Health Expenditure and Health Outcomes in ECOWAS

Funmilola V. Oniyide, Toluwalope T. Ogunro, and Olorunfemi Y. Alimi

Department of Economics and Development Studies,
Lead City University, Ibadan, Oyo State, Nigeria

E-mail: *oniyidefunmilola@gmail.com*; *rehobotty@gmail.com*; *haleemphemy480@gmail.com*

Abstract

Health of a population has been of importance to the international community as stressed in sustainable development goals (SDGs) specifically, goals three and goal six. The priority given to health can be reflected in government expenditure on health which in turn determines economic growth of a nation. The burden of disease in West African region is high as 69% of diseases in the region is linked to chronic and infectious diseases causing death. In effect, life expectancy in the region is 63.24 years in 2020 which is low compared to that of developed countries. While there are indications that regions are improving health outcomes, investment in human capital is an avenue for an economy to achieve the desired health goals, low infant mortality, low maternal mortality, high life expectancy and low under-five mortality. There are opportunities to advance the gains made overtime especially through sustained health expenditure. Health sector in some African countries is lagging in required infrastructure as reflected in the demand for health care abroad. Also, there are variations in spending to health care across countries while in some contexts, private sector and international community commit more resources to health care in developing countries. In the light of this, the paper examines the relationship between health expenditure and health outcomes in ECOWAS region. In achieving this objective, data on health outcomes and health expenditure was sourced from World Development Indicators (WDI) for 15 member states of the West African region, using Panel data spanning from 2000 to 2020 and panel analysis was conducted. The outcome of this study indicates a significant effect of healthcare expenditure on health outcomes in ECOWAS region. Healthcare expenditures improve life expectancy and reduce the risk of mortality rate. Hence, the study recommends that government should allocate and monitor funds towards improving health systems. Basic amenities that have direct effect on health status of the population such as clean sanitation, basic clean water, preventive medications and should be, accessible to people.

Keywords: Private health spending, public health expenses, external health cost, child mortality, life expectancy, ECOWAS.

1. Introduction

Health expenditure is an important indicator of investment in human capital which determines health outcomes (Alimi, Odugbemi, and Osisanwo, 2023). Investment in human capital becomes crucial owing to the potentials inherent in humans that aid economic growth. Asides the significance of health to productivity, promoting wellbeing and health of people has been a major goal in the sustainable development goals (SDGs). As an affirmation to this, African leaders in the year 2001 proposed a commitment of fifteen percent of yearly budget to the health sector (World Health Organization, 2014). Commitment to this proposition is expected to improve health outcomes in these countries.

Statistics show that six of these African countries achieved the target with Rwanda, Liberia, Malawi increasing spending above the 15% target while others specifically, Madagascar, Zimbabwe and Togo spent a little above the benchmark. Other countries like Nigeria, South Africa, and Ghana did not meet the target (Novignon and Lawson, 2017). Africa still lags behind developed countries in terms of investment in health with data depicting that 70% of government expenditure in developed region is invested in health (Healthcare Index, 2022; CEO World, 2021), an indication of disparity in priorities given to health across regions. Unfortunately, the region does not fair very well in major health indicators when compared with developed countries.

Life expectancy index in African region is 66 years for female and 63 years for male which is lower than developed countries with an average life expectancy of 75 years. Infant mortality is 41 persons per 1,000 births with African countries ranked among regions with the highest deaths in the world (CEO World, 2021; Healthcare Index, 2022). This may not be disconnected from the low government expenditure and poor quality of health infrastructure in the region. As an antidote to this, there are multiple sources of expenditure in health like private health expenditure, public health expenditure and external health expenditure to augment low government expenditure.

This study examines the relationship between health expenditure and health outcomes in ECOWAS. The study contributes to knowledge by introducing environmental variables as an important social determinant of health. Also, a review of the literature depicts varying results which may be linked to choice of variables, methodology and scope of analysis.

Most of the literature evaluated has not yet found enough cross-country empirical evidence on the relationship between health expenditure and health outcomes in ECOWAS countries. African studies already in existence have not adequately addressed cross-country traits like ECOWAS, which this study intends to fill in the literature. Given the aforementioned, this study used recent data and a panel data approach to investigate the impact of healthcare expenditure on health outcomes and economic growth in ECOWAS.

This study has the following sections. Next, we review all relevant scholarly literature on the issue. The data, empirical model, and estimating methods are presented in the third section. The fourth section of this study analyses empirical findings and discusses findings. The fifth section summarizes and makes policy suggestions.

2. Literature review

The amount of funds a country invests and spends on health care has a direct correlation with the rate of economic growth. Forecasting a nation's wellbeing in terms of its level of health preparation depends on an understanding of the interactions and underlying relationships between health expenditure and national development

Furthermore, relevant empirical studies were reviewed in this section. Some studies argued that healthcare expenditure has direct effect on health outcomes of the population. Rahman, Khanam, and Rahman (2018) used fixed and random effect models for 15 nations from 1995 to 2014 to determine the relationship between healthcare expenditure and health outcomes. The findings showed that healthcare expenditure greatly decreased newborn death rates. Since private healthcare expenditure had a bigger impact than public healthcare expenditure, the study came to the conclusion that health expenditure in SAARC should be increased in order to improve population health. Additionally, it is important to employ public health funding wisely and effectively and to implement the right strategies for enhancing sanitary facilities. According to David (2018), the results of the progressive effects of malaria incidence and expenditure on health outcomes in Nigeria using the ordinary least square (OLS) estimate approach showed that increasing health and educational spending will lower the incidence of malaria.

A regression analysis by Nwankwo (2018) was used to investigate the impact of public health expenditure on maternal mortality using data collected from roughly 25 chosen states between 2003 and 2015. It was discovered that public health spending was a key element in lowering the incidences of maternal death using the instrumental variables approach as a panacea to the econometric problem of endogeneity. In order to enhance health outcomes, the study advocated higher expenditure in the health sector. Novignon *et al.* (2012) used the fixed and random effects estimator to assess the effects of healthcare expenditure on population health status and to look at the effect by public and private expenditure sources in 44 Sub-Saharan African countries from 1995 to 2010. The findings showed that both public and private healthcare expenditure show a strong positive relationship with health status, though public healthcare expenditure had a relatively higher impact. The findings further showed that healthcare expenditure has a considerable impact on health status by raising life expectancy and lowering death and infant mortality rates.

Wang (2021) investigates the associations between public health expenditure and country-level health outcomes. The results indicated a negative correlation between government health expenditure and infant mortality rate, but a positive correlation between government health spending and life expectancy at birth. Becchetti, Conzo and Salustri (2015) examined the relationship between health expenditure and health outcomes for a sizable sample of Europeans over the age of 50 using individual and regional-level data. The findings demonstrated that changes in the prevalence of chronic diseases are negatively and significantly impacted by health expenditures relative to GDP and health expenditures per capita. After adjusting for real per capita income, literacy level, and female labor market participation, health expenditure also has heterogeneous effects on health outcomes.

Edeme, Emecheta and Omeje (2017) examined the impact of public health expenditure on health outcomes (measured by birth weight and infant death rates) in Nigeria. The findings demonstrate a long-term equilibrium relationship between public health expenditure and health outcomes. It implies that rising public health expenditure raises life expectancy and lowers infant mortality rates while also having a significant impact on urban population and HIV prevalence rate. However, per capita income in Nigeria has no bearing on health

outcomes. According to the study, public health expenditure is still crucial for enhancing health outcomes in Nigeria.

Arthur and Oaikhenan (2017) examined the impact of health expenditure on health outcomes measured by life expectancy, under-five mortality, and maternal mortality across 46 sub-Saharan African nations between 2000 and 2015. According to research, the region's health expenditure is significantly influenced by factors including the gross domestic product (GDP) per capita, the number of physicians per 1,000 people, the population's age over 65, and the death rate for children under the age of five. Similarly, Nketiah-Amponsah (2019) discovered that health expenditure had a positive and significant impact on all three health outcomes. Based on the findings, it was hypothesized that sub Saharan Africa's health results tend to improve as healthcare expenditure steadily rises over time.

Koçyiğit, and Çilhoroz (2021) used Ordinary least square (OLS) regression to examine the factors influencing health expenditure in 163 nations from 2010 to 2016. The results demonstrate that health expenditure grows when income, the number of people over 65, the unemployment rate, and urbanization rise, while inflation has no statistical impact on health expenditure. The study found that developing strategies to alter people's lifestyles to avoid unemployment, distributing health resources to urban and rural populations fairly, and reducing chronic diseases are crucial for improving health outcomes. Azuh *et al.* (2020) used the Autoregressive Distribution lag technique to look at the long-run effects of public health expenditure on under-five mortality in Nigeria for the years 1985 to 2017. The results of the study revealed that public health expenditure is statistically significant. It had a positive correlation with under-five mortality, suggesting that raising public health expenditure would raise the rate of under-five death.

