Government Health Expenditure, Health Aid and Under-Five Mortality in Nigeria

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Abstract

Problem: There have been increase in the volume of Official Development Assistance (ODA) to developing regions of the world, especially Sub-Saharan Africa following the millennium declaration. Nigeria is the third highest receiver of ODA after Tanzania and Mozambique. Substantial part of these in-flows go to the health sector due to its importance. In addition, Nigerian governments' allocation to the health sector has been increasing in recent years. Meanwhile the nature of the effects of spending these massive resources on the healthcare sector is not clear as there have not been concordance in the results of most past works. The study therefore examined the effects government health expenditure and health specific aid on infant mortality rate in Nigeria. **Approach:** Data on different variables for the study were from 1980 to 2021 sourced from World Development Indicator, Organization for Economic Cooperation and Development (OECD) and Food and Agriculture Organization (FAO) database. The data were analysed within the ARDL framework where short-run model, long run model and post estimation analyses were carried out **Findings:** The bound test results indicated the presence of long run cointegration. The short run model results indicated that health aid did not have direct effect on under-5 mortality rate (U5MR) in Nigeria. Meanwhile, lagged under five mortality (U5MR), government expenditure on health (GEXH) ($P<0.5$) and its interaction with foreign aid for health $(P<0.05)$, and GDP per capita ($P<0.5$) significantly reduced U5MR in the short run while GHEX $(P<0.01)$ directly affected U5M outcome in the long run. It addition, GHEX's interaction with foreign aid $(P<05)$reduce UMR significantly in the long run and the results suggested that the two variables were complement. **Conclusion:** The study concluded that health sector aid did not have any direct effect on U5MR while GHEX and its interaction with health sector aid improved U5MR and it was concluded that GHEX and AID were complementary. This study recommended improved government expenditure in the health sector while coordination and utilization of foreign aid for the health sector are specially monitored and guided in order to stimulate its effectiveness in reducing under-five mortality in Nigeria.

Key words: Foreign aid for health, Government health expenditure; Under-5 death, health outcome, Physician density, healthcare, financing, Health Infrastructure, Nigeria, Bound Test

Introduction

Under-five mortality rate defines the probability per 1,000 that a newborn baby will die before reaching age five, if the baby is made to experience the age-specific mortality rates of the specified year. This phenomenon is a major development and health indicator, especially in developing countries such as Nigeria. The incidence of mortality is of great economic importance given the fact that in most instances, a degree of morbidity (sickness and incidence of disease occurrences) usually precedes death and this

consume a large proportion of households' resources in terms of money, opportunity costs of time and physical stress thereby impairing greatly on ability to contribute to economic growth and standard of living.According to Dhrifi (2018), the worrying situation regarding child mortality has attracted the attention of policy makers, stakeholders and researchers. In the former global development agenda the Millennium Development Goal (MDG) for instance, "to reduce child mortality" was the fourth goal (MDG–4) while in the succeeding agenda, the Sustainable Development Goal (SDG) the third goal (SDG-3) is "to ensure healthy lives and promote well-being for all at all ages". The SDG-3 has 13 targets and 28 indicators towards meeting the target. One of the key target is "ending all preventable deaths under five years of age". According to Morakinyo&Fagbenle(2017), this interest has led to the development of sound interventions aimed at reducing child mortality globally as part of the Sustainable Development Goals (SDGs) by 2030.All of these are pointers to the importance of the under-5 mortality in any development agenda. Reducing the scourge of under-5 mortality is considered a key policy objective and strategy. At the same time, international organizations, such as the United Nations Children's Fund (UNICEF), the World Bank and the World Health Organization (WHO) have incorporated the objective of reducing child mortality into most of their present and future programmes.

In assessing the progress made during the MDGs, the World Health Organisation – WHO (2016)) posited that globally, noticeable progress towards targets had been made in reducing under 5 mortality. It was further stated that in 2013, 6.3 million children under the age of five died, whereas, 12.7 million in this age bracket died in 1990. The world estimated rate was 90 per 1000 live birthsin 1990 while it was 46 per 1000 live births in 2013, representing a 49% decline.

