Willie Wilfred Okoi
Department of Economics,
University of Calabar, Calabar
okoiwillie1@gmail.com

Valentine Dan Oku
Department of Economics,
University of Calabar, Calabar
valentine.oku@diaderc.org

Ikpi Inyang Ikpi
Department of Economics,
University of Calabar, Calabar
inyangikpi@yahoo.com

***Corresponding Author**
Willie Wilfred Okoi
Department of Economics,
University of Calabar, Calabar
okoiwillie1@gmail.com

HEALTH INFRASTRUCTURE DEVELOPMENT AND LIFE EXPECTANCY AT BIRTH IN ANGLOPHONE WEST AFRICAN COUNTRIES

Abstract

This study examines the relationship between health infrastructure and Life expectancy in Anglophone West African countries, namely Nigeria, Ghana, Gambia, Liberia, and Sierra Leone, using panel data from 2000-2025. The study employed the Panel Autoregressive Distributed Lag (ARDL) model to investigate both the long-run and short-run dynamics among the variables. The long-run results revealed that immunization coverage, birth attended by skill health staff as well as specialist surgical workforce have positive and statistically significant effects on life expectancy, indicating that improvement in these aspects of health infrastructure contributes to better health outcomes in the region. Conversely, basic health services and health spending per capita exhibit negative and significant relationships with life expectancy, while hospital bed density shows a negative but significant effect. The short run estimate indicates weak and statistically significant relationship between most health infrastructure variables and life expectancy, suggesting that the impact of health infrastructure on life expectancy is more pronounced in the long-run than in the short run. Country-specific results revealed that heterogeneous effects across Nigeria, Ghana, Gambia, Liberia, and Sierra Leone reflecting differences in national health systems and institutional capacity. The study concludes that strengthening health infrastructure, particularly through increased immunization coverage, and expansion of the specialist health workforce is essential for improving health outcomes in Anglophone West Africa. The study recommended policy efforts should be focused on efficient allocation of health resources and sustainable investment in health infrastructure to enhance life expectancy and reduce under five mortality rate, basic health services, Hospital Beds.

Keywords: *Health Infrastructure, Life expectancy, hospital beds, birth attended by skill health staff, Anglophone West Africa*

INTRODUCTION.

Health infrastructure constitutes the structural backbone of any national health system, encompassing hospitals, clinics, diagnostic facilities, essential medical equipment, health technologies, supply chains, sanitation systems, and the human resources required to deliver health care services. Blake et al (2022). In developing regions, the availability, accessibility, and quality of health infrastructure significantly determine the efficiency of health service delivery and the overall health outcomes of the population. Koroglu, (2026). Within West Africa, disparities in health infrastructure remain a major development challenge, particularly in Anglophone countries such as Nigeria, Ghana, Sierra Leone, Liberia, and The Gambia (WHO, 2025). These infrastructural deficiencies manifest in poor health outcomes across the sub-region. Indicators such as high maternal and child mortality rates, low life expectancy, high prevalence of communicable diseases (malaria, tuberculosis, HIV/AIDS), and the rising burden of non-communicable diseases reflect the direct consequences of weak health systems. Degun et. al. (2023).

For instance, limited diagnostic capacity and inadequate emergency response infrastructure hinder early detection and management of disease outbreaks, while poor distribution of health facilities and weak referral systems limit access to essential care, especially in rural and semi-urban areas. Blake et al. (2022).

In 1998, the heads of the 15 states of the Economic Community of West African States (ECOWAS) established a regional health institution, the West African Health Organization (WAHO), to improve health systems and address the common health challenges faced in the region through coordination, collaboration and cooperation among the member states. (WHO, 2025). The challenges that required multinational collaboration included epidemics, counterfeit medication trade and the harmonization of policies to address their common health problems.

Consequently, health outcomes across the region remain among the lowest globally. Maternal mortality remains high despite global improvements; child mortality are still alarming; and the burden of infectious diseases such as malaria among others continue to weigh heavily on health systems. Yaya et al. (2020).

Over the decades, socio-political instability, weak institutional frameworks, and fluctuating economic conditions further impeded consistent investments in health infrastructure. Countries like Liberia and Sierra Leone particularly suffered the long-term impacts of civil wars, which destroyed health facilities, reduced the health workforce, and weakened surveillance systems.

Although, Ghana and Nigeria have made notable progress through national health insurance schemes and health-sector reforms, challenges persist in funding, quality of care, urban-rural disparities and inequitable distribution of resources, Agyepong, (2017). Smaller Anglophone countries such as The Gambia and Sierra Leone continue to rely heavily on donor funding and external technical support to sustain basic health services. The region also faces critical shortages of doctors, nurses, midwives, and public health professionals, which further constrain the capacity of existing infrastructure to deliver quality care.