Using the ARDL, the Error Correction model, and the Granger causality test, Obisike *et al.* (2021) examined the effect of public health expenditure on health outcomes in Nigeria from the years 1981 to 2018. The Granger causality test results show unidirectional causality between public health expenditure, private health expenditure, foreign assistance on health, health education, and newborns protected against tetanus. Error Correction Mechanism results were negative and statistically significant

over the long term. As a result, it was determined that both public and private health expenditure help to enhance health outcomes in Nigeria.

With a panel data of 32 Sub-Saharan African nations from 2000 to 2015, Langnel and Buracom (2020) investigated the impact of governance and health expenditure on infant mortality using Generalized Method of Moment (GMM). Findings demonstrate that health expenditure and governance do not directly affect infant mortality. It further showed that though significant but have a negative association with infant mortality, which suggests that the administrative strength of nations can account for the efficacy of health expenditures. According to the report, governance needs to be continually improved to produce results in the area of health. Using the ARDL estimator, Akinbode and Sam-Wobo (2020) examined the impact of government health expenditure on maternal health outcomes in Nigeria from 1980 to 2018. The findings demonstrated that in the short run, government health expenditure, the number of doctors per thousand, and GDP per capita significantly reduced maternal mortality rate, while in the long run, government health expenditure, female school enrollment, and GDP per capita significantly reduced maternal mortality ratio.

3. Methodology

In this section, the study presents the methodology used to achieve the objectives of this study in conjunction with the model specification, theoretical expectation, estimation method and data source and description.

3.1 Data

The study evaluates a cross section of 15 ECOWAS nations from 2000 to 2020 (data availability) using an annual data sourced from World Development Indicator (WDI) and World Health Organization (WHO). The list of member countries includes Benin, Burkina Faso, Cabo Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo. There are two reasons for selecting these countries. The countries form a group of low human development countries except Cape Verde and Ghana that falls within medium human development and region in Africa with similar economic policies. Also, the countries have a common interest to pursue and achieve both Millennium Development Goals (MDG) and the

Sustainable Development Goals (Alimi, Ajide, and Isola, 2020). The data gathered were subjected to various econometrics tests with the aid of E-views and STATA.

3.2 Empirical Model

The model for analyzing the effect of healthcare expenditure on health outcomes is consistent with previous empirical literatures like Grossman (2000), and Fayissa and Gutema (2005). The health production function of this study is specified as:

$$H = f(Y, S, V, D) \quad (1)$$

Where: H represent a vector of health outcomes (that is, life expectancy, under-five mortality, maternal mortality, infant mortality), Y represent a vector of per capita economic variable, such as private, public, national and external healthcare expenditure per capita, S represent a vector of social variables, which includes education (Primary school enrollment) and age structure of the population, V represent a vector of environmental factors (sanitation, prevalence of malaria and HIV and access to water), D represent a vector of health service utilization variables, preventive healthcare services (immunizations).

In addition, the model is created by incorporating i (individual units) and t(time) to represent the characteristics of cross-sectional and time series data, as per the characteristics of a panel data set. In accordance with these attributes, the empirical model is specified as:

$$\text{In}h_{it} = \beta_0+\beta_1 InHE_{it}+\beta_2 S_{it}+ \beta_3 V_{it}+\beta_4 D_{it}+u_{it} \quad (2)$$

Where h_{it} represent Health outcome (proxy with life expectancy at birth (*LEB*), under-five mortality rate (*U5MR*), maternal Mortality rate (*MMR*) and infant mortality rate (*IMR*)), *HE* represents private healthcare expenditure, public healthcare expenditure, national healthcare expenditure, and external healthcare expenditure respectively. β_1 denotes the coefficients of the explanatory variables to explain the effects of one unit or percent change in the respective variable on health outcomes holding other variables constant. β_0 denotes the intercept terms in the equations, u_{it} represent the error term.

Table 1: Descriptive Statistics

Signs	Variables Measurements	Mean	Std. Dev.	Max.	Min.	Kurtosis	Skewness	Obs.
Outcome Variables								
lep	Life expectancy at birth, total (years)	57.459	6.125	73.166	39.441	0.444	0.241	315
mmr	Maternal mortality ratio (modeled estimate, per 100,000 live births)	652.025	351.367	2480	58	4.675	1.478	315
imr	Mortality rate, infant (per 1,000 live births)	67.048	24.053	138.1	12.2	0.180	0.166	315
u5mr	Mortality rate, under-5 (per 1,000 live births)	107.11	43.072	224.9	14.2	-0.002	0.176	315
Main Explanatory Variables								
nhe	Current health expenditure per capita (current US$)	48.43	33.88	191.28	7.544	4.988	2.034	315
puhe	Domestic general government health expenditure per capita (current US$)	14.44	22.18	116.99	1.126	10.699	3.326	315
pvhe	Domestic private health expenditure per capita (current US$)	24.96	15.79	80.29	3.479	0.183	0.938	315
exhe	External health expenditure per capita (current US$)	9.024	8.449	74.70	0.452	15.984	3.076	315
Control Variables								
im_dtp	Immunization, DPT (% of children ages 12-23 months)	74.62	17.42	99	25	-0.242	-0.764	315
Im_hepB3	Immunization, HepB3 (% of one-year-old children)	73.86	20.17	99	10	1.311	-1.304	315
Im_ms	Immunization, measles (% of children ages 12-23 months)	71.94	16.02	99	30	-0.587	-0.429	315
Ihiv	Incidence of HIV, all (per 1,000 uninfected population)	0.918	0.699	3.85	0.05	3.592	1.667	294
f_hiv15_24	Prevalence of HIV, female (% ages 15-24)	0.945	0.664	4.4	0.1	3.319	1.222	315
Inc_mal.	Incidence of malaria (per 1,000 pop.at risk)	320.9	148.5	603.21	0.008	-0.185	-0.812	313
Inc_tb.	Incidence of tuberculosis (per 100,000 people)	167.8	97.05	367	36	-0.920	0.486	315
Bw	People using at least basic drinking water services (% of population)	64.1	11.917	88.77	36.85	-0.711	-0.122	315
Bs	People using at least basic sanitation services (% of population)	24.9	16.079	79.12	5.197	0.562	1.132	315
p15_64	Population ages 15-64 (% of total population)	53.4	3.371	67.13	47.18	4.053	1.413	315
f_ p15_64	Population ages 15-64, female (% of female population)	53.9	3.019	65.99	47.78	3.636	1.232	315
p65ab	Population ages 65 and above (% of total pop.)	3.035	0.617	5.673	2.407	7.444	2.641	315
f_p65ab	Population ages 65 and above, female (% of female population)	3.377	0.833	6.661	2.582	6.739	2.577	315
f_psch	School enrollment, primary, female (% gross)	86.59	21.77	145.59	25.99	-0.159	-0.175	296

Note: Std Dev. - standard deviation; Max. - maximum; Min. - minimum; Obs. - observation.
Source: Author's computation (2023)

The outcome variables consist of life expectancy total (years), maternal mortality rate (modeled estimate per 100,000 live births), Infant mortality rate (per 1,000 live births), Under-five mortality rate (per 1,000 live births). From the summary statistics presented in Table 1, the average value of life expectancy, maternal mortality rate, infant mortality rate and under-five mortality rate are 58 years, 652.03, 67.05, 107.11 ratio respectively.

As regards the explanatory variables, the healthcare expenditures are measured by National healthcare expenditure (current health expenditure per capita, current US $), public healthcare expenditure (domestic general government health expenditure per capita, current US $), private healthcare expenditure (domestic private health expenditure per capita, current US $), and external healthcare expenditure (external health expenditure per capita, current US $). In Table 1, the average values of national, public, private and external healthcare expenditures are US$48.43, US$ 14.44, US$ 24.96, US$ 9.02.