The Sub-Saharan African (SSA) region has been said to contribute significantly to the global child mortality situation. For instance, according to Sharrow*et al.* (2022), in 2019, the total world under-five mortalities wereestimated at about 5.2 million, Sub-Saharan Africa (SSA) contributedabout 2.85 million representing about 55% of these global under-five mortalities. In the same vein, Nigeria has been said to be one of the countries in the SSA region contributing to both regional and world under five deaths. World Bank data indicates that under-5 mortality in Nigeria was 209 per 1000 live births in 1990 which declined marginally to 182 per 1000 live births in 2000 and 126.4 per 1,000 live births at the MGD's target date of 2015 while it decline further to 110.8 per 1000 live births in 2021 in the country.Most of the global under-five deaths occur in Sub-Saharan Africa and South Asia countries, this countries include Nigeria, India, Pakistan, the Democratic Republic of Congo, Ethiopia and China (UNICEF, 2018)
In order to achieve improved health outcome such as the under-5 mortality rate, there is need for improved health infrastructure and personnel. These are finance through government earmarked expenditure and from private spending. Private health financing through out-of-pocket expenditure may not be sustainable because the quest for good health comes with a large amount of health bill for a number of people which may result in massive catastrophic health expenditure for some middle and low income individuals and households in a country like Nigeria. Hence, the need for government to finance healthcare.
One important source of intervention in the healthcare sector isforeign aid for health otherwise called health aid. After the millennium declaration, the earlier commitment of the developed countries in the 1960s to donate up to 0.7% of their GNP to developing countries as development aid was resuscitated world (Radelet, 2004). Health aid are often tailored towards addressing specific health issues.These aids come from sources outside the country to address health issues and it contributes significantly to overall resources committed to healthcare in developing countries, including Nigeria. After the declaration of the MDG, the aid allocated to health sector has been on the increase. Nigeria as a country has benefitted greatly from official development assistance (ODA) to thehealth sector. ODA to Nigeria increased from $52.189million to $184.527million in 2016 (OECD, 2021). Notwithstanding this increase under-5 mortality still remain high in the country and beyond.
Government expenditure on health in Nigeria has been increasing nominally in recent years. For instance, it was 15.2 Billion Naira in 2000, and it increased to 99.1 Billion Naira in 2010 and 296.4 Billion Naira in

2018 (World Bank, 2020). In the same vein, the foreign aid for the health sector has been increasing, especially after the millennium goal declaration in Monterrey Mexico. OECD (2021) reported that in 2010 constant US Dollar value, foreign aid to the health sector in Nigeria was $67.3 million in 2000 and this increased marginally to $68.5 million in 2010 and $126.6 million in 2019.

Meanwhile little is known about the extent to which government expenditure and foreign aid for the health sector have reduced the death of children under the age of five in Nigeria. Some previous studies (e.gOyedele 2017; Burguet and Soto 2013).have made attempts at unravelling the nature of the relationship between government expenditure and health aid on under five mortality in countries around the world, some covering Nigeria. The results have been diverse and have now been mostly outdated. The present study used presently available up-to-date data and appropriate approach to assess the effects of government health expenditure and health aid on under-5 mortality rate in Nigeria.A knowledge of the marginal effect of an extra Dollar inflow into the health sector and extra Naira spent on health by government will serve as a policy guide towards effectiveness and better health outcomes. The rest of this paper consists of Section 2 which reviewed relevant literature and Section 3 which explained the methodology adopted. The fourth section presents and discussed results while the last section summarized and concluded accordingly.

Review of empirical literature

There have been efforts at assessing the effect of governmenthealth expenditure and/orforeign aid for health on health outcome especially under-5 mortality and methodology, results and conclusions have been diverse. For instance, Alves and Belluzzo(2005) used the anthropometric data from the 1996 standard of living survey and panel data models gotten from census data in Brazil from 1970 to 2000 to investigate the determinants of infant mortality rates. It was revealed that child health (in terms of mortality rates) in Brazil can be explained by the levels of education, sanitation and poverty which are the main causes of child mortality in Brazil.Issa and Quattara (2006) used the ordinary least square technique to estimate the effect of private and public health expenditure on infant mortality rates using panel data covering 160 countries from 1980 to 2000 . A strong negative relationship was found to be between infant mortality, per capita-income and female education. Findings revealed that the effect of health expenditure on infant mortality should be addressed according to the level of development which is measured by the countries income level.

