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EFFECT OF GOVERNMENT HEALTH EXPENDITURE ON MATERNAL HEALTH OUTCOME IN NIGERIA

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ABSTRACT
High maternal mortality has been one of the challenges confronting developing countries, including Nigeria. Maternal health conditions become more worrisome when the Millennium Development Goals (MDG) failed to achieve its health target by year 2015. Given this background, this study examined the effect of government health expenditure on maternal health outcome in Nigeria. Data were sourced from the World Development Indicator (WDI) from 1980 – 2018; and analyzed within the ARDL framework due to the different orders of integration of the series. The results showed that lagged maternal mortality ratio – MMR ($P<0.050$), government health expenditure - GHEXP ($P<0.05$), number of physicians per thousand LPHY ($P<0.05$) and GDP per capita ($P<0.1$) reduced maternal mortality rate significantly in the short run, while GHEXP ($P<0.05$), female school enrolment - FSEN ($P<0.05$), and GDPPC ($P<0.05$) significantly reduced MMR in the long run. Based on these findings, the study recommended improved funding of the health sector among others, in order to reduce maternal mortality in Nigeria and be able to meet up with SDG3 target.

Key word: Government, Health, Mortality, Pregnancy, Spending

ABSTRAIT
La mortalité maternelleélevée a été l'un des défis aux quells sont confrontés les pays en développement, dont le Nigéria. Les conditions de santé maternelle deviennent plus préoccupantes lorsque les objectifs du Millénaire pour le développement (OMD) n'ont pas atteintleurobjectif de santé d'ici à 2015. Dans cec ontexte, cette étude a examine l'effet des dépensespubliques de santé sur les resultants en matière de santé maternelle au Nigéria. Les donnéesproviennent de l'indicateur de développement mondial (WDI) de 1980 à 2018; et analysé dans le cadre ARDL en raison des

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different orders d'intégration de la série. Les resultants ont montré que le ratio de mortalité maternelle retardé - RMM (P <0,050), dépensespubliques de santé - GHEXP (P <0,05), nombre de médecins pour mille LPHY (P <0,05) et PIB par habitant (P <0,1) a réduit la mortalité maternelle à court terme, tandis que le GHEXP (P <0,05), le taux de scolarisation des filles - FSEN (P <0,05) et le GDPPC (P <0,05) ont considérablement réduit le TMM à long terme. Sur la base de ces résultats, l'étude a recommandé l'amélioration du financement du secteur de la santé, entre autres, afin de réduire la mortalité maternelle au Nigéria et de pouvoir atteindre l'objectif ODD3.

Mot-clé:gouvernement, santé, mortalité, grossesse, dépenses

INTRODUCTION

Maternal health outcome describes the health condition or what befalls pregnant women during pregnancy, childbirth and post-delivery period. There are a number of indicators of maternal health outcomes which include maternal mortality ratio, maternal mortality rate, and maternal morbidity. According to the Population Research Institute (PRI, 2020), maternal mortality ratio is the yearly number of female deaths per 100,000 live births as a result of causes which have to do with or aggravated by pregnancy or the manner pregnancy is handled (excluding causes which may be classified as accidental). Furthermore, maternal mortality or maternal death is the death of a female during pregnancy or within 42 days succeeding delivery or end of pregnancy (WHO, 2016). Maternal mortality rate is the number of maternal deaths (direct and indirect) in a given period usually one year per 100,000 women who are in the reproductive age during that period. Maternal morbidity however refers to mental or physical illness or disability which can be directly linked to child delivery or pregnancy. Among these, the maternal mortality ratio has been favoured as good indicator of maternal health outcome globally. Alexander, Wildman, Zhang, Langer, Vutuc and Lindmark (2003) asserted that it is more appropriate to adopt maternal mortality ratio instead of maternal mortality rate as the former reflects the fact that the numerator is not entirely included in the denominator.

High maternal mortality has been one of the challenges confronting most developing countries globally. The high incidence of maternal mortality in any society comes with consequences which includes loneliness for the husband alongside loss of supporting source of income to the household. The consequences are also seen on the children who are left behind with no mother to cater for their daily needs. In extreme circumstances, many of the children are subjected to child-labor, malnutrition, poor hygiene, avoidable injuries, psychological depression, reduced education, social isolation, abuse and reduced parental care. The multiplier effect of maternal mortality is so numerous that policy makers globally make its reduction a health policy priority. Major effects on the society in developing countries include increased crime among teenagers, drug abuse, robbery and general tendency to diminish family and cultural values.

