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Governance, Health Financing and Health Outcomes in Nigeria: A Quantitative Assessment

Abstract

Good health is essential to achieve sustainable development in any economy. Nigeria is no exception. No wonder it is the third goal in the sustainable development goals of the United Nations. Achieving good health also needs to be well funded with institutional quality, hence this study. This paper examined the effect of health financing and governance quality on health outcomes in Nigeria from 1980 to 2018 using secondary data sourced from World Development Indicators (WDI). A co-integration test and a vector error correction model (VECM) were employed to analyse the data. Short- and long-term results of an analysis based on life expectancy and infant mortality as a measure of health outcomes and dependent variables demonstrate that institutions empowered with good governance could produce positive health outcomes in the country.

Keywords: health financing, governance, life expectancy, infant mortality, co-integration, VECM

JEL Classification: H110, I100, I120

Praktyki zarządzania, finansowanie ochrony zdrowia i wyniki zdrowotne w Nigerii: ocena ilościowa

Abstrakt

Dobra kondycja zdrowotna jest kluczowa dla osiągnięcia zrównoważonego rozwoju w dowolnej gospodarce, w tym w Nigerii. Nie dziwi fakt, że ONZ wskazało dobry stan zdrowia jako trzeci cel zrównoważonego rozwoju. Utrzymanie dobrej kondycji zdrowotnej wymaga nakładów finansowych oraz sprawnie funkcjonujących instytucji. Te właśnie zależności przeanalizowano w niniejszym artykule. W artykule zbadano wpływ finansowania opieki zdrowotnej i jakości zarządzania na wyniki zdrowotne w Nigerii w latach 1980–2018, wykorzystując dane wtórne oparte na Światowych Wskaźnikach Rozwoju (WDI). Na potrzeby analizy danych zastosowano test kointegracji i model wektorowej korekty błędów (VECM). Wykorzystując zarówno oczekiwaną długość życia, jak i śmiertelność niemowląt jako miarę wyników zdrowotnych i zmiennych zależnych, wykazano na podstawie wyników krótko- i długoterminowych, że instytucje usprawnione za pomocą dobrych praktyk zarządzania mogą przynieść pozytywne wyniki zdrowotne w kraju.

Słowa kluczowe: Finansowanie ochrony zdrowia, praktyki zarządzania, oczekiwana długość życia, śmiertelność niemowląt, kointegracja, VECM

Introduction

Investing in health is inevitable because protecting communities from infectious diseases brings greater security and stability. Health is not necessarily the absence of illness and diseases but the presence of the populace's adequate (psychological, social and physical) well-being. However, most of the West African Countries are faced with different levels of crises in health financing even though the region has witnessed the outbreak of global infectious diseases in recent times, such as Ebola. Public sector spending on health is low in most West African countries, Nigeria inclusive. Most of the time, making health a priority has been a daunting task. Healthcare financing implies mobilising funds for healthcare services (Oyefabi *et al.*, 2014). It could also mean providing medical and related services to maintain good health. So, the essence of financing health is to ensure that funds and proper financial incentives are available and channelled so that public and personal health care is accessible to all individuals.

Health financing covers three essential functions. These are revenue collection, risk pooling, and purchase of health services. Revenue collection is how funds are raised from different sources to finance the health system. Risk pooling is how revenue collected is managed while purchasing implies transferring the pooled funds to the providers of health services to enable them to provide health services to the population (Asante, Wasike, and Ataguba, 2020). Per capita health spending in low-income countries was $110 in 2015, which is behind target according to the World Health Organization (WHO). On average, the total health expenditure that comes from the government is less than 30%. This is low when compared to high-income and middle-income countries. This compels the populace to depend heavily on out-of-pocket expenditures (Asante, Wasike, and Ataguba, 2020; Aregbeshola, 2021). With this, millions of people do not have access to health services due to poverty. Out-of-pocket expenditure (OOP) constitutes almost 70% of total national healthcare expenditure (Alfred *et al.*, 2016; Micheal, Aliyu, and Grema, 2020). This high OOP has pushed poor households to self-medication, quack practitioners, and postponing medical treatment. All these harm individuals' and households' health and impoverish people with low incomes even more. Despite the importance of health financing, some studies found health financing to improve health outcomes (Kulkarni, 2016; Edeme, Emecheta, and Omeje, 2017), while in some countries, health financing does not promote health outcomes (Nathaniel and Khan, 2019).

One of the following three models describes the health system of most countries – national health, social, and private insurance models (Kulesher and Forrestal, 2014). The national health model is seen as the universal health coverage of all citizens by the federal government financed through tax revenue; the social insurance model is funded by any employer, individual or private insurance funds; the private insurance model is employment-based or when individuals purchase health insurance (private) which is financed by employers or individuals. The governments of developing countries adopt different health financing models to achieve universal health coverage. Standard models in developing countries are private, community-based, and social health insurance (Domapielle, 2020). In low-income countries, the informal sector population is found to be excluded from the social health insurance scheme. It majorly captures the formal sector. In Nigeria, the Federal Government introduced the National Health Insurance Scheme (NHIS) to guarantee better access to efficient healthcare services and reduce household out-of-pocket expenditure. However, statistics revealed that as of 2016, approximately 4.2% of the population were covered. These are mainly the federal government's civil servants (including their dependents) (Health and Managed Care Association of Nigeria, 2017). As a result, 75.2% of total health expenditure was accounted for by Out-Of-Pocket spending, which implies that 25% of the households spend over 10% on health, which exposed those households to catastrophic health expenditure.