According to the National Health Research System (NHRS, 2024), despite decades of policy reforms, donor interventions, and national health strategies, many Anglophone West African countries continue to experience inadequate health infrastructure, low investment in basic healthcare, weak health information systems, and persistent shortages of qualified healthcare personnel.

According to Nketia-Mponsah, (2019). The health systems in these countries were shaped by colonial legacies that emphasized curative rather than preventive care, resulting in structural gaps that continue to affect health outcomes today. Post-independence economic shocks, civil conflicts (notably in Liberia and Sierra Leone), and recurring epidemics such as Ebola have further strained already fragile infrastructure. Several studies have been carried out on health infrastructure and life expectancy in West Africa, no studies have been carried out in

Anglophone West African countries in this context. This study therefore, seek to examine the nexus between health infrastructure and life expectancy.

Literature review

2.1.1 Conceptual Issues

2.1.1.1 Health Infrastructure

Health infrastructure is the comprehensive network of physical facilities (hospitals, clinics, labs) organizational structures, staff, resources (like clean water, sanitation), technology (IT, communication), and systems (policies, logistics) that enable the delivery of healthcare services, health promotion, and disease prevention for a population Boachie, (2018). It's essential for managing everyday health needs and responding to crises like pandemics, ensuring access to care and fostering overall community well-being. Meng & u (2023).

Health infrastructure includes all systems, organizations, interventions and resources intended for health promotion and illness prevention. Health care systems promote health and well-being for community members through care services such as primary care, hospital care and long-term or home care, Olufemi et al (2019). Public health systems monitor, detect and intervene when disease or risks impact community health to limit harm and promote healthy lifestyles, environments and policies. Health infrastructure supports all health services from vaccinations and chronic disease prevention programs to emergency preparedness efforts.

Life Expectancy at birth

According to World Bank: Life expectancy at birth is the average number of years a newborn baby is expected to live if current age-specific mortality rates remain constant, serving as a key indicator of population health, reflecting improvements in medicine, public health, and living.

standards. It's a snapshot of current mortality patterns, not a prediction of an individual's lifespan, showing how much longer people live due to reduced deaths at all ages, from infancy to old age. The statistic “life expectancy at birth” actually refers to the average number of years a newborn is expected to live if mortality patterns at the time of its birth remain constant in the future. In other words, it’s looking at the number of people of different ages dying that year, and provides a snapshot of these overall “mortality characteristics” that year for the population.

According to OECD: Life expectancy at birth is the average lifespan a newborn can be expected to live, assuming that age-specific mortality levels remain constant. This is estimated as the actual age-specific death rate of any birth cohort cannot be known in advance. If death rates fall, actual life spans will be higher than life expectancy calculated using current death rates.

Life expectancy at birth is one of the most frequently used health status indicators. Gains in life expectancy at birth can be attributed to several factors, including rising living standards, improved lifestyle and better education, as well as greater access to quality health services. This indicator is measured in years for the total population and by gender.

State of Health Infrastructure in Anglophone West African countries

Health infrastructure in Anglophone West African countries (primarily Nigeria, Ghana, Sierra Leone, Liberia, and The Gambia) is characterized by a mix of urban-focused tertiary care, significant, underfunded, and often dilapidated rural primary healthcare centers, and a growing, yet uneven, reliance on public-private partnerships, Osakede (2022). While some countries are experiencing recent, targeted investments, such as Nigeria's $2.2 billion Health Sector Renewal Investment Initiative. overall, the sector faces substantial gaps in equipment, maintenance, and skilled personnel. Yaya et al. (2020).

According to OECD (2025), West Africa's infrastructure investment needs are the second lowest of all African regions. To reach physical stocks of infrastructure comparable to peer countries showing high levels of productive transformation in other developing world regions, West African countries will need to invest approximately USD 20 billion per year by 2040, mainly in transport, followed by the digital sector, Odey et al (2023). This investment could increase West Africa's gross domestic product (GDP) growth by 5.4 percentage points.

The region's public infrastructure expenditure stands at 1.6% of GDP, slightly below the continental average (1.8%). Major sources of infrastructure financing vary from country to country. Côte d'Ivoire and Togo have the highest levels of public infrastructure spending, Nigeria the highest level of infrastructure investments with private participation and Senegal the highest of official development finance directed to infrastructure. Olufemi et al (2019).

Some West African countries are encumbered by debt servicing costs. While Guinea, Mali, Niger and Togo spend more on infrastructure than on debt servicing, Guinea-Bissau allocates 51 times more public finances to debt servicing than to infrastructure – the second-highest rate on the continent. Infrastructure priorities are closely linked to West Africa's agricultural transformation, as infrastructure can improve food security and avoid dependence on food imports. All-season roads and better energy access could yield more reliable transport services and more efficient processing facilities.