Karlsen, Say and Souza (2011) stated that most of the maternal deaths occurring in developing countries are avoidable. The Millennium Development Goal five (MDG5) pointed to the need for a reduction in maternal mortality by 2015. Although, isolated successes were achieved elsewhere at the end the target year, the achievement in Sub-Saharan Africa, including Nigeria was far from the target. Building on the momentum gathered by MDG 5, the Sustainable Development Goals

(SDGs) established a hybrid agenda to improve maternal health with a view to ending avoidable maternal death.

The public health system in developing countries has witnessed about 60 million women give birth annually without skilled birth attendants due to low availability of such personnel especially in rural areas (Nwankwo, 2018). Also, most health care facilities do not have the right equipment to save lives in times of emergencies and serious complications. The distance between health services and population is a barrier in cases where poor women are unable to pay for transport, health care service fee and drugs. The UNICEF (2019) reported that globally from 2000 to 2017 maternal mortality ratio fell by 38 percent as deaths reduced from 342 to 211 per 100,000 live birth which implied an average annual reduction of 2.9 percent. Although, this looks attractive, it still fall short of the 6.4 percent yearly reduction rate which is needed to achieve the first target of the third global Sustainable Development Goal (SDG3.1) of seventy (70) maternal deaths per 100,000 live birth by 2030. While South Asia has achieved the highest percentage reduction of 59 percent, Sub-Sahara Africa achieved only39 percent. It should however be noted that the two regions are responsible for 86 percent of maternal deaths in the world. Meanwhile, in assessing maternal mortality as a major health problem, the United Nations (2013) posited that in the last 50 years, the global rate of maternal death had hardly reduced in developing countries despite improvement in other health indicators. As at 2018 in Nigeria, maternal mortality rate stood at 968 per 100,000 live births and the population total figure may be scary.

Government health expenditure plays an important role in reducing maternal mortality in low and middle income countries of the world (Xu, Soucat and Kutzin, 2018). Ogundipe and Lawal (2011) observed that public health spending in Nigeria is not sufficient as budgetary allocations to the health sectors of the economy remain small. This makes people to engage in out-of-pocket expenditure which may lead to *catastrophic health expenditure* which describes a situation where funds meant for household consumption are used to pay for healthcare. This may exacerbate poverty.

The World Bank (2019) data showed that the Nigerian government spent ₦500.7 million on health in 1990 and maternal mortality ratio was 1350. In 2017, government health expenditure went up to ₦245 Billion and maternal mortality ratio was 917 for every 100,000 live births. It should be noted that the Nigeria maternal mortality ratio is still higher than the sub-Sahara Africa average of about 547. According to Plümper (2013), an important but unsettled issue in health policy and finance is the marginal effect of health care spending on health outcomes. Few contradictory facts are known about the impact of health spending on maternal health outcomes in Nigeria. Therefore, this paper aims at bridging this obvious knowledge gap. The paper specifically assesses the trend, and seeks to determine the effect of government health spending on maternal mortality. Based on the findings, conclusion and recommendations are drawn.

REVIEW OF EMPIRICAL LITERATURE

There are a number of empirical research which focussed on health outcomes indicators around the world. Anyanwu and Erhijakpor, (2007) utilized data covering 1999 to 2004 from 47 countries in Sub-Sahara Africa (SSA) countries to determine the links between spending of government on health and per capita income on infant and under-5 mortality. It was reported that under-5 and infant mortality was significantly affected by health spending. The study concluded that total spending on health and its public component were germane to positive health outcomes. Wang,

Ye, Wang and Huntington, (2013)examined the economic effect of maternal death on Chinese rural households especially in the immediate years succeeding maternal deaths. The findings expectedly showed that compared to childbirth, maternal death has a negative effect on the economy of households.