Likewise, in 2016, total government health expenditure was 0.6 per cent of GDP (World Bank, 2017). This low level of government health expenditure was due to the economic downturn. However, it was further argued that even when the country had good economic terms, there has been a lower investment in health over two decades compared to countries with similar economic status to Nigeria (World Bank, 2017). There are also disparities in health system financing, such as uneven distribution of resources and budget constraints in different areas across countries. The health outcomes in Nigeria are not so encouraging. Life expectancy for males is 54.7, female is 55.7, while total life expectancy is 55.2 in Nigeria (WHO, 2018), infant mortality rate for Nigeria in 2019, 2018, 2017 were 60.662, 62.142, 64.708 deaths per 1000 live births respectively (United Nation-World Population prospect, 2019), maternal mortality rate for Nigeria in 2015, 2014, 2013 were 814.00, 820.00, 821.00 per 100,000 live births respectively (World Bank, 2012).

The government cannot be left out in making concrete decisions related to the well-being of its populace. Some empirical studies opined that good governance is needed to improve health outcomes through health financing (Holmberg and Rothstein, 2011; Osakede, 2020). Therefore, good governance has a role to play in promoting health outcomes. Nigeria has been described as experiencing political instability, corruption, an ineffective government, and a lack of rule of law (Fayissa and Nsiah, 2010).

Good governance provides checks and balances in health financing for the system's proper functioning (Phua *et al.*, 2015). Corruption is experienced by 80% of the population in the health sector in developing countries (Holmberg and Rothstein, 2011). Corruption could involve bribing health professionals and diverting medical supplies meant for public use into personal use (Vian, 2008; Mackey and Liang, 2012). According to (Easterly, 2006), it is possible for donors also to influence bad governance when they support corrupt governments or programs that are not successful, and these all have effects on global health outcomes. More so, fungibility exists if external aid for health care reduces government health spending from domestic sources (WHO, 2011). Several studies have studied government spending and health outcomes, but few have investigated health financing and governance. It is, therefore, against this background and given the importance of health financing that this study aims to assess the effect of health financing and good governance on health outcomes in Nigeria. Section two presents the relevant literature review, while data and methodology are specified in section three. In section four, the variables are analysed, results are discussed, and conclusions are drawn in section five.

Empirical review

Governance and health outcomes in Nigeria

Faraq (Faraq *et al.*, 2013) examined the relationship between health expenditure and health outcomes and the role of good governance in 133 low-income and middle-income countries. The study proxied health outcomes with child and infant mortality, while the health expenditure proxy was total and public health spending and GDP per capita. Also, government effectiveness was used to measure good governance. The fixed effect model result shows that health spending significantly reduced child and infant mortality and government health spending. The study concluded that health spending is adequate with good governance. Likewise (Hu and Mendoza, 2013) examined the determinants of child health in developing countries in 136 countries between 1960 and 2005. Their empirical analysis suggests that quality of governance (control of corruption and bureaucracy quality) and public spending on health services reduce child mortality. Sirag *et al.* (2017) examined the determinants of health financing in 177 developed and developing countries. They formulated three public health financing models in their study for the countries. The first model does not include the institutional variables;

the second model includes one of the two institutional variables, government effectiveness, while the third model includes the other institutional variable, control of corruption. Using GMM estimators, the empirical findings showed that income improves health financing with an elasticity of less than one. Public expenditures as a share of GDP improve total and public health financing while lowering private health financing. Also, developed countries are characterised by a high quality of governance, while low quality of governance is peculiar to developing countries. Their study concluded that GDP per capita and government expenditure are important factors that influence health financing. Governance quality is also an essential factor that helps achieve sustainable health financing, which will drastically reduce catastrophic health expenditures and out-of-pocket expenses, which could further impoverish people experiencing poverty.

Bashir (2016) evaluated the role of government expenditure in Nigeria's health sector. They measured life expectancy and infant mortality rates against government expenditure between 2000 and 2013. Pearson's moment correlation indicates that when government spending on health increases, the infant mortality rate reduces, significantly improving the government's life expectancy and expenditure. In selected middle-income countries, Salatin and Noorpoor (2015) examined the theoretical relationship between quality of governance effectiveness and health economics between 2002 and 2011. The methods of estimation used were Generalised least squares (GLS) and Generalised method of moments (GMM), and their findings showed that governance quality has a positive and significant effect on life expectancy. Some studies (Thornton, 2002; Baltigi and Moscone, 2010; Santias *et al.*, 2011; Moscone *et al.*, 2012; Fayissa and Train, 2013; Ravangard, 2014) have used the production function approach to examine the performance of health care system, and this is mainly estimated using the ordinary least square (OLS) techniques. This approach consists of input and output variables, where the input variables contribute to output production. The output variables could be life expectancy at birth and infant mortality rate. In contrast, the input variables could be health care resources both in monetary and non-monetary terms.