EMPIRICAL LITERATURE

Sango-Cocker & Bein (2018) investigated the private, public, and public-private healthcare sectors of West Africa. Data was obtained from World Bank Indicators within the period of 16 years (from 1999 – 2014). Using pooled regression and pairwise correlation. The study found that female population lived longer than the male population and a positive relationship was obtained between the variables of healthcare spending and life expectancy for the public healthcare sector.

Blake et al (2022). Examined the burden of disease in Nigeria and compared it with 15 other West African countries between 1998 and 2019. The study analyzed mortality, years of life lost (YLLs), years lived with disability (YLDs), Life expectancy, healthy life expectancy (HALE), and health system coverage across 369 diseases, injuries, and87 risk factors. The findings showed that Nigeria made significant health gains during the study period. Life expectancy and healthy life expectancy increased by about 18%, reaching 64.3 years, while mortality declined across all age groups for both males and females. The study also noted improvements in health expenditure per person, indicating progress in Nigeria’s health system despite the continuing disease burden.

Osakede (2022) examined the effect of infrastructure types on health system performance in Africa using data for 54 countries in the region and over the period 2003–2018. Using the System GMM estimation technique. The results showed a significant effect of transport and ICT in improving the length of life and reducing under-five mortality. Improvement in ICT reduced maternal deaths. An increase in all infrastructure types (transport, electricity and ICT) significantly reduced infant mortality. From the results, only ICT is associated with improvement in all population health outcome variables used in the study. Findings suggest the key role of infrastructure on health system performance, with ICT shown to have more influence on health systems than other infrastructure types.

Koroglu & Bayar (2026) examine the interplay among indicators of health expenditures, the index of information and communication technologies (ICT), healthy life expectancy at birth (HALEB), and healthy life expectancy at age 60 (HALE60) in the Sub-Saharan African countries over the 2000–2021 period by means of robust causality and regression approaches. The results of the causality analyses reveal a bidirectional causality among indicators of health expenditures, ICT, HALEB, and HALE60 at the panel level.

Meng & Lu (2023), investigated the spatial and temporal patterns of healthy life expectancy (HLE) and the effects of health financing in West African countries, 1995- 2019 using a Dynamic Spatial Durbin Model. The study found that HLE exhibited significant spatial dependence and clustering across the region. Although total health expenditure, government health spending, out-of-pocket (OOP) spending, and development assistant for health (DAH), generally increased over the study period, government health expenditure per person declined, while the share of OOP spending fell from 57% (1995-1999) to 42% (2015-2019). The result showed that total health expenditure improved HLE in the long term, whereas high OOP spending negatively affected HLE.

Iworise (2021), investigates the effect of country, gender and the associated interaction term on life expectancy in West African countries. The empirical analysis revealed that country and gender have statistically significant effect on life expectancy in West Africa, while the associated interaction term has no significant effect on life expectancy.

Sakir & Oseni(2022), assessed the effect of health aid on life expectancy using data on 46 SSA countries from 2000 to 2019 which were sourced from the World Development Indicator, Organization for Economic Co-operation and Development Creditor Reporting System, and United Nations Children’s Fund. System Generalized Method of Moment (system GMM) was. The results showed that health aid does not have any significant effect on life expectancy in SSA. Rather, life expectancy was significantly improved by school enrolment, trade openness, Gross Domestic Product per capita and physician density, while corruption significantly reduced it.

Yogo and Mallaye (2012) utilized data covering the period 2000 to 2010 from 28 countries in SSA, to examine the effect of foreign aid meant for the health sector on health outcomes. The study took care of the likely endogeneity, used the instrumental variable and reported that health aid improved health outcomes in SSA. Specifically, additional unit of health aid increased life expectancy by 0.14 years. These effects operated mostly through the improvement in the primary school completion rate of female. The study further reported that the Oaxaca-Blinder decomposition showed that the differences in the quantum of foreign aid for the health sector received did not account for the gap in the health outcomes between stable countries and countries that are just coming out of conflicts.

Ssozi and Amlani (2015) assessed the effectiveness of health expenditure on proximate and ultimate goals of healthcare in SSA covering 43 countries which were chosen solely due to availability of data from 1995 to 2011. With the use of the GMM framework. The health expenditure was decomposed into public and non-public expenditures. The regression results showed a positive effect (magnitude of coefficients of public and non-public health expenditure as explanatory variables) on immunization and nutrition, and a negative effect on HIV/AIDS which were classified as proximate goals but very small value (low effects) on life expectancy which was regarded as the ultimate goal.