Maruthappu, Ng, Williams and Zeltner (2014) examined the possible relationship between government health spending and maternal mortality in twenty-four countries in European Union over a thirty year period. It reported that an annual 1 percent reduction in government health spending significantly increased the rate of maternal mortality and concluded that policies aimed at reducing government health spending will worsen maternal mortality in the European Union. The study advised that policy makers should in the alternative ensure that cost reductions goes along with sufficient increase in efficiency in order to maintain quality of care. Kes, Ogwang and Pande (2015) examined the consequences of maternal deaths on households in the rural areas of Western Kenya. It was reported that maternal mortality has a negative impact on household. The study also showed that majority of maternal deaths was through failure of caesarian sections.

Ahmad and Hassan (2016) assessed the effect of public health spending and governance on health outcomes in Malaysia and reported that public health spending and corruption has long and short run effects on health outcomes in the country. Nicholas, Nketiah-Amponsah and Senadza (2016) examined the effect of private and public health expenditures on some selected maternal-child health outcomes in SSA using panel data from 40 countries from 2000-2010. The results of the fixed effects estimation technique showed that spending by government on health had no significant effect on MMR in SSA. In another study,Boachie, Ramu&Põlajeva (2018) examined the link which may exist between Ghanaian government spending on health and some health outcomes. It was reported that increasing public health spending by 10 percent can actually avert 0.102–4.4 infant and under-five deaths in every 1000 live births while increasing life expectancy at birth by 0.77–47 days in a year.

In Nigeria,Nwankwo (2018) examined the effect of public health spending on maternal mortality using regression analysis with data drawn from 2003 to 2015 from about 25 selected states. Using instrumental variables approach as a panacea to the econometric problem of endogeneity it was found that public health spending was a vital factor in reducing the occurrences of maternal mortality. Based on the findings, the study recommended increased spending on the health sector in order to improve health outcomes. Adewunmi, Acca and Afolayan (2018) carried out a study aimed at assessing the impact of government spending on health on relevant outcomes in Nigeria. It adopted neonatal, infant and child mortality rate to proxy health outcomes. The result showed that government expenditure on health had positive relationship with neonatal, infant and child mortality rate. Private health expenditure, life expectancy and numbers of physicians returned inverse relationship with neonatal, infant and child mortality. The findings, however, showed some divergence, hence the need to carry out further assessment.

METHODOLOGY

Theoretical Framework and Model Specification

In a bid to assessing the relationship between public expenditure on health and maternal health outcomes, the study builds on the Grossman demand model. The model specifies aggregate Health

Production Function (HPF) with health spending as an input. Thus adapting the methodology of Grossman (1972), the health outcomes model is specified as:

$Y_t = f(HE_t, X_t), t = 1,2,3 \ldots . . T \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots . \ldots \ldots \ldots 1$

Where Y_t represents maternal health outcome, at time t such as the maternal mortality ratio (MMR) which is the indicator of interest in the present study. HE_t is health spending and X_t is a vector of other possible factors which may be affecting health outcome (control variables) at time $t$such as number of physicians, number of hospital beds, female secondary school enrollment (to proxy female level of enlightenment) and GDP per capita.

Therefore, $MMR = f(GHEXPC,\ NHBS,\ PHY,\ FSEN,\ GDPPC)$ ….(2)

The model can be further explicitly expressed as:

$MMR = \alpha_0 + \alpha_1 GHEXPC_t + \alpha_2 NHBS_t + \alpha_3 PHY_t + \alpha_4 FSEN_t + \alpha_4 GDPPC_t + \mu_t \ldots \ldots \ldots . . (3)$

Where MMR is maternal mortality ratio which is measured in units of deaths per 100,000 live births. GHEXPC is Government health expenditure per capita, NHBS is the number of hospital bed per thousand, PHY is number of physicians per one thousand people, FSEN is female secondary school enrollment measured in percentage, GDPPC is GDP per capita (2010 =100). *Apriori* expectation of the coefficients is $\alpha_1,\ \alpha_2,\ \alpha_3,\ \alpha_4, \alpha_5\ < 0$i.e increase in each of the listed regressors is expected to cause reduction in MMR.

Data Sources

Data from 1980 to 2018 on maternal mortality ratio, government expenditure on health per capita, number of hospital beds per 1000 people, number of physicians per 1000 people, female secondary school enrollment rate and GDP per capita were obtained from the World Bank's World Development Indicators (WDI).