Grossman (1972) developed a demand for a good health model. This model assumes that health is a durable capital stock which produces healthy output time. It is also assumed that there is a first stock of health inherited by individuals that reduces with age at an increasing rate, which could be increased by investment. The rate of depreciation increases when humans grow older, and thus, expenditure on health and medical care increases for elderly people. The model stated that a person's accumulated knowledge affects productivity (market or non-market). At the same time, the time he spends on earning and commodities depends on his health stock. When the stock falls below a certain level, death occurs. Consumers demand health as a commodity (investment and consumption commodity).

Similarly, a demand for a health model was developed by Galama (2011). The model predicted a negative relationship between health status and showed that a healthier population demands fewer medical services than a less healthy population. Keynesian fiscal policy has a direct influence on consumption and investment. It depends on tax policy and how public expenditures are administered. In the healthcare system, fiscal policy is essential to ensure adequate health sector financing, equity in health services distribution, and easy access to the populace to reduce out-of-pocket expenditures. Tax policy is the primary source of public revenue used to finance public expenditure, which increases the income level, expands effective demand and enhances the equal distribution of income. The policy also has a macroeconomic role in determining economic growth and income distribution. This should be implemented over time to prevent the occurrence of peaks and slumps in investment (Galama, 2011).

Health financing and health outcomes in Nigeria

Anton and Onofrei (2012) investigated the relationship between health system performance and total health spending in some selected countries from Central and Eastern Europe. The regression analysis performed with cross-sectional data explained the differences in health expenditure and the implications this has on the system efficiency. Their findings show that the total health spending and GDP per capita are essential factors explaining the differences in the health sector, apart from other lifestyle factors that could also play essential roles. Using the fixed effect model, Kim and Lane (2013) used two health outcome indicators to analyse the relationship between national outcomes and public health expenditure among seventeen OECD countries between 1973 and 2000. The results showed that government health expenditure reduces infant mortality and life expectancy. Their findings also discovered that men consume health services more regularly than women. Likewise, there is an essential improvement in health outcomes for women when spending on health expenditure increases. This effect is more pronounced than in men. The study (Oladosu, Chanimbe, and Anaduaka, 2020) examined the impact of public health expenditure on health outcomes in Ghana and Nigeria. Health outcomes were captured with HIV/AIDS, maternal, malaria and infant mortality. The study finds that public health expenditure needs to be augmented in Ghana and Nigeria to improve health outcomes. Using pooled regression and pairwise correlation, Sango-Coker and Bein (2018) investigated West Africa's private, public, and public-private healthcare sectors from 1999 to 2014. They found out that the women in the population lived longer than men. Also, in the public health sector, healthcare spending improves life expectancy, while healthcare spending does not significantly improve life expectancy in the private health sector. The findings of Bein *et al.* (2017) on the relationship between healthcare expenditures and health outcomes in eight East African countries with the use of regression techniques show that healthcare expenditures contribute positively to life expectancy (both male and female) while healthcare expenditures reduce the number of neonatal, infant and under-five deaths.

In addition, Kulkarni (2016), in his study on examining the differences in the healthcare systems of emerging economies of BRICS, found that health outcome improves the Adult Literacy rate, GDP per capita, and out-of-pocket expenditure while the public health expenditure is positively related to Infant Mortality Rate. Boachie *et al.* (2018) re-examines the connection between government health outcomes and health expenditures with the use of annual data for the period of 1980–2014 on Ghana and Ordinary Least Square estimates (OLS) and two-stage Least Squares (2SLS) estimators. Their findings show that income and public health expenditure contribute to improving health outcomes within the study period. The health sector can be measured using four measures: equity, sustainability, accountability and performance (Health Finance and Governance Briefing Kit, 2015). Equity as a measure of the health sector aids better health outcomes, and it is simply the gap between health quality and peoples' access to health care services in a country. When the population have access to quality healthcare services, these services should be sustainable in the sense that the present and future amount of resources must be sufficient to meet the health needs of the present and future population. The sustainability of these resources also depends on the accountability and performance of the health sector. This will ensure checks and balances in the health sector and enable the government to implement effective health policies and deliver quality health services to the public in rural and urban areas (Sango-Coker and Bein, 2018).

Data and methodology

Secondary data were employed for the study. The data were sourced from the National Health Account (NHA) from the WHO database for public, private and total health financing, the World Development Indicator (WDI) of the World Bank, the World Governance Indicator (WGI) and ICRG for Governance variables. The dependent variables are life expectancy and infant mortality. In contrast, the explanatory variables are government effectiveness, bureaucracy quality, democracy index, GDP per capita, government spending on health, gross capital formation, and carbon emissions. The study made use of the health production function, which was postulated by Grossman (1972) and was also used in studies by Galama (2011), Riman and Akpan (2012), and Boachie *et al.* (2018). The health production function model is specified below:

$$Y_t = (Z_t, X_t) \tag{1}$$

Where t = 1, 2, 3, ……..T; Y_t is a vector for the two dependent variables, that is, life expectancy at birth (LEAB) and infant mortality rate (IMR); Z_t is a vector for GDP per capita (GDPC), domestic government health expenditure (DGHEXP), gross capital formation (GCF) and Carbon emission (CAEM); X_t is a vector for governance variables that is, government effectiveness (GVEF), Bureaucracy quality (BUQU) and democracy index (DMIN).