Mishra and Newhouse (2007) examined the relationship between health aid and infant mortality, using data from 118 countries between 1973 and 2004. It was reported that health aid had a statistically significant effect on infant mortality. If health aid per capita was doubled, there was going to be a 2 percent decline in infant mortality rate and this implied that, for the average country, increasing per capita health aid by US$1.60 per year is associated with 1.5 fewer infant deaths per thousand live births. It was observed that the estimated effect was small, relative to the targets envisioned in the Millennium Development Goals which were the global development targets at the time of the study.Gani, (2009) adopted data obtained from seven pacific island countries from 1990-2002 to investigate the effect of government health expenditure on infant mortality rates using the fixed-effects estimation procedure, findings from this study revealed that per capita health expenditure, per capita incomes and immunization are important factors which affect health outcomes.

Yaqub(2012) used the Ordinary Least Square technique and two stage least square method to examine the relationship between government health expenditure and infant mortality using data from 1980-2008. Findings from the study revealed that public health expenditure has negative effect on infant mortality and under-five mortalities when the governance indicators were included.

Boachie*et al,*(2015) examined the impact of government health expenditure on health status which included infant mortality in Ghana using data obtained from the World Development Indicator from 1990-2012, and it was reported that as government increased its health spending, the level of infant mortality fell. This is because essential health service like immunization and postnatal services for infants and under-five are usually provided by government at zero cost to the parents.Ahmad and Hasan(2016)

used an autoregressive lagged model to analyze the effect of public health expenditure on health outcomes in Malaysia using data from 1984 to 2009. It was reported that public health expenditure and corruption affect health outcomes in Malaysia. Barenberg,*et al,*(2017) investigated the effect of public health expenditure on infant mortality among Indian states from 1984-2012. Findings revealed that public health expenditure has an inverse relationship on infant mortality and that female literacy and urbanization also reduces infant mortality.

Raeesi,*et al,* (2017) investigated the effects of private and public health expenditure on health outcomes among countries with different health care systems using panel data which were collected in groups across 25 countries health care systems over 15 years from 2000-2015.It was revealed that significant relationship existed between health expenditure and health indicators and it was concluded that countries should select a suitable combination of health expenditure based on the healthcare systems since private and public expenditures have different effects on health outcomes in the health care system.

Edeme*et al.* (2017) used the OLSapproach to examine the relationship between public health expenditure and health outcomes (infant mortality) in Nigeria using time-series data gotten from World Bank Development Indicators from the year 1981-2014 and the findings suggests that public health expenditure remains a necessary factor in the improvement of health outcomes in Nigeria. Oyedele, (2017) examined the effect of health care expenditure on child mortality in West Africa, the study made use of data gotten from the World Development Indicator of the world bank from 1997-2014 for ten out of the thirteen West-African countries and findings revealed that government health expenditure has no significant effect on the reduction of under-five mortality

Dhrifi, (2018) used the three stage least square method to investigate the effect of health-care expenditures on child mortality rates for 93 developed countries with data from 1995 to 2012. The study revealed that health expenditure has a positive effect in reducing child mortality in upper-middle income and high-income countries and that child mortality can be reduced by strengthening the national health systems, expanding immunization programs, enhancing child monitoring growth, and ensuring the survival and improved health of mothers. Murunga*et al.* (2019) also reported the effect of public health spending on health outcomes in Kenya using data from 1984-2015 and reportedthat public health spending influenced infant mortality. It can be observed that findings has been diverse and there is the need do more in this area.

Methodology

Model Specification: The study adapted the model of Fayissa&Gutema (2008) and modified it with the additionof physician density and per capita food availability to suit the situation and location being studied:

The model is specified as thus:

$U5MR_t = \beta_0 + \beta_1 GHEX_t + \beta_2 HAID_t + \beta_3 GHEX * HAID_t + \beta_4 GDPPC_t + \beta_5 SSER_t + \beta_6 PHY_t + \beta_7 PCF_t + e_t$

Where;

U5MR= Under-five mortality rate; HAID = Health aid; GHEX= Government health; expenditure; GDPPC = GDP per capita; SSER= Secondary School Enrolment Rate; PHY = physician density; PCF = Per capita food production index; t = time; e_t = error term

Data Sources: Data covering 1980-2021 (42 years) was employed. The data wereobtained from World Health Organization (WHO), Organization for Economic Co-operation and Development (OECD) creditors reporting data base and the World Development Indicator (WDI) data base.

