is expected to live, reflecting the overall mortality rate and pattern of mortality across different age groups. Merriam-Webster (2016) definition describes life expectancy as the average lifespan of an individual, while Crimmins (2000) suggests that life expectancy estimates are typically based on age or age group. Life expectancy at birth is the most commonly used measure as it is not affected by the age structure. Esteban (2017) defines life expectancy as the number of years a person is expected to live, based on the average age at which members of a particular population group die.

Health expenditure refers to the amount of money spent on healthcare services, while life expectancy is a measure of how long

individuals are expected to live on average. Higher levels of health expenditure are generally associated with better health outcomes and higher life expectancies due to the availability and quality of healthcare services. In addition to the direct effects on health outcomes, health expenditure can also indirectly contribute to economic growth by increasing the productivity and workforce participation of healthier individuals. However, other factors such as healthcare quality, delivery efficiency, and social determinants of health also play important roles in determining life expectancy.

2.2 Empirical Review

Several studies have used various data sources and statistical methodologies to examine the effect of health expenditure on life expectancy in Nigeria.

A study conducted by Adeoti, Adeoti and Adeoye (2020) analyzed health expenditure and life expectancy in Nigeria. Time series data spanning from 1995 to 2018 was used. They employed the Autoregressive Distributed Lag (ARDL) approach to estimate the short-run and long-run relationships between health expenditure and life expectancy. According to the findings, health capital expenditure and out-of-pocket health spending had a positive and substantial effect on life expectancy, whereas health recurrent spending had a significant and negative impact. They recommended the Nigerian government increase health capital expenditure while decreasing out-of-pocket health expenditure in order to improve the country's life expectancy.

In a similar study, Bankole, Ajayi and Oladapo (2021) investigated the impact of health expenditure on life expectancy in Nigeria from 1986 to 2016 using the ARDL technique and discovered that total health expenditure, as well as capital and recurrent expenditure, has a considerable positive impact on life expectancy in both the short and long run. A 1% increase in overall health expenditure resulted in a 0.13% increase in short-run life expectancy with a 0.28% increase in long-run life expectancy. The study recommended the Nigerian government should raise its health spending in order to improve the health of its citizens and raise their life spans.

In another study by Olabisi (2019) examined the determinants of life expectancy in developing countries. the study found that the determinants of life expectancy in developing countries included economic growth, education, access to healthcare, and social and cultural factors. Specifically, the study found that economic growth, measured by GDP per capita, had a positive and significant impact on life expectancy. In addition, education, access to healthcare, and social and cultural factors also had positive and significant impacts on life expectancy.

The study by Olowookere *et al.*, (2019) used Autoregressive Distributed Lag (ARDL) technique to analyze the relationship between healthcare expenditure and health outcomes in Nigeria. The findings indicated that health capital expenditure had a positive and significant impact on both life expectancy and infant mortality, whereas recurrent health expenditure had a negative and significant impact on both. Out-of-pocket expenditure was not found to have any significant effect on life expectancy. The study concluded that policymakers in Nigeria should prioritize increasing health capital expenditure and reducing health recurrent expenditure to enhance health outcomes in the country. Similarly, Alabi *et al.*, (2018) conducted a study to explore the correlation between healthcare financing and life expectancy in Nigeria using time series data covering 1986 to 2016. The study established a positive correlation between healthcare financing and life expectancy in Nigeria, implying that boosting healthcare funding can lead to an improvement in life expectancy.

Also, 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 authors recommend that policymakers prioritize healthcare spending to enhance the health outcomes of the Nigerian population.

Most of the reviewed studies focus health expenditure recurrent, health capital expenditure, and total health expenditure as variables for their analysis,but this paper incorporated out of pocket health expenditure which according to the World Bank in Olayinka & Afolayan (2021) accounted for approximately 76.6% of total health expenditure in Nigeria. This indicates that a significant portion of healthcare costs in Nigeria is still being paid for directly by individuals and families.Also the reviewed studies stopped at 2018 while this paper makes us of updated data

2.3 Theoretical Framework

This study is anchored on Kee (2009) model of health expenditure which is also referred to as the "Human Capital and Health Expenditure Model" or simply the "Human Capital Model". The first was based on the model's slope homogeneity, while the other was based on the slope heterogeneity. In an evaluation of provincial health expenditures, Kee identified a few key characteristics that health-care expenditure decisions

are influenced not just by income but also cost of health-care services. Decisions in the case of higher out-of-pocket payments are based on the price level; the government is heavily involved in health supply and supervision, making the health sector a complicated mechanism; health supply to elderly population is thus linked to more health expenses.