Toseef et al. (2019) assessed the effects of total foreign aid and health sector aid on the health of residents of countries which received foreign aid since the inception of the MDGs. The study utilized data from 2001 to 2015, covering 90 aid recipient developing countries. Fixed effects multivariate regressions with alternative specifications were estimated for each of the measures of health considered in the study. The multilevel mixed model and the system GMM were also estimated. The study found some evidence that foreign aid has improved life expectancy in developing countries, but the effect was very small

Studies such as Ssozi and Amlani (2015) and Welander (2012) did not try alternative analytical procedures such as two stage least square (2SLS), instrumental variable (IV) models and GMM models which are capable of addressing the inherent endogeneity problem. Welander (2012), for example, failed to take care of reverse causality between foreign aid and development (health) in the study which may weaken the reliability of the results. Data used in some other studies (e.g., Yogo & Mallaye, 2012; Gomanee et al., 2005; and Welander, 2012) were outdated while some failed to include relevant control variables in their models (e.g., Kotsadam et al., 2018; Youde, 2010; Kizakethalackal, 2009).

Theoretical Framework

The Health Production Theory

The health production theory as propounded by Grossman (1972), depicts a relationship between physical outputs of a production process and physical inputs, i.e. factors of production. The practical application of production function is obtained by valuing the physical outputs and inputs by their prices. The economic value of physical outputs minus the economic value of physical inputs is the value addition generated by the production process. It is the maximum output that can be produced out of a given combination of inputs. The production function, therefore, describes a boundary or frontier representing the limit of output obtainable from each feasible combination of input. A production function can be expressed in,

$$Q=f(x_1, x_2, x_3, \ldots\ldots x_n) \text{----------------} 1$$

In Equation 1, Q, is the quantity of output, and $x_1, x_2, x_3, \ldots\ldots x_n$ are the quantities of factor inputs (such as capital, labour, land or raw materials.

The function may be expressed linearly in the form;

$Q = a + bX_1 + cX_2 + dX_3 + ...+ \alpha X_n$ (2)

Equation 2 is the linear expression of Equation 1. Applying this to empirical health modelling, health status depends on a number of factors, some of which can be influenced by the individual decisions. Hence, health can be produced. Similarly, health is also a consumption good because it enters into the utility function of the individuals.

Specifically, this work employs the demand for health care production function postulated by Grossman (1972). The model stated that the demand for health care is derived, and it is produced through a process of a production function. The model has been widely employed in empirical studies of health and health care (Abbas, 2010; Berger & Messer, 2002; Kulkarni, 2016).

According to Grossman (1972), there exists a relationship between health status and the economic and non-economic factors. In the model, individuals are assumed to inherit a stock of health capital H_0 Thereafter their health stock evolves according to the relationship as;

$H_t - H_{t-1} = 1_{t-1} - \Omega_{t-1} H_{t-1}$--3

Where represents health stock at the beginning of period t, is gross investment during the t-1 period and is the rate of depreciation in operation during the same period. The equilibrium stock of health capital is defined by the condition as;

$B_t + \alpha_t = (\mu + \Omega_t - €_t - 1)€_t$--4

Where B_t is the pecuniary benefit of health capital, α_t is the non-pecuniary marginal benefits, μ is the rate of interest),$€_t$ is the marginal cost of investment and -$€_t$-1 is the percentage change in gross investment. Following Wagstaff (1993), we thus retain the inherently linear nature of the net investment identity of Equations 3 and 4 and adopt a linear specification of the demand for health Equation of the form;

$H_t = \alpha X_t + \mu_t$--5

Where H, X and u are demand for health, determinants of demand for health and error term respectively. In its broad form, Equation 5 is specified as:

$H_t = \alpha_1 X_{1t} + \alpha_2 X_{2t} + \mu_t$---6

Equation 6, expressed: H as any measure of health status like Life expectancy, under five mortality, X_{1t} is the non-economic factors like demographic (population below or above certain age group) and health service variables (like population doctor ratio, population hospital ratio etc.) and X_{2t} is the vector of economic factors like: (income per capita), social (education), environmental (urbanization). Although, Grossman (1972) presented the model at micro level, studies have employed this specification at macroeconomic level (Fayissa & Gutema, 2014).

Methodology

3 Model specification

This study is anchored on the health production theory as propounded by Grossman (1972), depicts a relationship between physical outputs of a production process and physical inputs, i.e. factors of production. The practical application of production function is obtained by valuing the physical outputs and inputs by their prices. The economic value of physical outputs minus the economic value of physical inputs is the value addition generated by the production process. It is the maximum output that can be produced out of a given combination of inputs. The production function, therefore, describes a boundary or frontier representing the limit of output obtainable from each feasible combination of input. A production function can be expressed in,

Health outcome =(infrastructure, personnel, expenditure, environment)

$$Q=f(x_1, x_2, x_3, \ldots\ldots x_n) \text{------------------------} (1)$$

In Equation 1, Q, is the quantity of output, and $x_1, x_2, x_3, \ldots\ldots x_n$ are the quantities of factor inputs (such as capital, labour, land or raw materials.