Definition of variables

Under-five mortality: It is the death of children below the age of five and it is the subject of the present study. It is measure in rate of per 1,000 live births

Health aid: This is in-cash or kind transfer of resources from foreign countries or organization to the country in question and it is measured is in constant US dollars and represents Official Development Assistance to health sector.

Government expenditure on health: It is the amount of money spent by government on healthcare services and it is expressedas proportion of total GDP.

Gross Domestic Product per capita: This is measured as GDP in dollars as a ratio of population.

Secondaryschool enrolmentrate: The gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Secondary education completes the provision of basic education that began at the primary level, and aims at laying the foundations for lifelong learning and human development, by offering more subjects or skill-oriented instructions using more specialized teachers.

Per capita food production index: This was included in the model for the present study as availability food in the right quantity and quality is aphenomenon that promote good health.

Rationales for Inclusion of Variables

The main variables in the study were government health expenditure and health aid which are important variables thought to be important in the improvement of health outcomes. GDP per capita is an important indicator of economic performance and it is a unit used to compare average standard of living across countries or regions. Secondary school enrollment rate was included based on the thinking that educated mothers are able to maintain better health through their ability to understand and interpret health information. Per capita food production variability compares the variations of per capita food production index across countries and this is an important variable to measure the nutritional level of the children which has direct link with child health.

Estimation Procedure

Pre-Estimation

Descriptive Statistics: This is meant to capture the inherent characteristics of the variables used. It describes basic statistic such as mean, median, maximum, minimum, standard deviation, skewness, kurtosis and Jarque-Bera of the series

Stationarity test: The unit root test was performed on the series to ascertain the existence or otherwise of unit root in the series used for the study. Stationarity is important because it is a pre-condition to conducting a non-spurious regression analysis and must be tested.

Co-integration Test: Co-integration implieslong run relationship or equilibrium exists between the independent variables and dependent variables. The ARDL Bound test procedure was adopted in assessing the existence of long run relationship among the study variable.

Main Estimation

The model was estimated based on the result obtained from the unit root and the co-integration test. Since the series were integrated of different order i.e. I(0) and I (1), Autoregressive Distributed Model (ARDL) estimation technique wasadopted to assess the relationships among the variables of interest.

$$\Delta LU5MR_t = \alpha + \mu\text{TREND} + \sum_{m=1}^{M} \theta_m \Delta LU5MR_{t-m} + \sum_{c=0}^{C} \varphi_c \Delta GHEXP_{t-p} + \sum_{j=0}^{J} \vartheta_j \Delta HAID_{t-j} + \sum_{r=0}^{R} \theta_r \Delta GHEXP * HIAD_{t-r} + \sum_{p=0}^{P} \varphi_p \Delta PHY_{t-p} + \sum_{q=0}^{Q} \delta_q \Delta SSER_{t-q} + \sum_{l=1}^{L} \epsilon_l \Delta LGDPC_{l-1} + \sum_{d=0}^{d} \pi \Delta LPFP_{t-d} + \beta_1 LU5MR_{t-1} + \beta_2 GHEXP_{t-1} + \beta_3 HIAD_{t-1} + \beta_4 GHEXP * HAID_{t-1} + \beta_5 PHY_{t-1} + \beta_6 SSER_{i,t-1} + \beta_7 LGDPC_{t-1} + E_{it}$$

Post Estimation Procedure

Post estimation diagnostic analyses carried out for the study included the normality test usingJaque-Bera approach; test for linearity to ascertain whether or not the model was well specified using Ramsey RESET; test tor heteroscedasticity using the ARCH-LM test and the test for serial correlation with the Bruech-Godfrey test.

Results and discussion of findings

Preliminary Results

Descriptive Statistics: This is presented in Table 1 and shows the averages, minimum, maximum, standard deviation, skewness, kurtosis and Jaque-Bera statisticsof the variables used in included in the study. A clear view of these statistics may provide some preliminary understanding of the behaviours and patterns of the series which may be useful for further decisions.