Other controlling variables are incidence of HIV (per 1000 uninfected population) and the annual percentage of population growth in ECOWAS with the mean values of 0.92% and 2.70% respectively. The average mean of Immunizations (DPT, Hep B and Measles) stands at 74.6%, 73.9% and 71.9% respectively. Also, the mean of the people using at least basic drinking water services and sanitation services are 64.1% and 24.9% which are the goal 3 and 6 of the sustainable development goal (SDG) The mean of incidence of malaria and tuberculosis in ECOWAS shows 320.9 per 1000 and 167.8 per 100,000 which indicates that 320.9 average of the population are at risk of malaria and 167.8 per 100,000 has tuberculosis in ECOWAS. As for female primary school enrollment in ECOWAS, their average mean is 86.6%. Concerning, population of age structure of 15-64 (% of total population and female population and 65 and above (% of total population and % of female population) stands the mean value of total population 53.4% and 53.9% female population of ages 15 – 64years. While 3% and 3.4% are the mean value recorded for the ages 65 and above (both for the % of total and female population) in ECOWAS.

Table 2: Correlation Matrix

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
lep	-0.822	-0.936	-0.923	0.525	0.657	0.108	0.181	0.626	0.444	0.583	-0.486	-0.592	-0.642	-0.441	0.664	0.584	0.507	0.556	0.526	0.559	0.428
mmr(1)	1	0.836	0.764	-0.320	-0.497	-0.007	0.034	-0.538	-0.290	-0.467	0.315	0.397	0.352	0.648	-0.499	-0.359	-0.351	-0.383	-0.315	-0.355	-0.260
imr(2)		1	0.954	-0.501	-0.602	-0.130	-0.187	-0.688	-0.446	-0.623	0.380	0.552	0.654	0.466	-0.654	-0.611	-0.462	-0.502	-0.361	-0.381	-0.366
u5mr(3)			1	-0.575	-0.602	-0.258	-0.245	-0.718	-0.425	-0.648	0.289	0.409	0.651	0.333	-0.750	-0.606	-0.579	-0.609	-0.428	-0.426	-0.542
nhe(4)				1	0.845	0.747	0.395	0.371	0.272	0.383	-0.097	-0.208	-0.517	0.001	0.581	0.626	0.784	0.748	0.604	0.621	0.371
puhe(5)					1	0.359	0.092	0.395	0.295	0.439	-0.182	-0.351	-0.581	-0.272	0.519	0.637	0.759	0.748	0.780	0.819	0.294
pvhe(6)						1	0.183	0.040	-0.034	-0.003	-0.059	0.091	-0.221	0.257	0.341	0.316	0.514	0.459	0.215	0.184	0.254
exhe(7)							1	0.375	0.381	0.388	0.007	-0.081	-0.147	0.239	0.331	0.248	0.190	0.178	-0.027	-0.005	0.252
im_dtp(8)								1	0.678	0.933	-0.122	-0.234	-0.406	-0.247	0.499	0.341	0.390	0.385	0.208	0.230	0.414
im_hepb3(9)									1	0.714	-0.201	-0.296	-0.343	-0.079	0.363	0.238	0.254	0.259	0.089	0.122	0.162
im_ms(10)										1	0.007	-0.187	-0.387	-0.149	0.486	0.346	0.397	0.385	0.231	0.259	0.347
ihiv(11)											1	0.843	0.066	0.504	-0.043	-0.259	0.168	0.128	0.028	-0.046	-0.031
f_hiv15-24(12)												1	0.380	0.501	-0.193	-0.511	0.004	-0.047	-0.230	-0.273	-0.001
inc_mal(13)													1	-0.049	-0.502	-0.604	-0.480	-0.549	-0.490	-0.489	-0.355
inc_tb(14)														1	-0.105	-0.266	0.030	0.026	-0.130	-0.169	-0.065
bw(15)															1	0.706	0.571	0.586	0.446	0.393	0.386
bs(16)																1	0.429	0.438	0.454	0.430	0.170
p15-64(17)																	1	0.985	0.591	0.627	0.592
f_p15-64(18)																		1	0.605	0.648	0.595
p65ab (19)																			1	0.969	0.351
f_p65ab (20)																				1	0.346
f_psch (21)																					1

Note: lep – Life expectancy at birth (total years) ; mmr – Maternal mortality rate (per 100,000 live birth); imr- Infant mortality rate (per 1,000 live births); u5mr-Under-five mortality rate (per 1,000 live birth); Public healthcare expenditure per capita; pvhe- Private healthcare expenditure per capita; exhe – External healthcare expenditure; im_dtp – Immunization, DPT (% of children ages 12-23 months); im_hepb3 - Immunization, HepB3 (% of one-year-old children); im_ms - Immunization, measles (% of children ages 12-23 months); ihiv- Incidence of HIV, all (per 1,000 uninfected population); f_hiv15-24 - Prevalence of HIV, female (% ages 15-24);inc_mal - Incidence of malaria (per 1,000 population at risk); inc_tb - Incidence of tuberculosis (per 100,000 people); bw- People using at least basic drinking water services (% of population); bs - People using at least basic sanitation services (% of population);p15-64 -Population ages 15-64 (% of total population); f_p15-64 - Population ages 15-64, female (% of female population); p65ab - Population ages 65 and above (% of total population); f_p65ab- Population ages 65 and above, female (% of female population), f_psch- School enrollment, primary, female (% gross).

Source: Author's computation (2023).

In addition, the correlation matrix indicating correlation matrix indicating the level of association between the variables is displayed in Table 2, there are no worrisome difficulties regarding the link between the variables because the correlation results do not indicate any risks of having multicollinearity.

4. Empirical result and discussion

The empirical estimation commences with a cross sectional dependence test (CD) used to further analysis of the study to confirm whether all variables in the same cross section are correlated. This is explaining the interdependency of variables of interest between cross sections and it is attributed to the effect of some unobserved common factors, common to all variables affecting each of them in different ways. The need to guarantee accurate estimates and estimator effectiveness, the Pesaran CD test becomes imperative.

Table 3: Cross-Sectional Dependence Test Results (d.f. = 105)

H_0: There is no cross-sectional dependence

Test	Main explanatory variables	Dependent Variables							
		Life expectancy		Maternal mortality		Infant mortality		Under 5 mortality	
		Stat.	Prob.	Stat.	Prob.	Stat.	Prob.	Stat.	Prob.
Pesaran CD	National health	3.2319	0.0012	4.4700	0.0000	3.8285	0.0002	5.5606	0.0000
	Public health	2.1175	0.0342	5.8108	0.0000	4.4302	0.0000	9.1722	0.0000
	Private health	4.2392	0.0000	2.0620	0.0392	2.1467	0.0318	3.9250	0.0001
	External health	4.3198	0.0000	4.3560	0.0000	3.4005	0.0006	3.5622	0.0004

Note: Other explanatory variables included with the main explanatory variables are basic water and sanitation, immunizations (Hepb3, DTP and measles), incidence of HIV, malaria and tuberculosis, female prevalence of HIV, female school enrollment, total population age structure (65 and above, 15-24, 15-64), female population age structure (65 and above, 15-24, 15-64).
Source: Author's computation (2023).

Following the cross-sectional dependence (CD) test reported in table 1, confirms the rejection of null hypotheses of no correlation at predictable significance levels. As for the test statistics values of Pesaran CD test, the values of health outcomes models are significant statistically as they reject the null hypotheses at 5% significance level.

Table 4: Panel Unit Root Test Results

Variables	Variable Description	Levels			1st Difference			Decision
		LLC	Breit	IPS	LLC	Breit	IPS	
bs	Basic sanitation	-2.6731***	-0.1552	-12.173***	-	-1.8306**	-	I (1)
bw	Basic water	-2.0640***	-3.3928***	0.6547	-	-	-3.6155***	I (1)
exhe	External health expenditure	-1.8627	-0.8208	-0.2650	-6.7473***	-7.7250***	-8.7762***	I (1)
nhe	National health expenditure	-1.6164**	-3.1151***	2.4291	-13.5125***	-11.2304***	-11.7622***	I (1)
puhe	Public health expenditure	-1.8879**	-1.3273*	0.2263	-12.0540***	-6.2903***	-10.2515***	I (1)-
pvhe	Private health expenditure	-1.8040**	-0.2623	-1.8100**	-11.1831***	-9.0773***	-8.5554***	I (1)
f_hiv15_24	Female Prevalence of HIV	-3.5629***	-2.3244***	-3.5045***	-	-	-	I (0)
f_p15_64	Female Population (15-64)	-9.9486***	3.0992	-3.6267***	-	-	-	I (0)
f_p65ab	Female Population (65&above)	-2.7664***	-3.4219***	-0.6747	-	-	-2.5056***	I (1)
p15_64	Population (15-64)	-2.0442**	3.2849	-2.0741**	-2.2589***	-	-2.2262***	I (0)
p65ab	Population (65&above)	-2.0793**	-5.2243***	-2.1764**	-17.6394***	-2.7398***	-11.8546***	I (1)
f_psch	Female Primary Sch. Enrollment	1.5121	5.1248	3.1128	-7.7483***	-3.3823***	-5.7511***	I (1)
Ihiv	Incidence of HIV	-0.2423	-4.7482***	1.2148	-7.1957***	-4.6874***	-6.0155***	I (1)
im_dtp	Immunization, DTP	-3.7072***	-2.3640***	-0.6281	-	-	-12.2434***	I (1)
im_hepb3	Immunization, HEPB3	-2.0162**	3.7901	-1.5199*	-10.1459***	-5.4675***	-10.1593***	I (1)
im_ms	Immunization, measles	-3.0762***	-1.9461**	-1.2848*	-13.2150***	-6.2514***	-10.5367***	I (1)
inc_mal	Incidence of malaria	-2.3782***	1.6069	-4.3903***	-	-3.6146***	-	I (1)
inc_tb	Incidence of tuberculosis	-6.1127***	7.2478	-1.6664**	-	-4.5767***	-	I (1)
imr	Infant mortality rate	0.2289	-2.2716***	1.1727	-2.4431***	-	-2.4794***	I (1)
lep	Life expectancy at birth	-29.5700***	3.5081	-42.2908***	-	-4.0415***	-	I (1)
mmr	Maternal mortality rate	-6.2432***	9.6395	0.5512	-	-1.4659*	-5.4159***	I (1)
u5mr	Under-5 mortality rate	-2.1755**	0.5801	0.1851	-	-1.6325**	-2.7135***	I (1)