Data Analyses

Pre-estimation Analyses: These consist of descriptive analyses of the data series in order to enhance the understanding of their underlying characteristics. These include mean, median, maximum, minimum, standard deviation, normality test, skewness and kurtosis. Graphical illustration of the series also show their trend pattern which can give some insight into the behaviour of the data. Furthermore, the stationarity of each of the series were assessed in order to avert spurious regression. The Augmented Dickey-Fuller test developed by Dickey and Fuller (1979) and the Phillip-Perron (1988) test were adopted. The ARDL bound test was also carried out in order to establish the presence of long-run cointegrating relationship among the series.

Estimation

The model for the study was estimated using the Autoregressive Distributed Lag Model (ARDL) procedure due to the different orders of integration of the series. The estimated model is stated as:

$$\Delta lnMMR_t = \alpha + \sum_{m=1}^{m} \delta_m \Delta ln\mathrm{MMR}_{t-1} + \sum_{j=0}^{j} \Theta_j \Delta \ln GHEXPC_{t-1} + \sum_{d=0}^{d} \pi_d \Delta \mathrm{HBDS} + \sum_{c=0}^{c} \sigma_c \Delta \mathrm{PHY}_{t-1} + \sum_{b=0}^{b} \phi_b \Delta \mathrm{FSEN}_{t-1} + \sum_{n=0}^{n} \Omega_n \Delta \ln \mathrm{GDPPC}_{t-1} + \gamma_1 InMMR_{t-1} + \gamma_2 lnGHEX_t + \gamma_3 HBDS_t + \gamma_4 PHY_t + \gamma_5 FSEN_t + \gamma_6 lnGDPPC_t + \varepsilon_t + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Post Estimation Analyses

Normality test: This test was conducted to establish whether or not the residual of the estimated model was normally distributed. This was necessary so that the ARDL model would have a good predictive power over the sample period. An important test statistic used for this purpose was the Jarque-Berra test.

Linearity test: The test which was invented by Ramsey (1969) was used to examine if the model was well specified or not.

Heteroscedasticity Test: This was conducted to check if the variance of the error term series was constant overtime or not. It also tries to explain further the independence of the error term with respect to the explanatory variables. The Autoregressive Conditional Heteroscedasticity Lagrangian Multiplier (ARCH-LM) test was adopted.

Serial Correlation test: Autocorrelation is a violation of the Ordinary Least Square assumption of independence of the error term which has its attendant consequences. The Breusch-Pagan-Godfrey test was adopted.

RESULTS AND DISCUSSION

Results of Preliminary Analyses

Table 1 presents the summary of the descriptive statistics of the study variable series. The standard deviation values revealed that the series of GHEXPC, NHBS, PHY and FSER were widely dispersed around their averages while MMR and GDPPC were moderately dispersed. Some of the wide dispersion will be taken care of by converting the series to their natural logarithm values before being used for regression estimation. All the series were a bit positively skewed implying that the tails of their distributions lied to the right. This means that most of the observations in the series lied to the left of the mean. The kurtosis value whose threshold is 3 measures the peak levelof the distribution of the series and showed that only government health expenditure was mesokurtic (nearly normally distributed or with moderate peak). MMR, PHY, FSER and GDPPC were platykurtic (with relatively flat top distribution) while only NHBS was leptokurtic in distribution (with pointed peak). The Jarque-Berra test for normality combines the properties of skewness and kurtosis, hence, it provides better assessment of the normality of the distribution of a given series. The results showed that MMR, PHY, GDPPC and FSER were normally distributed while GHEXPC and NHBS were not.