The mean of under-5 mortality rate was 176.5 per 1000 live births in the country for the period covered by the study. This average is high compared with 156.9 per 1000 live births in Malawi and 125 for Sub-Saharan Africa but lower than 225 for Niger Republic. The average value of foreign aid for the health sector received in the period covered by the study was $846.5 million and that of health expenditure share of GDP value of 0.56%and GDP per capita value of $2,098.9 with SSER value of 30.8%. The quantum of foreign aid for health received by Nigeria has only been surpassed by those received by Tanzania and Mozambique in SSA (Akinbode, 2022). The standard deviation values show that most the series dispersed moderately around their mean values. The kurtosis statistics indicated that only school enrolment and GDP per capita was mesokurtic (moderately peaked in distribution) while others were either platykurtic or leptokurtic in distribution.The skewness values show that only under-5 mortality rate skewed to the left (negative) while only government health expenditure was not normally distributed.

Table 1: Descriptive Statistics of Study Variables

	U5MR	GDPPC ($)	GHEX	PHY	HAID	PCF	SSER
Mean	176.52	2098.93	0.58	0.34	846.52	6.08	30.83
Median	190.1	2194.03	0.4810	0.32	171.64	4.10	27.22
Maximum	213.3	2549.72	0.85	0.45	10820.35	15.80	56.21
Minimum	119.9	1376.42	0.33	0.18	14.65	2.2	13.68
Std. Dev.	34.88	1371.04	0.1942	0.0928	1940.60	4.14	9.33
Skewness	-0.41	0.6069	1.423	-0.2567	4.08	1.04	0.77
Kurtosis	1.48	1.7939	3.19	1.5716	20.14	2.64	3.06
Jarque-Bera	4.83	4.7577	6.06	3.7773	585.38	7.21	3.87
Probability	0.0896	0.0927	0.0049	0.1513	0.1392	0.03	0.14
Observations	42	42	42	42	42	42	42

Source: Authors' computation, 2023

***Correlation analysis*:** The correlation analysis resultis presented in Table 2. It shows the degrees of joint movement among variables. In addition, the results suggest that there were no too much high correlation between the variables to portend basic econometric problems for the model to be estimated.

Table 2: Result of Correlation Analyses

VARIABLES	U5MR	GHEX	HAID	GDPC	PCF	SSER	PHY
U5MR	1						
GHEX	-0.41	1					
HAID	-0.44	0.51	1				
GDPC	-0.39	0.63	0.53	1			
PCF	-0.57	0.37	0.59	0.65	1		
SSER	-0.66	0.36	0.62	0.47	0.45	1	
PHY	-0.31	0.41	0.28	0.33	0.11	0.16	1

Source: Authors' computation, 2023

Stationarity of the study series

This study adopted the Augmented Dickey Fuller (ADF) test to assess the presence or otherwise of unit root problem in the series adopted for the study. Results in Table 3 show that that the variables were integrated of different order i.e. government expenditure on health (GHEX), gross domestic product per capita (GDPPC), health aid (HAID), physician density (PHY) and secondary school enrollment (SSER) were stationary at first difference I(1) while under-five death (U5MR) and per capita food availability (PCF) were stationary at level.

Table 3Result of Unit Root Test

Variable	LEVEL			FIRST DIFFERENCE			I(d)
	Intercept	Trend & intercept	None	Intercept	Trend & intercept	None	
U5MR	0.54	-14.44***	-3.93***	-------	-------	-------	**I(0)**
GHEX	-1.31	-0.11	2.62	-10.13***	-5.25***	-0.91	**I(1)**
LGDPPC	-1.22	-2.27	1.80	-4.21***	-3.56***	-2.97***	**I(1)**
HAID	-1.28	-3.16	0.62	-5.40***	-5.32***	-5.21***	**I(1)**
PHY	-1.24	-1.90	0.25	-5.99***	-5.94***	-6.06***	**I(1)**
PCF	-2.56**	-2.11**	3.45***	--------	-------	------	**I(0)**
SSER	-1.92	-1.37	0.33	-5.18***	-5.29***	-5.21***	**I(1)**

, ** and * indicates 1%, 5% and 10% respectively*

Source: Authors' computation, 2023

Test of Long Run Co-integration

The ARDL Bound test procedure was adopted in assessing the existence of long run relationship among the study variables. Results on Table 4 shows that the computed F-statistic value was 8.14 which was greater than the upper bound value of 5.84 at 5 percent level of significance. This suggested the presence of a long run relationship among the series in the study.