Note: LL denotes Levin, Lin & Chin (2002); Breit represents Breitung (2001); IPS denotes Im, Pesaran & Shin (2003); ***, ** & * denote 1%, 5% & 10% significance levels.
Source: Author's computation (2023).

Regarding the panel unit root test confirmed female prevalence of HIV age 15 – 24 (f_hiv15_24) are stationary at levels of I (0). Likewise, population ages 65 and above (p_65_ab) is stationary at the levels of I (0) at 1% and 5% significant levels but at first differences the three (3) unit root test estimators reveal stationarity at 1% significance level respectively. Also, Immunization, measles shows stationarity at levels at 1% (LLC), 5% (Breit) and 10% (IPS) significance levels respectively but stationary at first differences at 1%.

The three (3) unit root test estimators revealed that external healthcare expenditure and female primary school enrollment (f_psch) are stationary at first difference of I(1). As regards Basic sanitation (BS), Incidence of Malaria (Inc_mal), Life Expectancy at birth (LEP), under-five mortality rate, infant mortality rate, maternal mortality rate, Incidence of tuberculosis (Inc_tb) and Private Healthcare Expenditures (PVHE) the unit root test results are mixed using the three (3) estimators. The results of Levin, Lin and Chin (LLC) and Im, Perasan and Shin (IPS) unit root test revealed that Basic sanitation (BS), Incidence of Malaria (Inc_mal), Life Expectancy at Birth (lep), Incidence of tuberculosis (Inc_tb), Private healthcare expenditure (PVHE) are stationary at levels but the Breitung (Breit) unit root test found that they are stationary at first differences.

Levin, Lin and Chin (LLC) and Im, Perasan and Shin revealed that immunization, HepB3 and Private Healthcare Expenditure (PVHE) are stationary at levels at 1% and 5% significant levels but the three methods show stationary at 1% significance level at first difference.

The unit root test results of Levin, Lin Chin (LLC) and Breitung (Breit) for Basic water (BW), National healthcare expenditure (nhe), Public healthcare expenditure (puhe), Immunization, DTP (Im_dtp), female population ages 65 and above (f_p65ab) are stationary at levels but Im, Pesaran and Shin (IPS) unit root test showed that they are stationary at first differences. It was observed that the estimators revealed National healthcare expenditure (nhe) and public healthcare expenditure (puhe) stationarity at first difference. The results of Breitung (Breit) unit root test showed that Infant mortality rate (imr) and incidence of HIV (Ihiv) are stationary at levels but Levin, Lin and Chin (LLC) and Im, Pesaran and Shin (IPS) unit root test revealed that infant mortality rate and incidence of HIV are stationary at first differences.

Meanwhile, unit root test of Levin, Lin and Chin (LLC) and Im, Pesaran and Shin (IPS) found that female population at ages 15 – 64 and Population at ages 15-64 are stationary at levels but unit root test of Breitung (Breit) found no results both at the levels and first differences. Levin, Lin and Chin (LLC) unit root test found maternal mortality rate and under-five mortality rate stationary at levels whereas Breitung (Breit) and Im, Pesaran and Shin (IPS) revealed stationarity of the variables at first difference The study concluded that Basic sanitation, Basic water, National healthcare expenditure, public healthcare expenditure, Private healthcare expenditure, external healthcare expenditure, Female population ages 65 and above, Population ages 65 and above, Incidence of HIV, Immunization, measles, Incidence of malaria, Incidence of Tuberculosis, Life Expectancy at birth , infant mortality rate, under-five mortality and maternal mortality rate are stationary at first difference.

Table 5: KAO Residual Test for Cointegration

H_0: There is no co-integration

Test	**Main explanatory variables**	**Dependent Variables**							
		Life expectancy		**Maternal mortality**		**Infant mortality**		**Under 5 mortality**	
		Stat.	**Prob.**	**Stat.**	**Prob.**	**Stat.**	**Prob.**	**Stat.**	**Prob.**
Kao Test	National health	-2.5088	0.0061	-2.1171	0.0171	-4.2555	0.0000	-3.6844	0.0001
	Public health	-2.5543	0.0053	-2.1604	0.0154	-4.7150	0.0000	-4.0545	0.0000
	Private health	-2.3931	0.0084	-2.0360	0.0209	-4.3708	0.0000	-3.6307	0.0001
	External health	-2.3332	0.0098	-2.1673	0.0151	-4.2347	0.0000	-3.6062	0.0002

Note: Other explanatory variables included with the main explanatory variables are basic water and sanitation, immunizations (Hepb3, DTP and measles), incidence of HIV, malaria and tuberculosis, female prevalence of HIV, female school enrollment, total population age structure (65 and above, 15-24, 15-64), female population age structure (65 and above, 15-24, 15-64).
Source: Author's computation (2023)

Table 3 presents the KAO Residual test for cointegration (Kao). Within the conventional probability test criteria, Table 4.6 revealed that a rejection of the null hypotheses of no cointegration for the model at 5% level of significance. This means that there exists a long-run relationship among the regressand and regressors across all the estimated models in the study. Hence, it approves that the presence of co-integration or a

long-run relationship between healthcare expenditures and health outcomes in ECOWAS.

4.1 Short Run and Long Run Parameter Estimation

The empirical result of the effects of healthcare expenditures on health outcomes in ECOWAS using the pooled mean group estimator were discussed in this section. The null hypotheses of Hausman tests in Tables 6-9 indicate that the difference in coefficients of mean group and pooled mean group not being systematic are accepted at 5% level of significance. This therefore, indicates the suitability of pooled mean group as the appropriate estimator to test the research hypothesis. Health outcomes as the outcome variable was measured by life expectancy, maternal mortality rate, infant mortality and under-five mortality rate. Four models were estimated and labeled 1, 2, 3, and 4. The selection of optimal lag lengths on the variables were selected automatically using the Bayesian Information Criterion (BIC) after setting it at three in order to ensure sufficient degree of freedom. The most common lag across the fifteen ECOWAS countries is one for each variable of interest.

4.1.1 Effect of Healthcare Expenditures on Life Expectancy at Birth in ECOWAS

Table 6 presents the summary of short-run and long-run parameter estimates of the pooled mean group or panel autoregressive distributed - ARDL (1, 1, 1, 1, 1, 1) of healthcare expenditures and life expectancy at birth. From the table, the coefficients of error correction term (ECT) are found to be positive and negative and statistically significant at the conventional level. The coefficients of the error correction term are -0.1181, -0.1479, 0.0622 and 0.0139 respectively with their probability values of t-statistic less than 1%. The implication is that the empirical models of life expectancy at birth in each healthcare expenditure models correct their short-run disequilibrium by 11.8%, 14.8%, 6.2% and 1.4% speed of adjustment in order to return to the long run equilibrium. This confirms that there is an existence of a long run relationship between healthcare expenditures and life expectancy at birth in ECOWAS countries. Thus, it established that the models' equilibrium nature is valid in the long run.