Table 1: Descriptive Statistics

	GHEXPC	MMR	NHBS	PHY	FSER	GDPPC
Mean	38.30484	1156.73	1.6999	0.2544	27.4368	1766.341
Median	14.62144	1200	1.2000	0.247	22.6837	1581.562
Maximum	107.2198	1598.33	6.3703	0.4016	53.5122	2563.900
Minimum	9.025000	814	0.5000	0.113	8.7007	1324.297
Std. Dev.	33.98762	257.89	1.4830	0.0824	10.3424	436.7278
Skewness	0.748564	0.0862	1.8314	0.3673	0.5714	0.606912
Kurtosis	1.876141	1.6401	5.3105	1.9181	2.6588	1.793996
Jarque-Bera	5.694732	3.0533	30.4783	2.7791	2.3112	4.757697
Probability	0.057997	0.2173	0.0347	0.2492	0.3147	0.0926
Observations	39	39	39	39	39	39

Source: Author's compilation 2019

Graphical Description of the trend of the study variables

The graphs in figures 1 to 6 present the expression of relevant variables. Figure 1 reveals that the trend in government health expenditure was relatively stable between 1980 and 1998. Afterwards, it has been experiencing upward but fluctuating movement. The trend in figure 2 shows that NHBS experienced an upward trend from 1980-1988. There was sharp fall from 1988-1990 and it has continued to decline since then. Maternal mortality rate as shown in figure 3 shows that maternal mortality was on a downward trend from 1980 up to 2008. Afterwards, it remained relatively stable until a surge in 2015. The trend in figure 4 shows physicians per 1000 people experienced an upward movement between 1980 and 2009 after which there was a sharp fall in 2010 and an upward trend afterwards. Female school enrollment has been on an upward trend from 1980 to 2013 before it started its downward movement as in figure 5. Finally, figure 6 shows the movement of GDP per capita in Nigeria. It fell freely from 1980 to 1984 perhaps due to the alleged widespread indiscipline and corruption in governance in Nigeria at that time. It kept fluctuating with relative stability from 1985 to 2000 after which GDPPC has continued to rise steadily.

Figure 1: Government Health Expenditure Per Capita

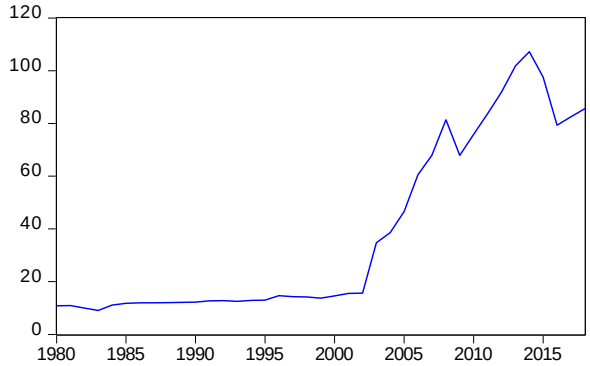


Figure 2: Hospital beds (per 1,000 people)

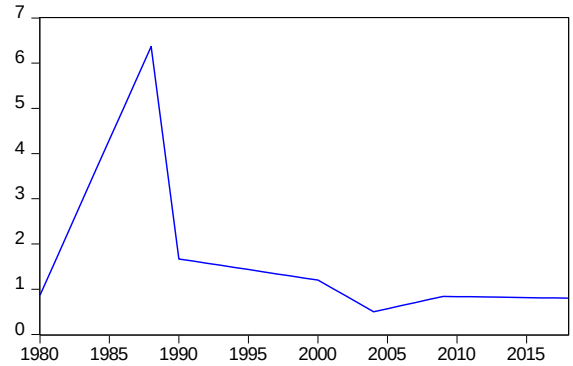


Figure 3: Maternal Mortality Ratio

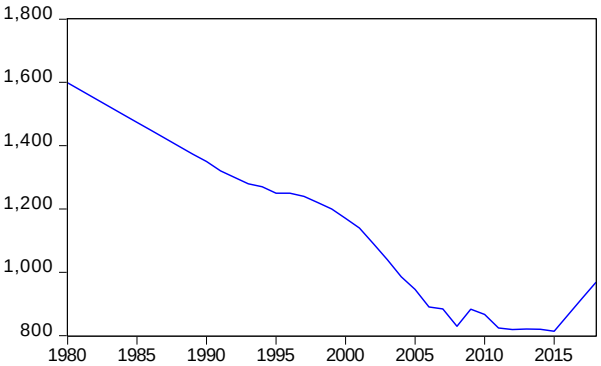


Figure 4: Physicians (per 1,000 people)