Dynamic model considered are of such form:

$$hit = \alpha + phit - Xit\,\beta + \varepsilon + \sum it = Uit \quad (1)$$

i is the provinces and t is time, β is a K x 1 vector where K is number of independent variables, X is a K x NT matrix of income and non income variables, μi is province specific parameter and Uit is the stochastic error term. The model also identifies three main factors that influence the supply of healthcare services: the healthcare services, cost in producing healthcare services, and the availability of healthcare providers. The implicit form of the model is represented mathematically as follows:

Demand for healthcare services

$$Q = f\left(E, Y, I, T\right) \quad (2)$$

Where: E represents educational level of the population, Y represents level of income of the population, I represent the availability and type of health insurance coverage, T represents advancements in healthcare technology while supply of healthcare services is mathematically as:

Supply of healthcare services

$$Q = g\left(P, C, N\right) \quad (3)$$

Where: P represents the healthcare services price, C represents healthcare services production cost, N represents availability of healthcare providers

The equilibrium level of healthcare services in the market can be determined by setting the demand for healthcare services equal to the supply of healthcare services:

$$f\left(E, Y, I, T\right) = g\left(P, C, N\right) \quad (4)$$

Equation (4) shows that the equilibrium level of healthcare services is determined by the level of education and income in the population, the availability and type of health insurance coverage, advancements in healthcare technology, healthcare services price, health care services production cost, and availability of healthcare providers.

Kee's model emphasizes the importance of healthcare technology and human capital investment in improving life expectancy, standard of living, and promote economic growth, while also considering the influence of market forces such as price and supply on the availability and affordability of healthcare services.

3. Materials and Methods

This paper used the *ex post facto* research design and times series retrieved from Central Bank of Nigeria statistical bulletin (2021); World Health Organization (2022) Global Health Expenditure database, and United Nation Development Programme [UNDP], (2021). The paper used the Autoregressive Distributed Laged (ARDL) and the Error Correction Model (ECM). According to Pesaran and Shin (1999), expanded by Pesaran, Shin, and Smith (2001) as best technique that allows the estimation of variables that are integrated into 1(0) and 1(1).

The paper adapted the model used by Ezeani and Efobi, (2018) in analyzing the effect of health expenditure on life expectancy in Nigeria the model's implicit form is:

$$LE = f(LHEX, CHEX, RHEX, OPHEX \quad (5)$$

Where LE is Life expectancy at birth, LHEX is total health expenditure, CHEX is health capital expenditure RHEX is health recurrent expenditure and OPHEX is out-of-pocket health expenditure

With an adjustment to highlight the objectives of study as well as type of data used in the analysis. The implicit function and model are shown below:

$$LEXCY_t = f(HCXP_t, HREXP_t, OPHE_t) \quad (6)$$

$LEXCY_t$ is life expectancy at a time t in Nigeria at, $HCXP_t$ represents health capital expenditure at a time t in Nigeria, HREXP represents health recurrent expenditure in Nigeria at time t, OPHE stands for out-of-pocket health expenditure in Nigeria at a time t. The following functional models are proposed to establish the functional relationship between health expenditures and life expectancy in Nigeria:

$$LEXCY_t = f(HCEX_t, HREX_t, OPHE_t) \quad (7)$$

Therefore, explicitly the model becomes:

$$LEXCY_t = \beta_0 + \beta_1 HCEX_t + \beta_2 HREX_t + \beta_3 OPHE_t + \mu_t \quad (8)$$