Table 6: Pooled Mean Group Estimates of Healthcare Expenses and Life Expectancy at birth

Variables	**Dependent Variable:** Life Expectancy at birth			
	1	**2**	**3**	**4**
	Short-Run Estimates			
ECT	-0.1181***	-0.1479***	0.0622***	0.0139***
	(0.0132)	(0.0133)	(0.0038)	(0.0007)
D (National Health Expenditure (-1))	0.0010*			
	(0.0007)			
D (Public Health Expenditure (-1))		0.0001**		
		(0.0004)		
D (Private Health Expenditure (-1))			0.0016***	
			(0.0005)	
D (External Health Expenditure (-1))				0.0003*
				(0.0002)
D (People access to basic sanitation (-1))	-0.0114	0.0095	-0.0084	-0.0109
	(0.0340)	(0.0368)	(0.0214)	(0.0216)
D (People access to basic water (-1))	-0.0549	-0.0990	-0.1007	-0.0934
	(0.0846)	(0.0990)	(0.0916)	(0.0892)
D (Incidence of malaria (-1))	0.0006	-0.0007	0.0022	0.0019
	(0.0034)	(0.0034)	(0.0032)	(0.0036)
D (Incidence of tuberculosis (-1))	-0.0094	0.0152	0.0095	-0.0066
	(0.0280)	(0.0185)	(0.0172)	(0.0174)
D (Incidence of HIV (-1))	0.0024	-0.0002	-0.0008	-0.0015
	(0.0027)	(0.0029)	(0.0025)	(0.0472)
	Long-Run Estimates			
National Health Expenditure	0.0316***			
	(0.0040)			
Public Health Expenditure		0.0326***		
		(0.0053)		
Private Health Expenditure			0.0513***	
			(0.0179)	
External Health Expenditure				-0.0177
				(0.0509)
People access to basic sanitation	0.0291***	-0.0454***	0.3914*	-0.9837
	(0.0030)	(0.0048)	(0.2216)	(2.7621)
People access to basic water	0.0258***	0.0493 ***	-0.0739	-0.1331
	(0.0030)	(0.0056)	(0.0563)	(0.4860)
Incidence of malaria	0.0706***	0.0460***	-0.0744	-0.2898
	(0.0096)	(0.0085)	(0.0560)	(0.8401)
Incidence of tuberculosis	-0.2294***	-0.6903***	0.0387**	-0.1168
	(0.3240)	(0.0748)	(0.1479)	(0.4067)
Incidence of HIV	-0.0266***	-0.0338***	-0.0446	-0.6281
	(0.0056)	(0.0106)	(0.0811)	(1.7903)
Constant	0.0862	0.1488*	-0.0009	0.0069
	(0.0698)	(0.0855)	(0.0473)	(0.0472)
Log Likelihood	1669.161	1701.047	1635.112	1630.098
Hausman Test (Prob.)	0.22 (0.999)	0.04(1.000)	2.19(0.901)	-0.12(1.000)
Country	14	14	14	14
Observations	280	280	280	280

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10.
Source: Author's computation (2023)

In the short run estimates, the parameters of lag one of the healthcare expenditures are positive and statistically significant at 5% level. This means that there exists a positive relationship between life expectancy and healthcare expenditures in ECOWAS. The implication is that healthcare expenditures have significant impact on short run life expectancy at birth in ECOWAS countries. The coefficient of access to basic sanitation in national, public and external healthcare model is negatively and statistically insignificant on life expectancy in the short run while in Private healthcare expenditure model, it is positive and statistically insignificant at conventional level. Similarly, the indirect impact of access to basic water on life expectancy at birth in the short run is statistically insignificant across the four models.

The incidence of malaria in national, private and external healthcare expenditure models have a positive effect on life expectancy at birth in the short run while in the public healthcare expenditure model, there is a negative and an insignificant effect on life expectancy at conventional level. The coefficients of incidence of tuberculosis on life expectancy at birth shows negative in national and external healthcare expenditure model, positive in public and private healthcare expenditure models and is not statistically significant at 5% level. Incidence of HIV have a positive coefficient in national healthcare expenditure model and a negative coefficient in public, private and external healthcare expenditure models and have no statistically significant. This shows that incidence of HIV has no statistical impact on short run expectancy at birth in ECOWAS.

Regarding the long run relationship between healthcare expenditures and life expectancy at birth in ECOWAS countries between 2000 and 2020, healthcare expenditure expenditures have a direct and significant impact on life expectancy except external healthcare expenditure and have no statistically significant impact on life expectancy in the long run. The parameter estimates of National, Public and Private healthcare expenditure are positively and statistically significant at 1% and external healthcare expenditure parameter estimate is negative and statistically insignificant at conventional level. The implication is that a 10% increase in national, public and private healthcare expenditure improves life expectancy by 0.32%, 0.32% and 0.51% respectively while a 10% change in external healthcare expenditure will result into 0.18% decrease in life expectancy as a whole in the long run.

Access to basic sanitation has a positive coefficient in national and private healthcare expenditure models and a negative coefficient in public and external healthcare expenditure models. In national and private healthcare expenditure model, access to basic sanitation have a direct and statistically significant impact on life expectancy at 1% and 10% significance level though in the public expenditure model, there is an indirect and a statistically significant impact of basic sanitation on life expectancy, also in external healthcare expenditure model, basic sanitation has an indirect and an insignificant impact on life expectancy at birth in ECOWAS. Likewise, people access to basic water and incidence of malaria has positive coefficients and they are statistically significant at 1% level in national and public healthcare expenditure models. In private and external healthcare expenditure models, there is a negative and statistically insignificant relationship between access to basic water and incidence of malaria on life expectancy in the long run.

In national and public healthcare expenditure models, incidence of tuberculosis and Incidence of HIV are negatively and statistically significant on life expectancy at 1% significance level while in private healthcare expenditure model, incidence of tuberculosis have a direct and statistically significant effect on life expectancy at 5% while incidence of HIV have an indirect and insignificant effect on life expectancy in the ECOWAS. Meanwhile, incidence of tuberculosis and incidence of HIV coefficients are negative and not statistically significant at conventional level in external healthcare expenditure model. It means that the negative effects of incidence of tuberculosis and incidence of HIV on life expectancy in ECOWAS are not statistically confirmed in the long run.

4.1.2 Effects of Healthcare Expenditures on Maternal Mortality Rate in ECOWAS

Table 7 presents the summary of short-run and long-run parameter estimates of the pooled mean group or panel autoregressive distributed - ARDL (1, 1, 1, 1, 1, 1) of healthcare expenditures and Maternal mortality rate. From the table, the coefficients of error correction term (ECT) are found to be negative and statistically significant at the conventional level, with coefficients of the error correction term -0.1379, -0.1199, -0.2030 and -0.1642 respectively and their probability values of t-statistic is less than 1%. The implication is that the empirical models of maternal mortality in each healthcare expenditure models correct their short-run

disequilibrium by 13.8%, 11.8%, 20.3% and 16.4% speed of adjustment in order to return to the long run equilibrium. This confirms that there is an existence of a long run relationship between healthcare expenditures and maternal mortality rate in ECOWAS countries.

Table 7: Pooled Mean Group Estimates of Healthcare Expenditure and Maternal Mortality Rate

Variables	**Dependent Variable: Maternal Mortality Rate**			
	1	**2**	**3**	**4**
	Short-Run Estimates			
ECT	-0.1379***	-0.1179***	-0.2030***	-0.1642***
	(0.0329)	(0.0403)	(0.0517)	(0.0365)
D (National Health Expenditure (-1))	-0.0071			
	(0.0080)			
D (Public Health Expenditure (-1))		-0.0148***		
		(0.0039)		
D (Private Health Expenditure (-1))			0.0215*	
			(0.0121)	
D (External Health Expenditure (-1))				-0.0020
				(0.0035)
D (Female HIV ages 15-24 (-1))	-0.0545	-0.05176	-0.0395	-0.0345
	(0.0386)	(0.0420)	(0.0445)	(0.0424)
D (Female Population ages 15-64 (-1))	0.0208	0.0146	-0.0192	0.0135
	(0.0369)	(0.0386)	(0.0390)	(0.0364)
D (Female Population ages 65 and above (-1))	-0.1150	-0.1607	-0.1549	-0.0807
	(0.1822)	(0.1932)	(0.2165)	(0.0005)
D (Female Primary School Enrollment (-1))	-0.0001	-0.0003	-0.0003	0.5569***
	(0.0006)	(0.0004)	(0.0006)	(0.1406)
	Long-Run Estimates			
National Health Expenditure	0.1636***			
	(0.0337)			
Public Health Expenditure		0.1005***		
		(0.0228)		
Private Health Expenditure			-0.1014***	
			(0.0136)	
External Health Expenditure				0.0369**
				(0.0171)
Female HIV ages 15-24	0.2827***	0.4311***	-0.0078	0.1398***
	(0.0517)	(0.0786)	(0.0147)	(0.0354)
Female Population ages 15-64	0.0561***	0.0745***	0.0426***	0.0610***
	(0.0139)	(0.0155)	(0.0064)	(0.0119)
Female Population ages 65 and above	-0.3281***	-0.2945***	0.0732	0.0236
	(0.0715)	(0.0830)	(0.0801)	(0.1040)
Female Primary School Enrollment	-0.0104***	-0.0082***	-0.0063***	-0.0082***
	(0.0011)	(0.0012)	(0.0007)	(0.0010)
Constant	0.5845***	0.3905***	0.9586***	0.5569***
	(0.1573)	(0.1543)	(0.2576)	(0.1406)
Log Likelihood	911.488	912.286	917.563	908.279
Hausman Test (Prob.)	0.21(0.9990)	3.06(0.6908)	0.68(0.9843)	1.46(0.9171)
Country	14	14	14	14
Observations	280	280	280	280

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10.
Source: Author's computation (2023).