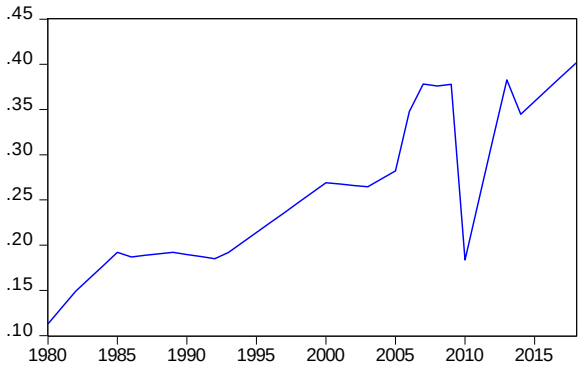


Figure 5: Female School Enrolment Rate

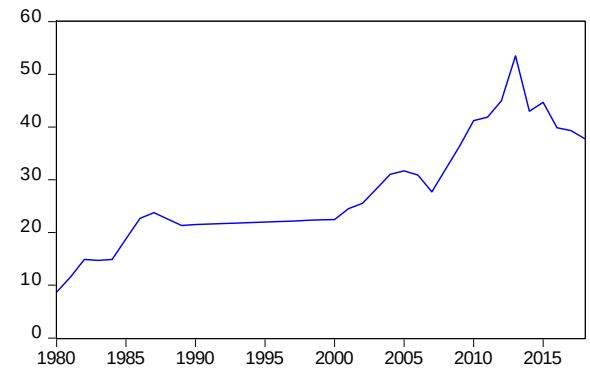
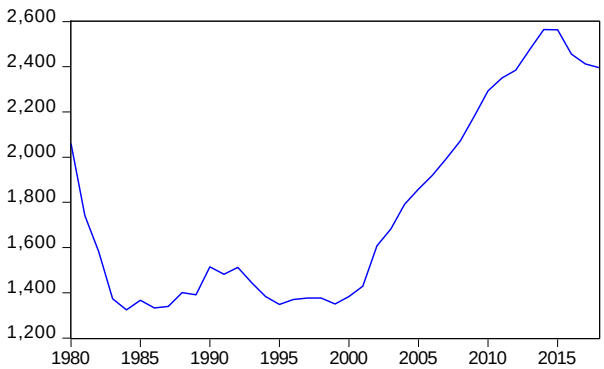


Figure 6: GDP per Capita



Graphical illustration of the study variables

Correlation Analysis

Correlation analysis shows the degree of association among the variables. A positive (negative) sign indicates joint movement of the variables in the same (opposite) direction while the size shows the strength of the joint movement. Table 2 presents the lower triangular correlation matrix of associations among different pairs of the study variables. It showed that there existed strong and

negative co-movement between LMMR and LGHEXPC, LMMR and PHY, LMMR and FSER, LGHEXPC and HBDS, HBDS and PHY and HBDS and PHY. Furthermore, there was a strong and positive relationship of between LGHEXPC and PHY, and between LGHEXPC and FSER. A moderate and positive relationship was also found between LMMR and LHBDS and between PHY and FSER.

Table 2: Correlation Matrix

	LMMR	**LGHEX**	**NHBDS**	**PHY**	**FSEN**	**LGDPPC**
LMMR	1					
LGHEXPC	-0.75	1				
HBDS	0.62	-0.59	1			
PHY	-0.76	0.67	-0.51	1		
FSEN	-0.72	0.55	-0.42	0.69	1	
LGDPPC	-0.68	0.74	0.32	0.29	0.16	1

Source: Author's Computation, 2019.

Test of Stationarity of the study variables

This study adopted the Augmented Dickey Fuller (ADF) and Phillip-Perron unit root tests whose results are presented in tables 3 and 4. It was found that the variables were integrated of different orders, for instance, LGHEXPC, LMMR, FSER and LGDPPC were stationary at first difference I(1) while NHBDS and PHY were stationary at level.

Table 3: Unit Root Test Result

Augmented Dickey-Fuller							
Variable	Level			First difference			I(d)
	Intercept	Trend & Intercept	None	Intercept	Trend & Intercept	None	
LGHEX	-1.27	-0.14	2.60	10.12***	-5.22***	-0.89	I(1)
LMMR	-1.62	1.05	-0.32	-3.30**	-3.83**	-1.46	I(1)
HOBEDS	-19.37***	-7.91***	-11.24***	---------	---------	---------	I(0)
FSEN	-1.58	-2.96	0.87	-1.25	-1.09	-0.87	I(1)
PHY	-3.49**	-3.83**	0.67	---------	---------	---------	I(0)
LGDPPC	-1.82	-1.95	0.84	3.53**	3.65**	3.46**	I(1)

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

Source: Author's Computation, 2019.