$$Y_t = \alpha Z_t + \beta X_t + \varepsilon_t \tag{2}$$

α and β and are the coefficients of health financing and governance variables, while ε_t is the error term. By disaggregating the components of Z_t and X_t. Equation 2 becomes

$$LEAB_t = \alpha_1 GDPC_t + \alpha_2 DGHEXP_t + \alpha_3 GCF_t + \alpha_4 CAEM_t + \beta_1 GVEF_t + \beta_2 BUQU_t + \beta_3 DMIN_t + \varepsilon_t \tag{3a}$$

$$IMR_t = \alpha_1 GDPC_t + \alpha_2 DGHEXP_t + \alpha_3 GCF_t + \alpha_4 CAEM_t + \beta_1 GVEF_t + \beta_2 BUQU_t + \beta_3 DMIN_t + \varepsilon_t \tag{3b}$$

To specify the long-run model for the VECM, we have the following:

$$ECT_{t-1} = Y_{t-1} - \alpha j X_{t-1} + \beta i R_{t-1} - \emptyset m U_{t-1} - \infty n V_{t-1} - \mu b W_{t-1} - \pi c Z_{t-1} - \varphi d S_{t-1} \tag{4}$$

To specify the short-run model, we have:

$$\Delta Y_t = \sigma + \sum_{j=1}^{k-1} \alpha j \Delta X_{t-j} + \sum_{i=1}^{k-1} \beta i \Delta R_{t-i} + \sum_{m=1}^{k-1} \emptyset m \Delta U_{t-m} + \sum_{n=1}^{k-1} \infty n \Delta V_{t-n} + \sum_{b=1}^{k-1} \mu b \Delta W_{t-b} + \sum_{c=1}^{k-1} \pi c \Delta Z_{t-c} + \sum_{d=1}^{k-1} \varphi \Delta S_{t-d} \tag{5}$$

Results and discussion

Note that LLEAB means log of life expectancy at birth, LIMR is a log of infant mortality rate, GVEF is government efficiency, BUQU is bureaucracy quality, LGDPC is a log of GDP per capita, DGHEXP is the domestic government health expenditure, LGCF is the log of gross capital formation, LCAEM is a log of carbon emission, DMIN is democracy index. We used the three-year moving average method to fill up the missing data in the Excel spreadsheet for this analysis so that we would not have any missing data.

Summary statistics

Table 1 below presents the summary statistics of both the dependent and explanatory variables. Descriptive statistics lets us determine whether the data are consistent and normally distributed. LIMR, LCAEM, GVEF, and DMIN are negatively skewed, while LLEAB, LGDPC, LGCF, and DGHEXP are positively skewed. The kurtosis tells us that GVEF, DMIN, and DGHEXP are peaked relative to the normal distribution while LLEAB, LIMR, LGDPC, LGCF, and LCAEM are flat relative to the normal distribution. Also, all the variables have a positive mean value except GVEF, which has a negative mean value. The positive mean value implies an upward trend in the time series where LGDPC has the highest mean value while DGHEXP has the lowest.

Table 1. Descriptive statistics of the data

	LLEAB	LIME	LGDPC	LGCF	LCAEM	GVEF	DMIN	DGHEXP
Mean	3.8699	5.1528	12.4611	29.0470	11.1378	-1.0097	2.9929	0.5363
Median	3.8314	5.2476	12.3788	28.7284	11.2051	0.9889	3.0741	0.4956
Maximum	3.9881	5.3627	12.8619	30.0478	11.5718	-0.8928	4.5000	0.8535
Minimum	3.8140	4.7867	12.2013	27.9950	10.4688	-1.2146	0.5000	0.3315
Std. Dev.	0.0574	0.2101	0.2371	0.6419	0.3731	0.0667	0.9175	0.1082
Skewness	0.8966	-0.5088	0.4630	0.3316	-0.5255	-1.5252	-0.9094	1.6609
Kurtosis	2.2156	1.6044	1.6169	1.6176	1.7605	5.2235	3.8692	5.4966
Jarque-Bera	6.2254	4.8476	4.5018	3.8202	4.2917	23.1155	6.6037	28.0604
Probability	0.0444	0.0886	0.1053	0.1481	0.1170	0.0000	0.0368	0.0000
Observations	39	39	39	39	39	39	39	39

Source: authors' computation

Unit root test

The results from the unit root test are presented in Tables 2a and 2b below. Augmented Dickey-Fuller (ADF) and Philip Perron (PP) are used to test for the Unit root. The result in Table 2a shows the unit root test with intercept, while Table 2b shows the unit root test with intercept and trend. In Table 2a, BUQU, LCAEM, DGHEXP, DMIN, and LGDPC are significant at 1% for both the ADF and PP. The LGCF is significant at levels for ADF and PP at 10% and 1%, respectively; LLEAB was significant at levels at 10% for ADF, while LIMR was significant at the first difference for ADF at a 5% significance level. In Table 2b, BUQU, LCAEM, DGHEXP, DMIN, and GVEF are significant at a 1% level for both the ADF and the PP test. LGDPC was significant at 5% level both for the ADF and PP test, LGCF was significant at levels for ADF at 5% level and significant at first difference for PP at 1%.