As regards the short run estimates of national and external healthcare expenditure have a negative coefficient and have no statistical significance on maternal mortality rate. Public healthcare expenditure has a negative and statistically significant impact on maternal mortality rate at 1% and private healthcare expenditures have direct and a statistically significant impact on maternal mortality rate at 10% in the short run. It implies that 10% change in national, public and external healthcare expenditure will result into 0.07%, 0.15% and 0.02% reduction and 0.22% in increase in maternal mortality rate in the short run. However, female HIV ages 15-24 and female population ages 65 and above has an indirect and insignificant effect on maternal mortality in the short run at conventional levels.

In national, public and external healthcare expenditure models, female population ages 15-64 have a positive and statistically insignificant impact on maternal mortality rate while in private healthcare expenditure model, female population ages of 15-64 have a negative and an insignificant effect on maternal mortality rate in the short run. Female primary school enrollment in national, public and private healthcare models have an indirect and insignificant impact on maternal mortality rate while in external healthcare expenditure model, there is a positive and statistically significant impact on maternal mortality rate in the short run.

Table 7 also reports the long run relationship between healthcare expenditures and maternal mortality rate. The coefficient of the pooled mean group regression estimator of national, public and external healthcare expenditures has a direct and statistically significant effect on maternal mortality rate whereas private healthcare expenditure has an indirect and statistically significant impact on maternal mortality rate in ECOWAS. This revealed that a 10% change in national, public and external healthcare expenditure will correct maternal mortality rate by 1.64%, 1.01% and 0.37% respectively. Also, a 10% change in private healthcare expenditure results into a decline of 1.01% in maternal mortality rate. The parameter estimates of national, public and external healthcare expenditures are positive and statistically significance at 1% and 5%. The private healthcare expenditure parameter estimate is negative and statistically significant at 1%.

Female population ages 15-64 have a direct and significant impact on maternal mortality rate in the four models at 1% in ECOWAS.

Moreover, there is a negatively and statistically significant effect of female primary school enrollment on maternal mortality rate in ECOWAS countries in the long run. In national, public and external healthcare expenditures models, female HIV ages 15-24 have a positive coefficient and have statistically significant effect on maternal mortality rate at conventional level and in private healthcare expenditure model, female HIV ages 15-24 have negative coefficients and is not significant at conventional level. It shows that female HIV ages 15-24 have a statistical effect in national, public and external healthcare expenditure models on long run maternal mortality rate in ECOWAS and in private healthcare expenditure model, female HIV ages have no statistical impact on maternal mortality rate in the long term.

Meanwhile, there is a negatively and statistically significant impact of female population ages 65 and above in national and public healthcare expenditure model on maternal mortality rate whereas, in private and external healthcare expenditure, there is a positively and statistically insignificant effect of female population ages 65 and above on maternal mortality rates in ECOWAS as a whole in the long term.

4.1.3 Effects of Healthcare Expenditures on Infant Mortality Rate in ECOWAS

Table 8 presents the long run relationship between healthcare expenditures and infant mortality rate in 15 ECOWAS countries between 2000 and 2020. In the long run of the pooled mean group estimator, healthcare expenditures have a negative effect on infant mortality rate in ECOWAS. National and public healthcare expenditures have an indirect and insignificant impact on infant mortality rate while private and external healthcare expenditures have an indirect but a significant impact on infant mortality rate in the long run. In magnitude terms, a 10% change in healthcare expenditures results into 0.18%, 0.20%, 0.37% and 0.58% decreases in infant mortality rate respectively in ECOWAS countries.

Table 8: Pooled Mean Group Estimates of Healthcare Expenditure and Infant Mortality Rate

Variables	**Dependent Variable:** Infant Mortality Rate			
	1	**2**	**3**	**4**
	Short-Run Estimates			
ECT	-0.1300***	-0.1032***	-0.3537***	-0.1298***
	(0.0202)	(0.0168)	(0.0213)	(0.0137)
D (National Health Expenditure (-1))	-0.0020			
	(0.0025)			
D (Public Health Expenditure (-1))		0.0018		
		(0.0014)		
D (Private Health Expenditure (-1))			-0.0017	
			(0.0023)	
D (External Health Expenditure (-1))				0.0004
				(0.0016)
D (Immunization, Hep B3(-1))	-0.0002*	0.0002*	-0.0002*	-0.0003***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
D (Immunization, measles (-1))	-0.0002	-0.0002	-0.0002	-0.0002
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
D (Immunization, DTP (-1))	0.0001	-0.0000	0.0001	0.0003
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
D (People access Basic sanitation (-1))	-0.0196	-0.0760	-0.0147	0.0042
	(0.1363)	(0.0955)	(0.1190)	(0.1052)
D (People access Basic Water (-1))	-0.1742	0.1067	-0.1563	-0.1445
	(0.1681)	(0.1351)	(0.1499)	(0.1350)
D (Incidence of Malaria (-1))	-0.0107	-0.0074	-0.0095	-0.0124
	(0.0168)	(0.0166)	(0.0173)	(0.0179)
D (Incidence of HIV)	-0.0002	0.0039	0.0072	-0.0005
	(0.0112)	(0.0061)	(0.0072)	(0.0123)
	Long-Run Estimates			
National Health Expenditure	-0.0184			
	(0.0165)			
Public Health Expenditure		-0.0204		
		(0.0171)		
Private Health Expenditure			-0.0366**	
			(0.0176)	
External Health Expenditure				-0.0584***
				(0.0220)
Immunization, Hep B3	0.0006	0.0008*	0.0008	0.0047**
	(0.0005)	(0.0005)	(0.0005)	(0.0020)
Immunization, measles	0.0013*	0.0036*	0.0016*	0.0028*
	(0.0009)	(0.0015)	(0.0009)	(0.0016)
Immunization, DTP	-0.0017**	0.0027*	-0.0021***	-0.0039**
	(0.0008)	(0.0016)	(0.0008)	(0.0017)
People access Basic sanitation	-0.0061*	-0.0123*	-0.0069*	-0.0095
	(0.0041)	(0.0080)	(0.0039)	(0.0086)
People access Basic Water	0.0160*	0.0279***	-0.0117	0.0312
	(0.0089)	(0.0073)	(0.0083)	(0.0254)
Incidence of Malaria	0.3071***	-0.1247***	0.2828***	0.5051***
	(0.0622)	(0.0414)	(0.0602)	(0.2046)
Incidence of HIV	0.1629***	0.0440**	0.1446***	0.1479***
	(0.0389)	(0.0191)	(0.0351)	(0.0511)
Constant	0.1786	-0.0767	0.1698*	0.1088
	(0.1786)	(0.1244)	(0.1116)	(0.1233)
Log Likelihood	1379.392	1409.123	1427.832	1393.319
Hausman Test (Prob.)	2.74(0.9495)	0.18(0.9844)	6.49(0.5928)	1.06(0.9978)
Country	14	14	14	14
Observations	280	280	280	280

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10.
Source: Author's computation (2023)

Immunization, Hepatitis B3 has a direct impact on infant mortality rate in ECOWAS countries. In national and private healthcare expenditure models, Immunization, Hepatitis B3 have a positive and statistically insignificant effect on infant mortality rate and in public and external healthcare expenditure models, Immunization, Hepatitis B3 have a positive and statistically significant effect on infant mortality rate at 5% and 10% in ECOWAS. Also, Immunization, measles and incidence of HIV impacted infant mortality rate in ECOWAS, as there is a positive effect of immunization, measles and Incidence of HIV on infant mortality rate as a whole in the long-run. The implication of this is that, a change in Immunization, measles will result into a direct change in infant mortality rate. Also, an increase in incidence of HIV will result into an increase in infant mortality rate in the long-run.