Table 4: Unit Root Test Result

Phillips-Perron							
Variable	Level			First difference			I(d)
	Intercept	Trend & Intercept	None	Intercept	Trend & Intercept	None	
LGHEX	-0.66	-3.94**	4.66***	---------	---------	---------	I(0)
LMMR	-1.42	-0.43	-1.90	-3.63***	-3.97**	-3.26***	I(1)
HOBEDS	-1.69	-2.70	-1.10	-3.14**	-3.10	-3.26***	I(1)
FSEN	-1.57	-2.27	0.92	-6.48***	-6.46***	-6.21	I(1)
PHY	-1.20	-3.58**	3.36***	---------	---------	---------	I(0)
GDPPC	-1.61	-1.72	-2.07	-3.43**	-3.52**	3.31**	I(1)

Where ***, ** and * indicates 1%, 5% and 10% respectively
Source: Author's Computation, 2019

Cointegration Test

The bound test for long run cointegration was carried out using ARDL framework. Table 5 shows the bound test results with the F-statistic value of 6.33, which was higher than the upper bound at all the relevant significant levels. This implies the presence of long run cointegration among the variables in model.

Table 5: Bounds Cointegration Test

Test Statistic	Value	K
F-statistic	6.33	4
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Source: Author's Computation, 2019

Short-Run Model Results

The results of the short-run model is presented in Table 6. The main explanatory variable of the study, LGHEXPC, alongside some other control variables namely PHY and LGDPPC came up with the expected negative signs. Present year LGHEXPC coefficient value of -0.4477 implied that a percent increase in health expenditure reduced maternal mortality ratio by 0.4477 percent in the present year while the lag value of -0.6808 implied that a 1 percent increase in the previous years reduced the MMR by 0.68 percent in the present year. The larger value of the lagged variable may be due to the gestation period of government health expenditure. For instance, some of the expenses may be incurred on hospital building or procurement of sophisticated hospital equipment

which may not be ready for use until the subsequent years. The delay may be due to the long process of building, procurements, clearing of imported equipment, installation and training of potential users. The negative value of the coefficient of LGHEXPC corroborates the finding of Maruthappu*et al.*, (2014) in a study of the relationship between health spending by government and maternal deaths in 24 European countries. It also aligned with the finding of Nwankwo (2018). The Nwankwo (2018) study employed state level panel data while the present study employed national aggregate data. Hence, present study provided opportunity of including other relevant macro-level variables as controls.

The PHY and its lag also returned negative and statistically significant coefficients. The value of -0.3028 means that an increase in the number of physicians per thousand by 1 percent decreased maternal mortality by 0.3 percent in the short run. The effect of its lag was however lower at about 0.22 percent. Maternal mortality reducing effect of number of physicians found in the present study corroborates the earlier finding of Cameron, Contreras and Cornwell, (2019) in a study which sought to understand the factors determining maternal deaths in Indonesian. Increase GDP therefore, is expected to increase demand for healthcare and facilitate positive health outcome such as reduction in maternal mortality. Increase in GDPPC by 1 percent in the previous year reduced MMR by 0.08 percent. It however contradicts the finding of Kavitha (2017) for very high human development countries who reported that GDP actually increased maternal mortality in the selected countries. The error correction coefficient value of -0.2539 implied that 25.39 per cent of the disequilibrium in the maternal mortality in the previous year is corrected in the present year. This means that it will take about 4 years for the system to restore back to its long run equilibrium path in the case of any external shock.