Where; $LEXCY_t$ is life expectancy rate in Nigeria at time t, $HCEX_t$ is health capital expenditure in Nigeria at time t and $HREX_t$ is the health recurrent expenditure in Nigeria at time t, $OPHE_t$ is the out-pocket health expenditure and β_0, β_1, β_2, β_3 and β_4 are parameters to be estimated, μ_t is the white noise error term in Nigeria at time t. The model of Autoregressive Distributed Lagged (ARDL) is:

$$\Delta LEXCY_t = \alpha_0 + \sum_{g=1}^{m} \alpha_{1i} \Delta LEXCY_{t-i} + \sum_{h=1}^{m} \alpha_{2i} \Delta HCEX_{t-i} + \sum_{i=1}^{m} \alpha_{3i} \Delta HREX_{t-i} + \sum_{i=1}^{m} \alpha_{4i} \Delta OPHE_{t-i} + \alpha_5 LEXCY_{t-i} + \alpha_6 HCEX_{t-i} + \alpha_7 HREX_{t-i} + \alpha_8 HREX_{t-i} + \varepsilon_t \quad (9)$$

Equation 9 will investigate the short-run and long-run relationships, as well as the impact of health expenditure on life expectancy in Nigeria.

Whereas the Error Correction Model (ECM) that was used in this investigation is as follows:

$$\Delta LEXCY_t = \beta_0 + \sum_{g=1}^{l} \beta_{1i} \Delta LEXCY_{t-i} + \sum_{h=1}^{m} \beta_{2i} \Delta HCEX_{t-i} + \sum_{i=1}^{n} \beta_{3i} \Delta HREX_{t-i} + \sum_{j=0}^{o} \alpha_{4i} \Delta OPHE_{t-j} + \beta ECM_{t-1} + \varepsilon_t \quad (10)$$

The estimation is adjusted using Equation 10 till the ECM coefficient becomes negative which indicates the statistical importance of the equation in terms of related t-value and probability value.

4. Results and Discussion

Table 1: Descriptive Statistics on Effect of Health Expenditure on Life Expectancy in Nigeria

	LEXCY	HREX	HCEX	OPHE
Mean	51.09091	161.3682	29.38545	71.10091
Median	51.50000	139.5450	26.50500	72.32500
Maximum	54.80000	388.3700	53.87000	77.27000
Minimum	46.60000	15.22000	7.100000	60.16000
Std. Dev.	2.686635	119.9863	15.36751	4.872459
Skewness	-0.268101	0.476731	0.167764	-0.964414
Kurtosis	1.783364	1.972952	1.824817	2.977775
Jarque-Bera	1.620407	1.800257	1.369165	3.410798
Probability	0.444768	0.406517	0.504301	0.181700
Sum	1124.000	3550.100	646.4800	1564.220
Sum Sq. Dev.	151.5782	302331.2	4959.367	498.5580
Observations	22	22	22	22

Source: Authors Computation, 2022 (Eviews-12)

The mean of each individual distribution is almost exactly located at the middle (median) of the distribution, as can be seen from the table above with exception to HREX. The mean indicates the average value of the series, but the standard deviation shows how much the data deviates from the mean and from the table above there is a large deviation from the mean. The skewness shows symmetry for all the variables (LEXCY, HREX, HCEX, OPHE) as their coefficients are positive. The kurtosis for (LEXCY, HREX, HCEX, OPHE) are platykurtic given their coefficients are less than 3. The p-value of Jacque-Bera normality test indicates normal distribution in all variables (LEXCY, HREX, HCEX, OPHE) (given the p-value is greater than 0.05 level of significance) Thus, the null hypothesis of normal distribution is accepted for all variables.

Table 2: Unit Root test results Summary using the ADF Procedure
Note: Test includes both Trend and Intercepts and all at 5% level of significance.

Variables	ADFTest Statistics	Critical Values	Order of Integration
Life Expectancy Rate (LEXCY)	-3.129237	-2.963972	I(1)
Health Capital Expenditure (HCEX)	-5.294543	-3.568379	I(1)
Health Recurrent Expenditure in Nigeria (HREX)	-6.230314	-3.580622	I(1)
Out-pocket Health expenditure (OPHE)	-5.438297	-3.568379	I(1)

Source: Authors Computation, 2022 (Eviews-12)

The stationarity test results show all variables stationary at first difference order of sintegration of the variables; hence, co-integration test determines if a long run relationship exists amongst variables. Therefore, ARDL estimation technique is the best suitable, However, to determine if the ECM will be included in the ARDL model estimation regression, it is important to test for long run relationship (co-integration).