The function may be expressed linearly in the form;

$$Q = a + bX_1 + cX_2 + dX_3 + \ldots\ldots + \alpha X_n \text{--------------------------------------} (2)$$

On the basis of theoretical and empirical exposition, the model for this study is expressed functionally as:

$$LFEXP_{it}=f(BASHS_{it}, IMUZTN_{it}, INSENT_{it}, HBDS_{it}, SSWF_{it}, HSPC_{it}) \text{------------------------} (3)$$

Panel estimation model

Panel estimation method is a statistical method used to analyze two dimensional panel data (cross-sectional and time series data). A typical panel data regression model can take the following form:

$$Y_{it}= \sum_{j=1}^{p} \emptyset_{ij} y_{i,t-j} + \sum_{j=0}^{q} \beta ij \, x_{i,t-j} + \mu_i + €_{it}$$

Where: y is the dependent variables, x is the explanatory variable, ∅ and β are the coefficient to be estimated, I and t represents indices of individuals and time, and € is the error term. An important assumption about the error term depends on whether the regression model is fixed or random effect model. In the fixed effect model, the error term, € is assumed to change non-stochastically over I and t, which is analogous to a dummy variable model. In a random effect regression model, the error term, € is assumed to change stochastically over I and t, requiring special analysis of the error variance matrix**.**

RESULTS

TABLE 1

	LFEXP	BASHS	HBDS	HSPC	IMUZTN	INSECNT	SSWF
Mean	57.78454	58.52462	1.510462	62.25338	74.17692	40.34231	1.632000
Median	59.16000	52.10000	0.900000	59.67500	80.00000	50.00000	1.000000
Maximum	66.25000	87.00000	80.00000	617.1600	97.00000	86.00000	8.000000
Minimum	44.83000	35.00000	0.320000	8.480000	30.00000	1.000000	0.150000
Std. Dev.	5.383247	16.66181	6.942773	60.51702	18.31654	29.12707	1.542035
Skewness	-0.545128	0.491660	11.24299	6.048362	-0.728540	-0.276566	2.587011
Kurtosis	2.309165	2.016880	127.6085	55.56862	2.322716	1.522025	9.140520

From the descriptive statistics in Table1above it could be seen that life expectancy at birth averaged 57.78454 with a maximum value of 66.25000. It had a skewness value of -0.545128 and a kurtosis value of 2.309165. Birth attended by skill health staff (BASHS) had a mean value of 58.52462 percent; maximum value of 87.00000. With a skewness value of 0.491660.

Also, the mean value of hospital beds per 1000 people (HBDS) was 1.510462, maximum value of 80.00000 and a minimum value of 0.320000. with a skewness value of 11.24299, which shows that there was a normal distribution.

Health spending per capita (HSPC) had a mean value of 62.25338, and a maximum value of 617.1600 and a minimum value of 8.480000. With a skewness of 6.04832. this shows an evidence of a normal distribution. The mean value of immunization of measles (IMUZTN) had a mean value of 74.17692, a maximum value of 97.00000. With a skewness of -0.728540 and a kurtosis value of 2.322716. the skewness value indicated that immunization has an inequality in its distribution.

Moreso, the mean vale of insecticide treated nets (INSECNT) was 40.34231; with a maximum value of 86.00000. The result showed a skewness value of -0.276566, which implies that insecticide treated nets as a percentage of household owning do not have a normal distribution. The mean value of specialist work force (SSWF) per 100,000 population was 1.632000, and the maximum value of 8.000000 and a minimum value 0.1542035

Unit Root Test.

The result of the unit unit root test using both the Augmented Dickey Fuller and Phillip Perron test showed a mixed order of integration. While some variables were stationary at level others were stationary at first difference. This underscores the use of the Autoregressive Distributed Lag Model of analysis to show country specific results across Ango-phone west African countries.

Table 2

PANEL ARDL Long-Run Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
LOG(BASHS)	-0.117371	0.011994	-9.785595	0.0000
IMUZTN	0.002854	0.000141	20.18810	0.0000
INSECNT	0.001341	7.04E-05	19.06392	0.0000
HBDS	-0.000527	0.000799	-0.658994	0.5117
SSWF	0.064366	0.004639	13.87412	0.0000
LOG(HSPC)	-0.011618	0.001740	-6.677483	0.0000

The long-run coefficient show the equilibrium relationship between the explanatory variables and life expectancy at birth. Basic health services (LOG BASHS), the coefficient is -0.117371 and statistically significant ($p< 0.01$). this implies that a 1% increase in basic health services reduces life expectancy at birth by about 0.117% in the long run.

The coefficient of immunization of children between 12-23 months (IMUZTN) is 0.002854 and is statistically significant ($p < 0.01$). this indicates that an increase in immunization coverage significantly improves life expectancy. Specifically, a unit increase in immunization increases life expectancy by 0.0029% in the long run.

Also, insecticide treated nets (INSECNT), the coefficient is 0.001341 and significantly improves life expectancy significant ($p < 0.01$). This suggest that greater distribution and usage of insecticide-treated nets significantly improves life expectancy.