Table 2a. Unit root test (Augmented Dickey-Fuller [ADF] and Phillip Perron [PP] test with intercept)

Variable	ADF test			PP test		
	Level	Ist Diff.	Remarks	Level	Ist Diff.	Remarks
BUQU	-2.5081	-5.0198***	I(1)	-2.2762	-5.9261***	I(1)
LCAEM	-1.1854	-6.0036***	I(1)	-1.2095	-6.0036***	I(1)
DGHEXP	-2.8382	-7.0166***	I(1)	-2.7709*	-6.4240***	1(1)
DMIN	-1.8901	-5.8869***	I(1)	-1.7341	-8.2459***	1(1)
LLEAB	-2.8497*	-1.0765	I(0)	1.3050	-1.0777	
LIMR	1.7859	-3.4762**	I(1)	1.0274	-1.2381	
GVEF	-4.7175***	-3.6563**	I(0)	-4.7361***	-23.4717	I(0)
LGDPC	-1.2215	-4.2121***	I(1)	-0.8291	-4.2659***	I(1)
LGCF	-0.9077	-2.6577*	I(1)	-0.7803	-5.0564***	I(1)

Note: *, **, *** denote 1%, 5% and 10% level of significance, respectively

Source: authors' computation

Table 2b. Unit root test (Augmented Dickey-Fuller [ADF] and Phillip Perron [PP] test with intercept and trend)

Variable	ADF test			PP test		
	Level	Ist Diff.	Remarks	Level	Ist Diff.	Remarks
BUQU	-2.5286	-5.0259***	I(1)	-2.3270	-5.9622***	I(1)
LCAEM	-1.9128	-5.9655***	I(1)	-1.9380	-5.9655***	I(1)
DGHEXP	-2.8823	-6.9364***	I(1)	-2.8305	-6.3249***	1(1)
DMIN	-2.8709	-5.9840***	I(1)	-2.3455	-12.6838***	1(1)
LLEAB	-3.5913**	1.6657	I(0)	-0.9228	-0.8153	
LIMR	-1.0717	-4.0421**	I(1)	-1.7322	-1.6351	
GVEF	-5.1814***	-3.8401**	I(0)	-5.1814***	-22.6869***	I(0)
LGDPC	-2.2744	-3.5648**	I(1)	-4.0260**	-3.9568**	I(1)
LGCF	-3.6665**	-2.9279	I(0)	-2.3613	-5.6603***	I(1)

Note: **, *** denote 1% and 5% level of significance, respectively

Source: authors' computation

Co-integration test

The co-integration test was introduced by Granger (1981) and Engle and Granger (1987). It implies stationarity due to a linear combination of two integrated variables with a common stochastic trend. In Tables 3a and 3b below, the test statistic's result shows that at least eight equations are co-integrated among the variables at the significance level of 5%. It could be deduced from this that a long-term relationship exists between the model's short-term and long-term equilibrium dynamics.

Table 3a. Co-integrating results with LLEAB as the dependent variable

Hypothesised	Trace			
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.970991	421.1278	159.5297	0.0000
At most 1 *	0.898529	293.6824	125.6154	0.0000
At most 2 *	0.853295	211.3149	95.75366	0.0000
At most 3 *	0.767976	142.2190	69.81889	0.0000
At most 4 *	0.707508	89.62606	47.85613	0.0000
At most 5 *	0.501986	45.37060	29.79707	0.0004
At most 6 *	0.326295	20.27399	15.49471	0.0088
At most 7 *	0.154818	6.055312	3.841466	0.0139

The trace test indicates eight co-integrating equations at the 0.05 level.

Source: authors' computation

Table 3b. Co-integrating results with LIMR as the dependent variable

Hypothesised	Trace			
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.944977	384.3059	159.5297	0.0000
At most 1 *	0.890390	279.9055	125.6154	0.0000
At most 2 *	0.849726	200.3157	95.75366	0.0000
At most 3 *	0.772142	132.0851	69.81889	0.0000
At most 4 *	0.760768	78.83986	47.85613	0.0000
At most 5	0.373435	27.34825	29.79707	0.0934
At most 6	0.240260	10.51818	15.49471	0.2430
At most 7	0.017242	0.626109	3.841466	0.4288

The trace test indicates eight co-integrating equations at the 0.05 level.

Source: authors' computation

Vector Error Correction Model (VECM)

VECM is appropriate for variables that have a co-integrating relationship. In the VECM model, the equation is different, and it also includes an error correction term (ECT), which implies the deviation from long-term equilibrium in the previous period. In a VECM model, we have both the long run (ECT) and the short run relationship. Tables 4a and 5a explain the long run relationship with LLEAB and LIMR as dependent variables, respectively, while Tables 4b and 5b explain the short run relationship with LLEAB and LIMR as the dependent variables respectively. In Table 4a, GCF, CAEM, GVEF, DGHEXP, and BUQU have a positive relationship with LLEAB, while GDPC and DMIN have a negative relationship with LLEAB, on average, ceteris paribus. Our result supports the findings of Kim and Lane (2013) that a positive relationship exists between government health expenditure and LLEAB. It is also partially in support of the findings of Anton and Onfrei (2012), who found that total health spending (DGHEXP) and GDP per capita (GDPC) are the most critical factors that explain the differences in health status. Also, two of our measures of governance quality (GVEF and BUQU) have a positive effect on LLEAB, which supports the findings of (Salatin and Noorpoor, 2015) that governance quality has a positive and significant effect on LLEAB.