Table 3: Bounds Test for Co-Integration Result

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	26.46524	10%	3.47	4.45
K	3	5%	4.01	5.07
		2.5%	4.52	5.62
		1%	5.17	6.36

Source: Authors Computation, 2022 (Eviews-12)

The result of the bounds co-integration test as shown above in Table 3, indicates the F-statistic of 26.46524 is greater than I(0) and I(1) critical bound of (4.01 and 5.07) at a 5% level of significance, the null hypothesis of no co-integration is rejected. The conclusion can therefore be made that there exists a long run relationship between Life expectancy, health capital, health recurrent, and out of pocket expenditure in Nigeria.

Table 4: ECM and ARDL Results
Dependent Variable of Life Expectancy in Nigeria

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	24.23259	1.783565	13.5866	0.0000
@TREND	0.374765	0.031385	11.94107	0.0001
D(HREX)	-0.001341	0.000481	-2.790355	0.0384
D(HREX(-1))	0.005742	0.000588	9.771892	0.0002
D(HREX(-2))	0.00312	0.000606	5.144676	0.0036
D(HCEX)	-0.003548	0.00215	-1.650299	0.1598
D(HCEX(-1))	0.014511	0.002035	7.130062	0.0008
D(OPHE)	0.024856	0.006264	3.967836	0.0107
D(OPHE(-1))	-0.065901	0.006248	-10.54792	0.0001
D(OPHE(-2))	-0.050264	0.006739	-7.458356	0.0007
CointEq(-1)*	-0.714886	0.05493	-13.01451	0.0000
R-squared	0.972974			
Adjusted R-squared	0.939191			
F-statistic	28.80089			
Prob(F-statistic)	0.000034			
Durbin-Watson stat	2.867124			

Long-run coefficient

Variable	Coefficient	Std. Error	t-Statistic	Prob.
HREX	-0.010844	0.002814	-3.853041	0.012
HCEX	-0.015463	0.006613	-2.338069	0.0665
OPHE	0.119336	0.027401	4.355133	0.0073

Source: Authors Computation, 2022 (Eviews-12)

From table 4, the result of that the ECM has the right sign which is negative (-) which is 0.714886. It will take a speed of 71% for the short-run disequilibrium to adjust to long-run equilibrium. With F-statistic of 28.80089 and a probability value of 0.000034 the model is a good fit. The R-squared and adjusted R-squared values indicate that the model can reasonably predict changes in Life Expectancy in Nigeria, with 97.29% and 93.91% of the variations being explained by health capital expenditure (HCEX), health recurrent expenditure (HREX), and out-of-pocket health expenditure (OPHE), while 2.71% is accounted for by the error term.

The results show that HCEX relationship with life expectancy is in the short-run, with no significant impact based on the probability value of 0.1598. However, it appears to have a significant effect in the lag period with 0.0008 probability. The long run, HCEX still maintains a negative non-significant result. HREX has a negative relationship with life expectancy in the short-run, with a significant impact based on the probability value of

0.0384. A unit increase in HREX leads 0.003548 reduction in life expectancy in Nigeria. HREX continues to have a negative significant relationship with life expectancy in the long run, as evidenced by the probability value of 0.012. Conversely, OPHE has a positive relationship with life expectancy in the short-run, with a significant impact based on the probability value of 0.0107. An increase by a unit in OPHE leads to a 0.024856 increase in life expectancy in Nigeria. In the long-run, OPHE maintains a significant and positive relationship with life expectancy, with a probability of 0.0073 value.