Specialist Surgical Workforce (SSWF). The coefficient is 0.064366 and statistically significant ($p< 0.01$). this indicates that an increase in specialist surgical workforce significantly improves life expectancy. Unit increase in the number of specialists increases life expectancy by 0.064%, highlighting the importance of skilled healthcare professionals.

Health Spending per Capita (LOG HSPC). The coefficient is -0.011618 and statistically significant ($p<0.01$). the result suggest that higher health expenditure per capita increases life expectancy, which contradicts theoretical expectations.

TABLE 3

PANEL ARDL SHORT RUN RESULTS (ERROR CORRECTION MODEL)

	Short Run Equation			
COINTEQ01	-0.313876	0.258692	-1.213318	0.2284
DLOG(BASHS)	0.016189	0.010426	1.552695	0.1243
D(IMUZTN)	-0.000103	0.000525	-0.196383	0.8448
D(INSECNT)	-0.000305	0.000227	-1.341319	0.1834
D(HBDS)	-0.005851	0.006374	-0.917945	0.3613
D(SSWF)	-0.016084	0.013667	-1.176901	0.2426
DLOG(HSPC)	0.008382	0.008742	0.958804	0.3404
ECM	1.322514	1.079566	1.225042	0.2240

The short-run dynamics show the immediate impact of changes in the explanatory variables.

The coefficient is -0.313876, but it is statistically insignificant (p=0.2284). although the coefficient is negative as expected, the insignificance suggests that the speed of adjustment from short-run disequilibrium to long-run equilibrium is weak. The coefficient implies that approximately 31% of deviations from long-run equilibrium are corrected annually, but the adjustments process is not statistically strong.

Country-Specific Short-Run Results- Nigeria.

TABLE 4

Variable	Coefficient	Std. Error	t-Statistic	Prob. *
COINTEQ01	-1.333856	0.013479	-98.95768	0.0000
DLOG(BASHS)	0.049527	0.000290	171.0357	0.0000
D(IMUZTN)	-0.002059	1.20E-07	-17099.07	0.0000
D(INSECNT)	-0.001169	3.39E-08	-34510.38	0.0000
D(HBDS)	0.013563	2.62E-05	517.6521	0.0000
D(SSWF)	-0.067455	0.000172	-391.2796	0.0000
DLOG(HSPC)	0.005338	1.90E-06	2803.806	0.0000
C	5.575910	0.232134	24.02023	0.0002

For Nigeria, the error correction term is -1.333856 and is significant ($p<0.01$). this indicates a very strong adjustment speed, meaning deviations from long-run equilibrium are corrected quickly. The result showed that basic health services increased life expectancy at birth, immunization reduces mortality significantly. Similarly, hospital beds positively affect life expectancy, while specialist surgical workforce negatively affects life expectancy at birth, and health spending per capita improves life expectancy at birth.

GHANA

TABLE 5

Variable	Coefficient	Std. Error	t-Statistic	Prob. *
COINTEQ01	0.010201	2.67E-05	381.8903	0.0000
DLOG(BASHS)	0.029373	0.000198	148.5351	0.0000
D(IMUZTN)	5.63E-05	1.94E-08	2897.716	0.0000
D(INSECNT)	-0.000109	6.35E-09	-17116.88	0.0000
D(HBDS)	-0.004923	8.47E-05	-58.08948	0.0000
D(SSWF)	-2.87E-05	5.60E-07	-51.30748	0.0000
DLOG(HSPC)	-0.000211	1.67E-06	-126.9200	0.0000
C	-0.037667	0.000457	-82.44035	0.0000

The result for Ghana showed that; Basic health services increase life expectancy at birth, Immunization positively affects life expectancy at birth. While insecticide treated nets reduce mortality. Hospital beds and health spending have negative effects. However, the error correction term is positive, suggesting stability in the adjustment processed.

GAMBIA

TABLE 6

Variable	Coefficient	Std. Error	t-Statistic	Prob. *
COINTEQ01	0.013107	0.000587	22.32933	0.0002
DLOG(BASHS)	-0.006032	0.000128	-47.13808	0.0000
D(IMUZTN)	0.001112	1.47E-07	7587.730	0.0000
D(INSECNT)	3.50E-05	6.05E-09	5787.844	0.0000
D(HBDS)	-0.014117	5.90E-05	-239.3153	0.0000
D(SSWF)	0.007973	0.000216	36.95205	0.0000
DLOG(HSPC)	0.006053	4.67E-05	129.5183	0.0000
C	-0.048916	0.010579	-4.623731	0.0190

The result for Gambia indicates that immunization significantly improves life expectancy at birth, health spending and surgical workforce positively influence health outcomes, while hospital bed negatively affects life expectancy.