Table 4: Result of ARDL Bound Test

Significant levels		1%	2.5%	5%	10%	F-statistic
Critical Value Bounds	Upper Bound I(1)	6.82	6.2	5.84	4.02	8.14
	Lower Bound I(0)	4.91	4.35	4.17	3.51	

Source: Authors' computation 2023

Effects of government health expenditure and health aid on U5MR

Table 5 presents the results of the short-run (dynamic) model of the effect of government expenditure and health aid on under-5 mortality in Nigeria. Results indicated that lagged dependent variable (U5MR(-1)), contemporaneous government health expenditure (GHEX) and its lag, interaction of health aid and government health expenditure (HAID*GHEX) and education proxy by secondary school enrolment rate (SSER) significantly affected under-5 mortality in Nigeria. The significant positive effect of lagged U5MR implies that increase in its value in the previous year increases the present period under-5 mortality rate. Precisely, a percentage point increase in U5MR in the previous period increased present period U5MR by 0.77 percentage point. This is a manifestation of persistence in under-5 mortality situation in Nigeria. It is worthy of note that foreign aid for health (HAID) though negative as expected but was significantly different from zero. The implication of this is that health aid did not directly improve under-5 mortality situation in Nigeria. This is contrary to the finding of Akinbode *et al.* (2021) which reported significant negative effect of foreign aid on infant mortality using data from 2000-2019 covering 46 countries in Sub-Saharan Africa (SSA). Meanwhile, the interaction of foreign aid with government expenditure returned significant negative effect on U5MR. This suggests that health aid essentially becomes effective when government also make significant commitment to health improvement through earmarked expenditures. In addition the significant negative effect of the interaction variable pointed to the fact that government expenditure and foreign aid for the health sector are complementary. However, government health expenditure has direct significant negative effect on U5MR in line with *apriori* expectation. The coefficient value of the contemporaneous government health expenditure of -0.131 implies that a percentage point increase in health expenditure share of GDP reduced U5MR by 0.13 percentage point. The result shows that the one year lag had higher impact and this may be due to gestation period required by most healthcare programme like any other developmental programme. The finding corroborates Yaqub (2012) in a study conducted in Nigeria which used data from 1980-2008 but contradicts Oyedele (2017) who reported that government health expenditure did not affect child and infant death in Nigeria. Furthermore, the result aligns with Barenberg,*et al,*(2017) which investigated the effect of public health expenditure on infant mortality among Indian states and reported that public health expenditure has an inverse relationship with infant mortality. Boachie and Ramu(2015) also reported that as government increases its health spending, the level of infant mortality falls in Ghana in a study that utilized data from 1990 – 2009.

It is expected that that the level of education of the people will significantly improve their understanding of basic health issues and therefore be able to take precautionary health measures. This is expected to result in reduced cases of under-5 mortality. Therefore, the significant negative coefficient of education proxy by secondary school enrollment rate (SSER) on U5MR conforms with*a priori* expectation. A percentage point increase in school enrollment rate reduced U5MR by about 0.041percent. This is also in line with Barenberg*et al.*, (2017).

Finally the error correction coefficient value of fulfil the basic requirements for the existence of long run relationship. These include being negative, less than one and significant. The value of -0.2142 returned in the present study implied that 21.42% of the total disequilibrium which may occur as a result of an external shock into the under-5 mortality system in the previous year is restored in the present year. By extension, this means that it will take about 4.67 years (4 years and 8 months) for the system to go back to its long-run equilibrium path.

Table 5 Short run (dynamic) model result

Dependent Variable: Under-five Mortality				
Variable	Coefficient	Std. Error	t-values	Probability
D(U5MR(-1)	0.7704***	0.1428	5.3931	0.0062
D(HAID)	-0.0454	0.0549	-0.8274	0.4812
D(GHEX)	-0.1310**	0.0544	-2.4083	0.0292
D(GHEX(-1))	-0.2315***	0.0605	3.8291	0.0097
D(GHEX*HAID)	-0.0951**	0.0480	1.9814	0.0491
D(GDPPC)	-1.5020	1.3368	-1.1235	0.3917
D(LPHY)	0.1205	0.1717	0.7018	0.5719
D(SSER)	-0.0409***	0.0106	-3.8796	0.0082
D(PCF)	-0.0063	0.0253	-0.0247	0.8285
ECM_{t-1}	-0.2142***	0.0749	-2.8569	0.0076

Source: Author's computation (2023)

Long run (static model): The result of the long run model presented in Table 6 shows that only Government health expenditure, its interaction with foreign aid for health and GDP per capita significantly affected U5MR in the long run. Government expenditure and its interaction with foreign aid for health being significant in the long run may be a manifestation of the fact that significant part of government health expenditure and foreign aid for health are in the areas of health infrastructures such as buildings, diagnoses equipment and some in training of personnel. These are long term investment in health. This may be the reason for the non-significance of foreign aid especially in the short-run.