In Table 4b, the co-integrating equation value implies that the deviation from the long-run equilibrium in the previous year is corrected for the current period as an adjustment speed of 0.37%. Also, a change in percentage in LGDPC, LGCF, LCAEM, DMIN, and DGHEXP is associated with 1.1, 0.08, 0.11, 0.07, and 0.26 percentage increase in LLEAB on average, respectively. In contrast, a percentage change in GVEF and BUQU is associated with an average 0.50 and 0.02 percentage decrease in LLEAB, respectively, in the short run. This supports the study of (Kim and Lane, 2013; Bashir, 2016; Bein *et al.*, 2017), that a government expenditure improves health (DGHEXP) and LLEAB. More so, the result also supports the findings of (Boachie *et al.*, 2018) that public health expenditure improves health outcomes.

In Table 5a, GCF, CAEM, GVEF, DGHEXP, and BUQU negatively affect LIMR, while GDPC and DMIN positively affect LIMR. This supports the findings of Kulkarni (2016) that GDPC has a positive effect on LIMR while CAEM has a negative effect on LIMR. It also supports the study of Bashir (2016) that an increase in the government budget for the health sector (DGHEXP) can reduce the mortality rate (infant).

In Table 5b, the co-integrating equations imply an adjustment speed of 102% from the previous year to the current period. Also, a one per cent change in LGDPC, LGCF, LCAEM, and DGHEXP is associated with 4.2, 925, 0.27 and 0.59 percentage decreases, respectively, in LIMR, while a percentage change in GVEF, DMIN, and BUQU is associated with 1.09, 0.15, 0.21 increase in LIMR in the short run. An increase in LGDPC and LGCF percentages will have a very significant influence on reducing IMR. This supports the findings of (Anton and Onfrei, 2012) that the most critical factors that significantly explain the differences in health status are LGDPC and DGHEXP.

Tables 4c and 5c explain the response of LLEAB and LIMR to shocks, respectively. In Table 4c, the response of LLEAB to GVEF and GCF is adverse to a positive shock of one standard deviation. This implies that LLEAB responds negatively to shocks in GVEF and GCF. Also, if one standard deviation positive shock is given to BUQU, GDPC, DGHEXP and CAEM, life expectancy will react to these shocks in all ten periods. This means life expectancy reacts to positive shocks in BUQU, GDPC, DGHEXP, and CAEM.

In Table 5c, the infant mortality rate (IMR) responds negatively to a shock in GVEF, GDPC, DGHEXP, GCF and DMIN through the ten periods, while IMR responds positively to a shock in BUQU and CAEM through the ten periods.

Tables 4d and 5d give the variance decomposition for LLEAB and LIMR, respectively. The variance decomposition scale is the variation (in percentage) in the endogenous variables induced by the shocks (innovations) that result from any variables in the system (Akintunde and Satope, 2013). The variance decomposition also tells the level of information that each variable adds to the other in the auto-regression and predicts the error variance of each variable that other variables' exogenous shocks can explain.

In Table 4d, GVEF, BUQU, LGDPC, DGHEXP, LGCF, LCAEM, and DMIN do not explain variations in LLEAB in period one. The shock from each variable increased from zero in the first period to 2.00, 0.13, 4.76, 0.08, 0.61, 1.59 and 0.01 per cent, respectively, in the tenth period. GDPC and GVEF offer significant explanations for LLEAB, while DMIN has the lowest power to explain the variations in LLEAB. This supports the findings of Sirag, Nor and Abdullah (2017) that GDPC is a crucial factor to be considered in health financing and that a high level of government effectiveness (GVEF) stimulates public health financing and reduces private health financing.

In Table 5d, GVEF, BUQU, LGDPC, DGHEXP, LGCF, LCAEM, and DMIN did not explain variations in LIMR in the first period. The shock from each variable increased from zero in the first period to 0.48, 0.72, 0.24, 0,.33, 1.79, 3.42 and 1.82 per cent, respectively, in per cent, nth period. C, AEM and DMIN offer significant explanations for LIMR, while LGDPC has the lowest power to explain the variations in LIMR. This supports Kulkarni's (2016) study that CAEM is significant in explaining the variations in LIMR.