LIBERIA

TABLE 7

Variable	Coefficient	Std. Error	t-Statistic	Prob. *
COINTEQ01	-0.224497	0.006686	-33.57653	0.0001
DLOG(BASHS)	0.011101	0.001251	8.874711	0.0030
D(IMUZTN)	0.000296	7.35E-08	4025.457	0.0000
D(INSECNT)	-0.000336	9.91E-08	-3389.825	0.0000
D(HBDS)	0.000227	1.53E-08	14784.15	0.0000
D(SSWF)	-0.020370	0.000272	-74.77722	0.0000
DLOG(HSPC)	0.041274	7.40E-05	557.4005	0.0000
C	0.967244	0.122608	7.888902	0.0042

The result for Liberia shows a strong positive effects of immunization, hospital beds and health spending per capita. The error correction term (-0.2.224497) confirms the existence of long-run equilibrium.
SEIRRA LEONE

TABLE 8

Variable	Coefficient	Std. Error	t-Statistic	Prob. *
COINTEQ01	-0.034335	0.000450	-76.30218	0.0000
DLOG(BASHS)	-0.003026	0.000115	-26.36335	0.0001
D(IMUZTN)	7.93E-05	4.30E-08	1841.918	0.0000
D(INSECNT)	5.55E-05	1.72E-08	3221.947	0.0000
D(HBDS)	-0.024005	9.89E-05	-242.7768	0.0000
D(SSWF)	-0.000540	2.89E-05	-18.65154	0.0003
DLOG(HSPC)	-0.010543	2.95E-05	-357.8518	0.0000
C	0.156000	0.007792	20.02174	0.0003

the result for Sierra Leone showed that: immunization significantly improves health outcomes, insecticide nets increase life expectancy at birth, while hospital beds and health spending have negative effects. The error correction coefficient -0.034335 indicates slow adjustment to equilibrium.

TABLE 9

Cross-Sectional Dependence Test

Test	Statistics	d.f	Probability
Breusch Pagan (Chi-square)	19.69159	10	0.0323
Pearson LM Normal	1.049070	-	0.2941
Pearson CD Normal	1.240040	-	0.2150
Friedman Chi-square	29.89231	25	0.2283
Frees Q	0.071225	-	-

The cross-sectional dependence test was conducted to determine whether shocks in one country affect other countries in the panel. The Breusch-Pagan Chi-square statistic is 19.69 a probability value of 0.0323, indicating the presence of cross-sectional dependence at the 5% level of significance. However, the test such as person LM, Pearson CD and Friedman Chi-square are statistically insignificant.

On the overall, the result suggests a weak cross-sectional dependence among the countries.

Discussion of the findings

The result revealed that immunization coverage has a positive and statistically significant impact on life expectancy in the long-run. This finding is consistent with theoretical expectation and suggest that increased immunization coverage helps reduce child mortality, prevent infectious diseases, and improve overall population health.

The country specific analysis also confirms that immunization significantly improves life expectancy across the countries in the panel. This underscores the importance of national vaccination programs in controlling preventable diseases such as measles, tuberculosis, and polio. This result is consistent with earlier studies which found that vaccination programs significantly reduce mortality rates and increase longevity in developing economies.

Insecticide treated nets and life expectancy, indicates that the use of insecticide-treated nets has a positive and significant effect on life expectancy in the long-run. This implies that malaria prevention strategies play a crucial role in improving health outcomes in Anglophone West Africa, where malaria remains one of the leading causes of death, especially among children and pregnant women. The positive effect suggests that increased distribution and usage of insecticide-treated mosquito nets contribute significantly to reduce malaria-related mortality and improving life expectancy.

Hospital beds and life expectancy finding showed that hospital beds have a negative but insignificant effect on life expectancy in the long-run. This suggest that the availability of hospital beds alone does not significantly influence life expectancy in the countries studied. The result indicates that healthcare outcomes depend not only on infrastructure but also on the quality of healthcare services, availability of medical personnel, and access to essential drugs and equipment. In many developing

In many developing countries, hospitals may lack adequate staffing, modern medical technologies, and essential resources, thereby limiting the effectiveness of healthcare infrastructure. The country specific results show mixed outcomes across the countries, indicating that the effectiveness of hospital infrastructure varies depending on health systems capacity of each country.

Specialist Surgical Workforce and life expectancy, the result showed that specialist surgical workforce has a positive and statistically significant impact on life expectancy in the long-run. This finding implies that an increase in the number of specialized healthcare professionals significantly improves healthcare service delivery and population health outcomes. The findings is consistent with theoretical expectations and aligns with previous studies which emphasize that human resources for health are a critical determinant of healthcare system performance and health outcomes.

Health spending per capita and life expectancy result showed a negative and statistically significant relationship with life expectancy in the long-run. The finding is not in tandem with theoretical expectations which suggest that increased health expenditure should improve health outcomes and increase longevity. The negative relationship may be explained by inefficiencies in health spending, poor allocation of resources, corruption, weak healthcare governance, and inadequate monitoring of healthcare investments in some of the countries studied.