Table 6 Long Run (Static)Model Results

Dependent Variable: Under-five Mortality				
Variable	**Coefficient**	**Std. Error**	**t-value**	**P-value**
HAID	0.0849	0.1070	0.7934	0.3810
GHEX	0.1037***	0.0210	-3.4597	0.0071
GHEX*HAID	-0.2384**	0.1134	2.1031	0.0411
GDPPC	-0.8512***	0.1485	-5.7314	0.0089
PHY	0.0147	0.0180	0.8171	0.4193
SSER	1.9115	1.6368	1.1678	0.2465
PCF	-0.0293	1.1815	-0.0248	0.8381
C	3.2656	0.3944***	8.2799	0.0049

Source: Author's compilation 2023

Post estimation diagnoses

Table 7 presents the results of diagnoses of the ARDL model estimated. These included the test for normality of the of the distribution of the residuals using the Jaque-Bera test; serial correlation in the residual using the Breusch-Godfrey serial LM test; heteroscedasticity using the ARCH LM test and

linearity using the Ramsey RESET test. The null hypotheses were that the residuals were normally distributed, there were no serial correlation, the error terms were homoscedastic and that the model was well specified. The probability values of each of the tests was higher than 5% supporting the acceptance of the null hypothesis for each of the tests. It was therefore concluded that the residuals of the model estimated were normally distributed, free from serial correlation and heteroscedasticity and the model was well specified.

Table 7: Post-Estimation Diagnostics Tests Summary

S/N	Econometric Problem	Tests Procedure	Statistics	Conclusion
1	Normality of distribution	Jarque-bera	0.62 (0.7346)	Residuals are normally distributed
2	Serial correlation	Breusch-Godfrey Serial Correlation LM test	0.20 (0.9042)	No serial correlation
3	Heteroscedasticity	ARCH LM Test	1.1864 (0.5526)	It is homoscedastic
4	Linearity	Ramsey Test	2.09 (0.1621)	The model is well specified

Source: Author's Compilation

Summary and Conclusion

This study examined the effect of government health expenditure and health aid on under-five mortality rate in Nigeria using data from 1980 to 2021 obtained from the World Development Bank Indicators, Organization for Economic Co-operation and Development (OECD) Creditor Reporting System (CRS) and Food and Agriculture Organization (FAO) database.The variables used for the study upon which data were collected were under-five mortality rate as the dependent variable, and government health expenditure, health aid, per capital food availability, physician density, GDP per capita and school enrollment as independent variables.Data were subjected to descriptive statistics (mean, median, mode, standard deviation, skewness and kurtosis), correlation analyses, stationarity tests using the Augumented Dickey-Fuller (ADF) test and the ARDL estimation (bound test, short-run and long run model estimation) and post-estimation diagnoses tests.

The stationarity tests showed that variables were integrated of different orders. The Autoregressive Distributed Lag Model developed by Pesaran, Shin and Schmidt (2001) was estimated. The ARDL bound test suggested the presence of long run relationship among the study variables. The short run model results revealed that lagged U5MR, government health expenditure (including its lag), and the interaction of government expenditure and health aid significantly reduced U5MR in Nigeria. Foreign aid for health did not directly influence U5MR but operated through government spending. This suggested that the two complemented one another. The long run model result showed that GDP per capita, government health expenditure and its interaction with health significantly improved the death of children under the age of five in Nigeria. In order to considerably improve under-5 mortality situation in Nigeria government is encouraged to increase expenditure to the health sector. As health aid was not significant directly, its coordination, project location and utilization should be given proper attention to ensure its impacts are felt direct by the people. Education should be encourage among young people while adults literacy programmes are expanded to include many illiterate adults given the significance of education in the short-run model while policies which are capable of promoting growth of the economy are pursued by the government as GDP per capita was a strong determinant of under-5 mortality in the long run.

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