Table 6: Short run (dynamic model)

Dependent Variable: Maternal Mortality Rate

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MMR(-1))	1.3938***	0.1733	8.0429	0.0000
D(LGHEX)	-0.4477*	0.0056	-1.7656	0.0876
D(LGHEX(-1))	-0.6802**	0.2889	-2.3546	0.0393
D(HOBEDS)	-0.0008	0.0052	-0.1514	0.8806
D(FSEN)	0.3305	0.0015	0.0226	0.9821
D(PHY)	-0.3028**	0.1239	-2.4447	0.0206
D(PHY(-1))	-0.2196**	0.0918	-2.3922	0.0467
D(GDPPC)	0.0309	0.0269	1.1486	0.2756
D(GDPPC(-1))	-0.0817*	0.0450	-1.8149	0.0841
ECM_{t-1}	-0.2539*	0.1094	-2.3208	0.0257
R^2	0.9881			
Adj R^2	0.9858			
DW	2.43			
F-Statistics	418.19 (Prob=0.0000)			

Source: Author's Compilation

Long run results

The long run results in table 7 revealed that only LGHEXPC (at 1 percent level), FSER (at 5 percent level) and PHY (at 5 percent level) were significant. All the significant variables returned negative coefficients. In the long run, an increase in government spending on health by 1 percent reduced maternal mortality by 0.18 percent. It is worthy of note that the variable was also significant and negative in the short run. Female school enrolment was not significant in the short run but returned a significant coefficient in the long run. This may be due to the possible lag in the effect of school enrolment on enlightenment and change in behaviour of the female folks. In the long run a percent increase in the female school enrolment rate reduced maternal mortality by 0.6 percent. This finding corroborates that of Pillai, Maleku and Wei (2013) in a study involving some selected developing countries. Finally, the number of physicians was significant in the long run. It is also in line with Weitzman's (2017) report in a study which assessed the nature of the relationship between female education and maternal health in Peru. The study asserted further that more years of female schooling reduced the tendency of several maternal health complications.

Table 7: Long run (static) results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGHEX	-0.1837***	0.0712	-2.5801	0.0043
HOBEDS	-0.014645	0.108659	-0.134779	0.8937
FSEN	-0.6023**	0.2850	2.1133	0.0285
PHY	-0.8114**	0.3354	-2.4192	0.0451
GDPPC	0.6710	2.3035	0.2913	0.3714
C	9.6363**	3.6171	2.6640	0.0123

Source: Authors' computation, 2019

Post-estimation diagnoses results

In order to establish the validity of the model estimated, a number of post-estimation diagnoses were carried out. These included the tests for linearity, homoscedasticity, autocorrelation and normality of the error term. The Ramsey RESET, ARCH-LM, Breusch-Godfery and Jarque-Berra tests were adopted to test for the four econometric phenomena respectively. The tests revealed that the model estimated was well specified (linear), the variance of the error term was homoscedatic, free from autocorrelation and was normally distributed as revealed by their probability levels which were higher than 5 percent level (table 8).

Table 8: Summary of post-estimation diagnoses

S/n	Econometric problem	Tests	Statistics	Prob Value	Conclusion
1	Normality test	Jarque-Bera	5.33	0.069605	Residuals are normally distributed
2	Serial correlation LM test	Breusch-Godfrey Serial Correlation LM test	2.56	0.2774	No serial correlation
3	Heteroscedasticity	Heteroscedasticity Test (ARCH)	3.16	0.2059	It is homoscedastic
4	Linearity Test	Ramsey Reset	2.09	0.1621	The model is well specified

Source: *Author's Computation, 2019*

SUMMARY AND CONCLUSION

The paper assessed the effect of government health spending on maternal mortality in Nigeria. Data from 1980 to 2018 on relevant variables were sourced from WDI. The data were assessed for the presence of unit root and it was discovered that the series were integrated of different orders, hence, were analyzed within the ARDL framework. The short run model revealed that GHEXPC, PHY and GDPPC significantly reduced maternal mortality in the short run while GHEXPC, FSER and PHY were the significant determinants of maternal mortality in the long run. Therefore, the study concluded that increase in government health expenditure, availability of medical personnel, female enlightenment (education) and improved economic condition will reduce maternal mortality in Nigeria.

RECOMMENDATIONS

Based on the finding if these study, government should improve allocation and release of funds to the health sector and monitor same to ensure effective utilization of such fund. Improved girl-child education should be pursued with more enlightenment and incentives. Finally, the cost of training of medical professionals should be further subsidized in order to be able to train more; while such professionals are advised to join in providing better medical care to the people.

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