The co-integrating equation and the long-run model can be expressed as

$$ECT_{t-1} = Y_{t-1} - \alpha j X_{t-1} - \beta i R_{t-1} - \text{ø} m U_{t-1} - \infty n V_{t-1} - \mu b W_{t-1} - \pi c Z_{t-1} - \varphi d S_{t-1}$$

therefore, the long-term result for Table 4a can be expressed as

$$ECT_{t-1} = 1.0000LLEAB_{t-1} - 9.59E\text{-}05GDPC_{t-1} + 1.43E\text{-}1GCF_{t-1} + 5.63E\text{-}05CAEM_{t-1} + 20.8839GVEF_{t-1} - 2.0619DMIN_{t-1} + 7.5530DGHEXP_{t-1} + 0.6757BUQU_{t-1} - 11.4384$$

Table 4a. Long run relationship with LLEAB as the dependent variable

Co-integrating Eq.	coinEq1
LLEAB (-1)	1.0000
GDPC (-1)	-9.59E-05 (4.2E-06) [-22.6115]
GCF (-1)	1.43E-1 (9.3E-12) [15.3098]
CAEM(-1)	5.63E-05 (8.1E-06) [6.9188]
GVEF (-1)	20.8839 (1.2515) [16.6877]
DMIN(-1)	-2.0619 (0.1096) [-18.8067]
DGHEXP (-1)	7.5530 (0.9627) [7.8459]
BUQU (-1)	0.6757 (0.0896) [7.5401]
C	-11.4384

Source: authors' computation

Table 4b. Short run relationship with LLEAB as the dependent variable

Error Correction Term	LLEAB
Co-integrating equation	0.0037
LGDPC	0.0108
LGCF	0.0008
LCAEM	0.0011
GVEF	-0.0050
DMIN	0.0007
DGHEXP	0.0026
BUQU	-0.0002

Source: authors' computation

Table 4c. Response of LLEAB to shocks

Period	LLEAB	GVEF	BUQU	LGDPC	DGHEXP	LGCF	LCAEM	DMIN
1	0.002867	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.005468	-0.000403	4.37E-05	0.000433	0.000155	-3.57E-05	0.000427	0.000131
3	0.007873	-0.000757	6.47E-05	0.000958	0.000175	-0.000157	0.000819	0.000187
4	0.010119	-0.001251	0.000116	0.001593	0.000236	-0.000417	0.001166	0.000125
5	0.012128	-0.001639	0.000254	0.002315	0.000303	-0.000679	0.001484	6.40E-05
6	0.013951	-0.002006	0.000412	0.002946	0.000383	-0.000966	0.001786	-3.13E-06
7	0.015586	-0.002338	0.000547	0.003560	0.000461	-0.001242	0.002071	-6.77E-05
8	0.017051	-0.002632	0.000680	0.004111	0.000533	-0.001498	0.002327	-0.000131
9	0.018361	-0.002900	0.000801	0.004614	0.000599	-0.001732	0.002561	-0.000187
10	0.019531	-0.003137	0.000910	0.005065	0.000658	-0.001944	0.002770	-0.000239

Table 4d. Variance decomposition result for LLEAB

Period	SE.	LLEAB	GVEF	BUQU	LGDPC	DGHEXP	LGCF	LCAEM	DMIN
1	0.002867	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.006220	98.51087	0.418803	0.004933	0.484118	0.061696	0.003289	0.471948	0.044347
3	0.010146	97.24794	0.714240	0.005922	1.073470	0.053016	0.025325	0.829421	0.050669
4	0.014528	95.94780	1.089401	0.009257	1.725307	0.052327	0.094685	1.049068	0.032156
5	0.019210	94.73647	1.351241	0.022753	2.438840	0.054816	0.179234	1.197150	0.019501
6	0.024100	93.70365	1.551614	0.043627	3.044246	0.060148	0.274664	1.309658	0.012392
7	0.029124	92.80144	1.706913	0.065190	3.579019	0.066205	0.369997	1.402213	0.009025
8	0.034223	92.03308	1.827856	0.086643	4.034778	0.072229	0.459440	1.477978	0.007997
9	0.039353	91.37288	1.925366	0.106911	4.426338	0.077759	0.541127	1.541302	0.008314
10	0.044479	90.80717	2.004525	0.125551	4.761626	0.082760	0.614649	1.594314	0.009405

The co-integrating equation and the long-run model for Table 5a can be expressed as

$$ECT_{t-1} = Y_{t-1} - \alpha jX_{t-1} - \beta iR_{t-1} - \o mU_{t-1} - \infty nV_{t-1} - \mu bW_{t-1} - \pi cZ_{t-1} - \varphi dS_{t-1}$$

therefore, the long-term result below can be expressed as

$$ECT_{t-1} = 1.0000LIMR_{t-1} + 0.0013GDPC_{t-1} - 2.14E\text{-}11GCF_{t-1} - 0.0007CAEM_{t-1} - 334.0696GVEF_{t-1} + 1.0228DMIN_{t-1} - 87.9806DGHEXP_{t-1} - 7.7408BUQU_{t-1} - 727.2442$$

Table 5a. Long run relationship with LIMR as the dependent variable

Co-integrating Eq	coinEq1
LIMR (-1)	1.0000
GDPC (-1)	0.0013 (6.8E-05) [18.8822]
GCF (-1)	-2.14E-11 (1.3E-12) [-16.7152]
CAEM(-1)	-0.0007 (0.0001) [-4.8214]
GVEF (-1)	-334.0696 (21.7041) [-15.3920]
DMIN(-1)	1.0228 (0.0683) [14.9820]
DGHEXP (-1)	-87.9806 (8.6140) [-10.2136]
BUQU (-1)	-7.7408 (1.4653) [-5.2827]
C	-727.2442