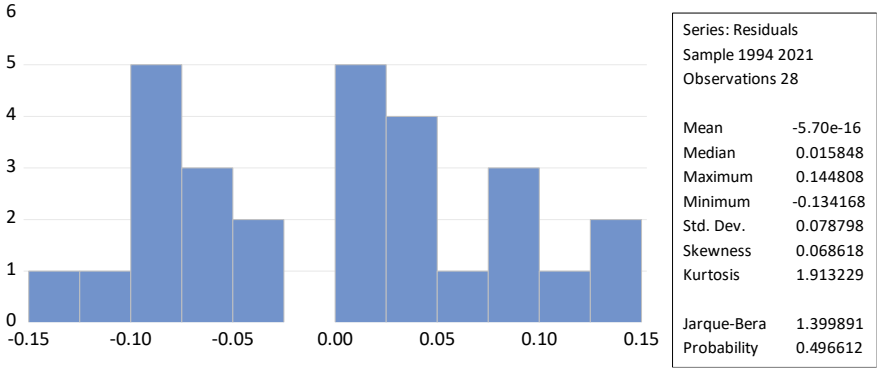

Figure 1: Normality Test
Source: Authors Computation, 2022 (Eviews-12)

The normality test is conducted to ensure that the data employed in this study are normally distributed. Observing from the normality diagram in Figure 1 as well as the Jarque-Bera value of 1.399891 and its corresponding p-value of 49 % which is greater than 5 % significant level, it confirms that the data are normally distributed.

The study findings agreed with the works of Bankole *et al.*, (2021), who investigated the impact of health expenditure on life expectancy in Nigeria from 1986 to 2016 using the Autoregressive Distributed Lag (ARDL) technique and discovered that total health expenditure, as well as capital and recurrent expenditure, has a considerable positive impact on life expectancy in both the short and long run. A 1% increase in overall health expenditure resulted in a 0.13% increase in short-run life expectancy with a 0.28% increase in long-run life expectancy. According to the report, the Nigerian government should raise its health spending in order to improve the health of its citizens and raise their lifespan. The study also advocated that the government allocate 15% of its entire budget to the health sector, in accordance with the 2001 World Health Organization (WHO) proposal of the Abuja declaration.

The findings further agreed with the work of Olabisi (2019) who examined determinants of life expectancy in developing countries determinants of life expectancy in developing countries: the role of health financing, public health and environmental factors which, found that out-of-pocket health expenditure had a positive and significant impact on life expectancy, while health capital expenditure and health recurrent expenditure had no significant impact.

5. Conclusion and Recommendations

The paper utilized Autoregressive Distributed Lag (ARDL) bound test in analyzing the effect of health expenditure on life expectancy in Nigeria between 1990 and 2021. The findings based on the Error Correction Model (ECM) result, indicates that the short-run negative relationship between health capital expenditure and life expectancy suggests that the benefits of investing in medical equipment and facilities may not be realized immediately. This could be owing to the time lag required for new healthcare facility construction and operationalization, also the time required for medical staff to obtain experience in using new medical technology. Furthermore, the short-run negative relationship between health recurrent expenditure and life expectancy suggests that allocating adequate funds for healthcare is insufficient to improve life expectancy. The positive relationship between out-of-pocket health expenditure and life expectancy indicated that people are prepared to pay for healthcare services from their pockets which, might be difficult and will result in disparities in access to healthcare.

In line with the findings, the recommendations are as follows:

i. The government of Nigeria should address the unfavorable correlation between health capital expenditure and life expectancy through a multi-facet approach which involves investing in health capital expenditure to improve the healthcare infrastructure. This can be achieved by improving the transparency and accountability of healthcare spending and investing in infrastructure to improve the efficiency of healthcare service delivery.

ii. The allocation of necessary financing for healthcare service delivery through enhancing efficiency and tackling corruption and inefficiencies in the healthcare system. These can effectively guarantee that health recurrent expenditure receives adequate funding in the national budget, which can help address brain drain among medical practitioners, improve the infrastructure of healthcare facilities, and invest in medical equipment and supplies. These efforts have the potential to make a significant difference in Nigeria's life expectancy.

iii. Out of pocket health expenditure should be encouraged through implementation of policies that incentivize citizens to invest more in their healthcare. This could involve providing tax incentives for citizens who purchase health insurance or contribute to health savings accounts this will significantly impact life expectancy in Nigeria.

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