The findings suggest that increasing healthcare funding alone may not necessarily translate into improved health outcomes unless funds are efficiently utilized.

Short-Run Dynamics

The short-run ARDL result revealed that many explanatory variables have no statistically significant effects on life expectancy at birth in the short-run. This suggests that improvement in health infrastructure and healthcare interventions takes time before their impact on population health outcomes becomes visible.

Country Specific Results

The ARDL result showed significant differences in how health infrastructure influences life expectancy across the countries studied.

For example, Liberia showed significant positive impact of immunization and health spending on life expectancy. Nigeria showed strong and significant relationship between most of the health indicators and life expectancy, suggesting that improvement in healthcare infrastructure may yield stronger health outcomes.

In contrast, Sierra Leone and Ghana showed mixed results, reflecting differences in healthcare systems, policy implementation, and institutional effectiveness. These variations highlight the importance of country-specific health policies tailored to the unique healthcare challenges faced by each country.

Cross -Sectional Dependence

The cross-sectional dependence test indicates weak interdependence among the countries in the panel. This suggests that health shocks or policy changes in one country may have limited spillover effects on other countries in the region.

Conclusion/Recommendations

The study concludes that strengthening health infrastructure, particularly through increased immunization coverage, and expansion of the specialist health workforce is essential for improving health outcomes in Anglophone West Africa. The study recommended policy efforts should be focused on efficient allocation of health resources and sustainable investment in health infrastructure to enhance life expectancy and reduce under five mortality rate, basic health services, Hospital Beds.

REFERENCES

Elizabeth Yinka Sango-Coker, Murad A. Bein (2018) The Impact of Healthcare spending on Life Expectancy: Evidence from Selected West African Countries. African journal of reproductive health. Vol 22, No 4.

Blake, A Olutobi S,. Ifedayo, M,. Iruka, N,. Adamu, A,. Aliyu, M,. Ameh, E,. Kyari, F,. Gadanya, F,. Mabayoje, D,. Adesola, Yinka,. Oni, T,. Rabiu, I,. Tsiga-Ahmed, F,. Dalglish, S,. Abimbola, S,. Colbourn, T,. Onwujekwu, U,. Eme T,. Gambo, A,. Ibrahim, A,. (2022): Population health outcomes in Nigeria compared with other west African countries, 1998–2019: a systematic analysis for the Global Burden of Disease Study. The Lancet, vol, 399 No: 10330.

Osakede Uche (2022) Infrastructure and Health System Performance in Africa. Managing Global Transition. Vol 20, No 4.

Koroglu, M,. & Bayar, Y,. (2026); ICT, health expenditures, and healthy life expectancy: empirical evidence from the Sub-Saharan African states. Journal of Public Health, Vol 13.

Yaya, Ola,. Oyekunrin, O,. & Ogbonna, A. (2020): Life Expectancy in West African Countries: Evidence of Convergence and Catching Up with the North. Munich Personal RePEc Archive. MPRA Paper No. 102873.

Meng, Z & Lu, N.(2023): Spatiotemporal patterns of healthy life expectancy and the effects of health financing in West African countries, 1995- 2019: A Spatial Panel Modelling Study. Journal of global health. Vol 13, No 04123.

Olufemi Solomon Olatunde, Abayomi A. Adebayo,. Fisayo Fagbemi (2019**),** Health Expenditure and Child Health Outcome in West Africa.

Dejun Zhou, Rowland A. Bassey, Mouchun Yan, Timothy A. Aderemi (2023) Do health expenditures affect under-five mortality and life expectancy in the ECOWAS sub-Region? African Journal of Reproductive Health. Vol 27, No 8.

Iworise, Jonathan (2021) Post Hoc Analysis of Life Expectancy in West African. American Journal of Applied Mathematics and Statistics, 2021, Vol. 9, No. 2, 57-65

Sakiru O,. & Oseni, O(2021) Effect of Health Aid on Life Expectancy in Sub-Saharan Africa. Effect of Health Aid on Life Expectancy in Sub-Saharan Africa. Vol 11, issue 1.

Boone, P,. Elbourne, D,. Fazzio, I,. Fernandes, S,. Frost, C,. Jayanty, C,. Kng, R,. Piaggio, G,. Dos-santos, A,. & Walker, R (2016): Effects of community health interventions on under-5 mortality in rural Guinea-Bissau (EPICS): a cluster-randomised controlled trial. The Lancet Global Health. Vol 4, issue 5.

Kalu, U., Anigbogu, Hilary , Ezenekwe, Uju, & Nga Chukwudi (2023) Public Health Financing Model and Under-Five Mortality Rate in Nigeria. International Journal of Advanced Research in Accounting, Economics and Business Perspectives. Vol 7, No 2.

Odey, F,.Bassey, E & Enya, E. (2023). Health Infrastructure and Economic Development Nexus in Nigeria: International Journal of Social Sciences and Management Research. Vol 9 No 9.