Source: authors' computation

Table 5b. Short-term relationship with LIMR as the dependent variable

Error Correction Term	LIME
Co-integrating equation	-0.0035
LGDPC	-0.0420
LGCF	-9.25E
LCAEM	-0.0027
GVEF	0.0110
DMIN	0.0015
DGHEXP	-0.0059
BUQU	0.0021

Source: authors' computation

Table 5c. Response of LIMR to shocks

Period	LIME	GVEF	BUQU	LGDPC	DGHEXP	LGCF	LCAEM	DMIN
1	0.002442	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.006421	-0.000136	0.000182	-0.000678	-0.000177	-0.000517	0.000524	-0.000473
3	0.010693	-0.000428	0.000349	-0.001081	-0.000406	-0.001120	0.001509	-0.001129
4	0.014785	-0.000765	0.000805	-0.001287	-0.000772	-0.001688	0.002455	-0.001765
5	0.018719	-0.001159	0.001279	-0.001372	-0.001084	-0.002345	0.003349	-0.002400
6	0.022523	-0.001526	0.001735	-0.001376	-0.001338	-0.003005	0.004215	-0.003051
7	0.026128	-0.001876	0.002229	-0.001343	-0.001584	-0.003621	0.005045	-0.003668
8	0.029528	-0.002212	0.002711	-0.001298	-0.001818	-0.004218	0.005831	-0.004246
9	0.032757	-0.002535	0.003159	-0.001245	-0.002029	-0.004794	0.006576	-0.004801
10	0.035816	-0.002839	0.003590	-0.001187	-0.002228	-0.005337	0.007283	-0.005329

Source: authors computation

Table 5d. Variance decomposition result for LIMR

Period	SE.	LIMR	GVEF	BUQU	LGDPC	DGHEXP	LGCF	LCAEM	DMIN
1	0.002442	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.006965	97.30145	0.038134	0.068007	0.948745	0.064774	0.551660	0.566804	0.460424
3	0.013011	95.42009	0.119159	0.091312	0.961554	0.116103	0.899493	1.507184	0.885107
4	0.020084	94.24114	0.194962	0.198919	0.813909	0.196418	1.083654	2.127393	1.143601
5	0.027969	93.38636	0.272127	0.311815	0.660301	0.251451	1.261591	2.530383	1.325969
6	0.036533	92.74255	0.333993	0.408382	0.528952	0.281611	1.415831	2.813985	1.474694
7	0.045631	92.23486	0.383038	0.500298	0.425678	0.301077	1.537382	3.026283	1.591383
8	0.055146	91.82124	0.423138	0.584270	0.346815	0.314766	1.637601	3.189877	1.682290
9	0.065004	91.47860	0.456628	0.656709	0.286265	0.323924	1.722565	3.319123	1.756189
10	0.075137	91.19104	0.484530	0.719775	0.239229	0.330355	1.793835	3.423752	1.817479

Source: authors computation

Conclusion

Quality health is vital for everyone because of its effect on economic and human welfare. Adequate financing of the health sector and good governance quality could improve the delivery of health services and health outcomes in less developed countries. Therefore, we have examined how health financing and quality of governance impacted health outcomes in Nigeria over 39 years (1980–2018).

The findings show that in the long run, gross capital formation (GCF), carbon emission (CAEM), government effectiveness (GVEF), domestic government expenditure (DGHEXP) and bureaucracy quality (BUQU) have a positive effect on life expectancy at birth (LEAB). In contrast, GDP per capita (GDPC) and democracy index (DMIN) adversely affect LEAB. This implies that an increase in GCF, CAEM, GVEF, DGHEXP and BUQU will increase LEAB and vice versa, while an increase in GDPC and DMIN will reduce LEAB and vice versa in the long run. Also, gross capital formation, carbon emission, government effectiveness, domestic government expenditure and bureaucracy quality have reduced the infant mortality rate (IMR). At the same time, GDP per capita and the democracy index have a positive relationship with IMR in the long run. This suggests that an increase in GCF, CAEM, GVEF, DGHEXP, and BUQU will reduce the infant mortality rate in the long run, while the increase in GDPC and DMIN will increase IMR. The short-term effect shows that GDPC, GCF, CAEM, DMIN, and DGHEXP increase LEAB while GVEF and BUQU decrease LEAB. Also, GDPC, GCF, CAEM, and DGHEXP decrease IMR while all the governance measures (DMIN, GVEF, and BUQU) increase IMR in the short run. The impulse response result shows that LLEAB responds negatively to a shock in GVEF and GCF, while LLEAB responds positively to a shock in BUQU, GDPC, DGHEXP, and CAEM. IMR respond positively to a shock in BUQU and CAEM, while IMR responds negatively to a shock in GVEF, GDPC, DGHEXP, GCF, and DMIN. More so, the variance decomposition result tells us that GDPC and GVEF offer significant explanations to LEAB, while CAEM and DMIN offer significant explanations to IMR.

From the study, it can be gathered that good governance promotes health outcomes. Hence, the government should strengthen institutions and ensure political stability, especially in Nigeria, since we now practise democracy. Also, the government should increase its spending on the health sector in the country to improve people's longevity and reduce death so that when people are healthy, they can contribute to the country's productivity level positively.

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