Meanwhile, there is a negatively and statistically significant impact of access to basic sanitation on infant mortality rate in national, public, and private healthcare expenditure models while in external healthcare expenditure model, there is a negative and an insignificant impact of access to basic sanitation on infant mortality rate at conventional level. However, access to basic water has a positive and statistically significant effect on infant mortality rate in national and public healthcare expenditure models, also have positive but statistically insignificant effect in external healthcare expenditure model while it shows a negative and an insignificant effect on infant mortality in private healthcare expenditure model. Also, Incidence of malaria have a direct and statistically significant outcome on infant mortality in national, private and external healthcare expenditure models and an indirect and significant outcome in public healthcare expenditure model in the long-run.

Table 9: Pooled Mean Group Estimates of Healthcare Expenditure and Under-Five Mortality Rate

Variables	**Dependent Variable:** Under-Five Mortality Rate			
	1	**2**	**3**	**4**
	Short-Run Estimates			
ECT	-0.0590***	-0.1751***	-0.3671***	-0.0368***
	(0.1567)	(0.0141)	(0.0440)	(0.0058)
D (National Health Expenditure (-1))	0.0077			
	(0.0065)			
D (Public Health Expenditure (-1))		0.0073		
		(0.0032)		
D (Private Health Expenditure (-1))			0.0017	
			(0.0039)	
D (External Health Expenditure (-1))				0.0011
				(0.0018)
D (Immunization, Hep B3(-1))	0.0000	0.0001	-0.0002**	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0002)
D (Immunization, measles (-1))	-0.0003	-0.0003	-0.0008	-0.0002
	(0.0002)	(0.0002)	(0.0005)	(0.0002)
D (Immunization, DTP (-1))	0.0001	0.0000	0.0002	0.0002
	(0.0002)	(0.0001)	(0.0001)	(0.0002)
D (People access Basic sanitation (-1))	-0.0472	-0.0928	0.0779	-0.0252
	(0.0785)	(0.0719)	(0.1663)	(0.0602)
D (People access Basic Water (-1))	-0.0571*	-0.0669	-0.3647	0.0649
	(0.0304)	(0.1709)	(0.3502)	(0.1099)
D (Incidence of Malaria (-1))	-0.0064	0.0024	-0.0008	-0.0089
	(0.0191)	(0.0069)	(0.0187)	(0.0119)
D (Incidence of Tuberculosis (-1))	0.0304	0.0340	0.0294	0.0023
	(0.0921)	(0.0552)	(0.0505)	(0.0692)
	Long-Run Estimates			
National Health Expenditure	0.1542***			
	(0.0240)			
Public Health Expenditure		0.0052		
		(0.0092)		
Private Health Expenditure			0.0245**	
			(0.0127)	
External Health Expenditure				-0.3180**
				(0.1504)
Immunization, Hep B3	0.0053***	-0.0020***	0.0001	0.0135**
	(0.0009)	(0.0007)	(0.0001)	(0.0070)
Immunization, measles	0.0044***	0.0009	0.0019**	-0.0051
	(0.0010)	(0.0008)	(0.0008)	(0.0037)
Immunization, DTP	-0.0022***	0.0025**	0.0013*	-0.0032
	(0.0008)	(0.0011)	(0.0007)	(0.0036)
People access Basic sanitation	0.0530***	0.0757***	-0.0215***	0.0664***
	(0.0097)	(0.0165)	(0.0038)	(0.0547)
People access Basic Water	-0.0344***	-0.0593***	0.0049**	-0.0678**
	(0.0054)	(0.0086)	(0.0021)	(0.0334)
Incidence of Malaria	0.0630***	0.1787***	0.0580***	1.0096**
	(0.0216)	(0.0465)	(0.0127)	(0.4883)
Incidence of Tuberculosis	2.6790***	3.3247***	0.3371***	0.4355
	(0.2167)	(0.5261)	(0.0626)	(0.4559)
Constant	-0.0455	0.0978	0.3293	-0.1252
	(0.1321)	(0.1621)	(0.2550)	(0.0878)
Log Likelihood	1410.813	1474.268	1424.417	1485.236
Hausman Test (Prob.)	3.40 (0.9068)	0.32(1.0000)	0.05(1000)	-5.02
Country	15	15	15	15
Observations	300	300	300	300

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10.
Source: Author's computation (2023)

4.1.4 Effects of Healthcare Expenditures on Under-Five Mortality Rate in ECOWAS

Table 9 presents the summary of short-run and long-run parameter estimates of the pooled mean group or panel autoregressive distributed - ARDL (1, 1, 1, 1, 1, 1) of healthcare expenditures and under-five mortality rate. From the table, the coefficients of error correction term (ECT) are found to be negative and statistically significant at the conventional level. The coefficients of the error correction term -0.0590, -0.1751, -0.3671 and -0.0368 respectively and their probability values of t-statistic are less than 1%. The implication is that the empirical models of maternal mortality in each healthcare expenditure models correct their short-run disequilibrium by 5.9%, 17.5%, 35.7% and 3.7% speed of adjustment in order to return to the long run equilibrium. This confirms that there is an existence of a long run relationship between healthcare expenditures and under-five mortality rate in ECOWAS countries.

As regards the short-run coefficients, the parameters of lag one of total external debt is positive and statistically insignificant at conventional level. It means that there exists a positive relationship between healthcare expenditures and under-five mortality rate in ECOWAS. The implication is that healthcare expenditures have insignificant impact on short-run under-five mortality rate in ECOWAS. However, the coefficients of immunization, Hepatitis B3 are negative in private and external healthcare expenditure models while it is positive in national and public healthcare expenditure models in the short run. In private healthcare expenditure model, immunization, Hep B3 impact the under-five mortality rate indirectly and significantly at 5% while in national, public and external healthcare expenditure models, immunization Hep B3 have no significant impact on short run under-five mortality rate in ECOWAS. Also, immunization, DTP and incidence of tuberculosis are positively and statistically insignificant at conventional level in short run.

Meanwhile, there is a negative and insignificant relationship between immunization, measles and under-five mortality rate in the short run. Similarly, people access to basic sanitation malaria have a negative and insignificant effect on under- five mortality rate in national, public and external healthcare expenditure models while a positive and insignificant effect occurs between people access to basic sanitation and under-five mortality rate in private healthcare expenditure model in the short run.

Also, Incidence of malaria have an indirect and statistically insignificant result on under-five mortality in national, private and external healthcare expenditure models whereas, in public healthcare expenditure model, there is a direct and insignificant result in the short-run.

Table 9 also reports the long-run impact of healthcare expenditures on under-five mortality rate in ECOWAS countries between 2000 and 2020. In the long-run estimates, National and private healthcare expenditure has a direct and significant impact on under-five mortality rate. Private expenditure also has a direct but an insignificant impact on under-five mortality while External healthcare expenditure have a negative and a statistically significant impact on under-five mortality rate in ECOWAS.

Immunization, Hepatitis B3 has a direct and an indirect impact on under-five mortality rate in ECOWAS countries. In national and external healthcare expenditure models, Immunization, Hepatitis B3 have a positive and statistically significant effect on infant mortality rate. In private healthcare expenditure model, there is a direct and an insignificant effect on under-five mortality rate whereas in public healthcare expenditure models, Immunization, Hepatitis B3 has a positive and statistically insignificant effect on under-five mortality rate at conventional level in ECOWAS. Also, Immunization, measles impacted under-five mortality rate in ECOWAS, as there is a positive effect of the immunization, measles on under-five mortality rate in national and private healthcare models significantly. In public healthcare expenditure model, immunization, measles has a direct and an insignificant effect on under-five mortality rate and a negative and insignificant effect in external healthcare expenditure models.

Meanwhile, there is a negatively and statistically significant impact of immunization DTP, and access to basic water on infant mortality rate in national healthcare expenditure model while access to basic sanitation, incidence of malaria and incidence of tuberculosis has positive and significant effect on under-five mortality rate in the long run at the conventional level. In public healthcare expenditure model, there is a positive and a statistically significant impact of immunization DTP, access to basic sanitation, incidence of malaria and incidence of tuberculosis on under-five mortality rate at conventional level whereas people access to basic sanitation has a negative and a statistically significant impact on under-five mortality in pubic healthcare expenditure

models. However, immunization DTP, access to basic water, incidence of malaria and incidence of tuberculosis has a positive and statistically significant effect on under-five mortality rate in private healthcare expenditure model, also have positive but statistically insignificant effect in external healthcare expenditure model while it shows a negative and an insignificant effect on under-five mortality rate mortality in private healthcare expenditure model.

Access to basic sanitation and incidence of malaria has a positive and significant effect on under-five mortality rate in external healthcare expenditure model. Also, in external healthcare expenditure model, immunization, DTP has an indirect and insignificant impact on under-five mortality while people access to basic water has a negative and significant effect on under-five mortality rate in ECOWAS. Meanwhile, incidence of tuberculosis coefficient is positive and not statistically significant at conventional level in external healthcare expenditure model. It means that incidence of tuberculosis has a positive effect on long run under-five mortality rate insignificantly in ECOWAS.

5. Conclusion and Recommendations

This research study gives an empirical insight on the relationship among healthcare expenditures, health outcomes and economic growth in ECOWAS for the period spanning from 2000 to 2020. The poor healthcare intervention in the health system has been one of the major challenges hindering the improvement of health outcomes and sustainable economic growth in ECOWAS countries. Therefore, aside ensuring adequate and proper utilization of healthcare expenditures, amongst other economic goals, there is need to invest more on child health system, maternal health delivery and any health-related activities, also implement appropriate policies that are able to sustain these qualities in both present and future of the countries in ECOWAS as they serve as mechanism in achieving a favourable health outcomes and sustainable economic growth in the region and Africa at large.

Regarding healthcare expenditures (national, public, private and external healthcare expenditure) and health outcomes indicators (Life expectancy at birth, infant mortality rate, maternal mortality rate and under-five mortality rate), the empirical outcomes show that healthcare expenditures significantly impact life expectancy at birth in the short run and in the long run, The national healthcare expenditure, public healthcare

expenditure and public healthcare expenditures significantly impact life expectancy directly in ECOWAS Likewise, healthcare expenditures and maternal mortality rate reveals that in the short run, national and external healthcare expenditure has a negative and insignificant impact on maternal mortality rate. Public healthcare expenditure has a negative and significant impact on maternal mortality rate in the short run. Private healthcare expenditure has a direct and significant influence on maternal mortality rate. The study reports that National, public and external healthcare expenditure had a positive and significant effect on maternal mortality rate in the long run but had a negative and significant effect on maternal mortality rate.

In the short run, the Healthcare expenditures has no significant effect on infant mortality rate and under-five mortality rate whereas, in the long run, National and public healthcare expenditure reports negative and insignificant effect on infant mortality rate whereas private and external healthcare expenditure has a negative and significant influence on infant mortality rate. As for the under-five mortality rate, it was observed that in the long run, national and private expenditure has a direct and significant influence on under-five mortality rate. External healthcare expenditure has a negative and significant impact on under-five mortality rate whereas, public healthcare expenditure impact directly but insignificantly on under-five mortality rate in ECOWAS. This therefore, implies that an improvement in health level of the population would result in an increase in gross domestic product per capita through healthier and more productive labour force.

The findings show that national, public and private healthcare expenditures positively and significantly impact gross domestic product per capita in the long run whereas external healthcare expenditure negatively and significantly impact gross domestic product per capita in ECOWAS for the understudied period. This implies that an increase in healthcare expenditures would result in an increase in gross domestic product per capita in ECOWAS except for external healthcare expenditure that has negative and significant impact on gross domestic per capita. This could be as a result of (i) different external funding sources allocated health to countries in ECOWAS (ii) poor distribution of direct foreign transfers and foreign transfers distributed by government encompassing by financial inflows into the national health system from outside the country.

The study recommended that aside allocation of funds into the health system, the government should ensure that basic amenities are in place such as clean sanitation, basic clean water, preventive medications and so on, as these also have direct effect on the health status of the population. Also, it is part of the Sustainable Development Goals that ECOWAS member should endeavour to achieve. That is, goal three (3) (good health and well-being) and goal six (6) (clean water and sanitation) of Sustainable Development Goals

Also, the study recommends that government of ECOWAS should put in place proper monitoring of public funds and international funds and ensure more funds are channeled on maternal delivery services. The number of physicians per patients is also an important aspect in health sector that needs urgent attention. Likewise, contributions or donations from international bodies in terms of funds, medications and so on, aside allocation of healthcare funds, should be channeled appropriately, monitored and utilized for its purpose.

References

Akinbode, S. O., & Sam-Wobo, G. N. (2020). Effect of government health expenditure on maternal health outcome In Nigeria. *FULafia Journal of Social Sciences*, *3*(2), 69-83.

Alimi, O. Y., Ajide, K. B., & Isola, W. A. (2020). Environmental quality and health expenditure in ECOWAS. *Environment, Development and Sustainability*, 22, 5105-5127.

Alimi, O. Y., Odugbemi, A. A., & Osisanwo, B. G. (2023). Public policy and health outcomes: Impact of health expenditure on life expectancy and child mortality. *Journal of Business Administration and Social Studies*, 7(1), 19-31.

Arthur, E., & Oaikhenan, H. E. (2017). The effects of health expenditure on health outcomes in Sub-Saharan Africa (SSA). *African Development Review*, *29*(3), 524-536.

Azuh, D. E., Osabohien, R., Orbih, M., & Godwin, A. (2020). Public health expenditure and under-five mortality in Nigeria: An overview for policy intervention. *Open Access Macedonian Journal of Medical Sciences*, *8*(E), 353-362.

Becchetti, L., Conzo P., & Salustri. F. (2015). The (w)health of nations: The impact of health expenditure on the number of chronic diseases. Centre for Studies in Economics and Finance. Working Paper 406.

CEOWorld Magazine (2023). Countries with the best health care systems, 2023. Available at https://ceoworld.biz/2023/08/25/revealed-countries-with-the-best-health-care-systems-2023/

David, J. (2018). Infant mortality and public health expenditure in Nigeria: Empirical explanation of the nexus. *Timisoara Journal of Economics and Business*, 11(2), 149–164.

Edeme, R. K., Emecheta, C., & Omeje. M. O. (2017). Public health expenditure and health outcomes in Nigeria. *American Journal of Biomedical and Life Sciences,* 5(5), 96- 102.

Langnel, Z., & Buracom, P. (2020). Governance, health expenditure and infant mortality in sub-Saharan Africa. *African Development Review*, *32*(4), 673-685.

Mohapatra, S. (2019). Public health expenditure and its effect on health outcomes: A new methodological approach in the Indian context. *Great Lakes Herald*, *13*(1), 1-20.

NEMBEO (2022). Healthcare index by country, 2022. Available at https://www.numbeo.com/health-care/rankings_by_country.jsp

Nketiah-Amponsah, E. (2019). The impact of health expenditures on health outcomes in sub-Saharan Africa. *Journal of Developing Societies*, *35*(1), 134-152.

Novignon, J., & Lawanson, A. O. (2017). Health expenditure and child health outcomes in Sub-Saharan Africa. *African Review of Economics and Finance*, *9*(1), 96-121.

Novignon, J., Olakojo, S. A., & Nonvignon, J. (2012). The effects of public and private health care expenditure on health status in sub-Saharan Africa: new evidence from panel data analysis. *Health Economics Review*, 2(22), 1-8.

Nwankwo C. E. (2018). The effects of public health spending on maternal mortality in Nigeria. *Journal of Economics and Sustainable Development,* 9(24), 141-152.

Obisike, N. E., Iwuchukwu, U. R., Unegbu, P. I., & Achumie, E. N. (2021). Impact of public health spending on health outcomes in Nigeria. *International Journal of Economics and Financial Management*, 6(1), 1–18.

Olatunde, O. S., Adebayo, A. A., & Fagbemi, F. (2019). Health expenditure and child health outcome in West Africa. *International Journal of Social Sciences Perspectives*, *5*(2), 72-83.

Rahman, M. M., Khanam, R., & Rahman, M. (2018). Health care expenditure and health outcome nexus: New evidence from the SAARC-ASEAN region. *Globalization and Health*, *14*(1), 1-11.

Sango-Coker, E. Y., & Bein, M. A. (2018). The impact of healthcare spending on life expectancy: evidence from selected West African countries. *African Journal of Reproductive Health*, *22*(4), 64-71.

Wang, Y., (2021). The greatest factors affecting life expectancy: A research based on different continents and countries. A paper presented at the 3rd International Conference on Machine

Learning, Big Data and Business Intelligence (MLBDBI) pp. 531-541.

World Health Organization (2014). The Abuja declaration: Ten years on Abuja Report, August 2014.