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FEMALE SCHOOLING, PUBLIC HEALTH EXPENDITURE AND MATERNAL MORTALITY IN NIGERIA

ABSTRACT

The study investigated the female schooling, public health expenditure, and maternal mortality trilogy in Nigeria from 1990 to 2023. Drawing on Grossman's health capital model, the research investigated how increased investment in women's education and government health spending impacts maternal health outcomes. Using ARDL estimation technique, the result revealed that public health spending reduces maternal death by 0.43 unit and 4.05 unit both in the short and long term, respectively. Similarly, increase in female secondary school enrolment by 1% reduces maternal mortality by 0.13 unit in the short term, while in the long run maternal mortality reduces by 7%. Furthermore, in contradiction to what is expected, increase in female schooling moderates the impact of health spending on increasing maternal mortality rate. In conclusion, improvement in public health expenditure and female schooling distinctively could lead to reduction in maternal mortality. Therefore, the study recommends that to achieve target 3.1 which aimed at reducing maternal mortality to be less than 70 per 100,000 live births by 2030 of the Sustainable Development Goals (SDGs) there is the need for distinct policy initiatives to expand female schooling and increase public health spending, in other, government should increase spending on the health sector and also encourage girls to go to school.

Keywords: *Female Schooling, Health Expenditure, Maternal Mortality, Sustainable Development Goals, Nigeria.*

1. INTRODUCTION

Maternal health embodies obstetrics and gynecologic health for women during prenatal, intranatal (labour period), and postnatal periods (World Health Organisation, 2025). Thus, government investment in maternal healthcare is critical for the sustainability of healthcare institutions (Rahman et al., 2018). Furthermore, WHO Factsheet (2025) states that 260,000 women suffered and died due to pregnancy-related issues which occurs before, during and after childbirth as at 2023. Maternal mortality is the complications that are experienced during and after childbirth from pregnancy-related issues among women of reproductive age. This is however more prevalent in developing countries (WHO, 2007). WHO Factsheet (2025) confirms that as at 2023, low-income countries and middle-income countries, maternal morbidity was recorded at 0.92 percent.

In low-income regions, women endure 1 in 66 chances of complications occurring during childbirth in comparison to high developed countries where women are facing the odds of 1 in 7,933 complications occurring during childbirth. According to the United Nations inter-agency estimates and the United Nations International Children's Emergency Fund (UNICEF), the global maternal mortality ratio reduced by 44 percent, from 385 to 216 deaths per 100,000 live births between 1990 and 2015 (Joseph et al., 2012). Similarly, UNICEF reported a 40 percent global decline in maternal mortality ratio, from 328 to 197 deaths per 100,000 live births between 2000 and 2023. Despite these improvements, maternal mortality remains a persistent issue in Nigeria. In 2022, Nigeria accounted for approximately 20% of global maternal deaths, with a mortality ratio of 512 deaths per 100,000 live births (World Health Organization, 2023). This high rate endures despite decades of policy reforms, healthcare investments, and international support (Akintunde et al., 2024).

Female schooling can substantially amplify maternal health and lessen maternal mortality, female schooling influences matured women perspectives (Allegri et al., 2011), increases their willingness to adopt modern obstetric practices (WHO, 2016), improve their capacity for health-related decision-making (Burchardt, 2010; Fotso, 2009), promotes economic self-sufficiency (Montagu, 2011; Fawole et al., 2012), and positively modify the overall health in complex ways (Shim, 2010).

Educated women tend to make more sensible decisions regarding their health and are likely to utilize the available maternal health care services and comply with the recommendations for prenatal care (UNICEF, 2018). Education embolden the adoption of good health care practices, creates empowerment and increases socio economic opportunities (Olowa et al., 2014). The direct consequence of the increased level of education of women is the adoption of good health care practices, informed reproductive decisions and the utilization of health care services (Eboh et al, 2024). In light of Nigeria's female literacy rates being as low as it is, assessing female education and the health of reproductive age women becomes critical and on the other hand, establishes the foundation for policies that position education as a primary means of improving maternal health (Mcalister et al., 2006; Godah et al., 2021; Enyioko, 2021).

Enhancing the health care services standard, value and accessibility through increased public health spending magnifies how maternal morbidity is affected by female schooling. Maternal deaths are reduced by timely and appropriate care and investment in medical resources such as skilled birth attendants and the necessary medical supplies (Zerhouni, 2019).

However, WHO reports from 2014 and 2019 indicate that most African countries continue to spend below the regional average of approximately US\$100 per capita on healthcare (Alam et al., 2014; Asongu et al., 2015; Arthur et al., 2017; Chireshe et al., 2020). According to UNICEF (2023), Nigeria's total health budget was N547 billion in 2021, N826.9 billion in 2022, and N1.17 trillion in 2023. In 2023, public health expenditure accounted for approximately 5.3% of the total budget, significantly below the African Union's 15% target (Paul et al., 2024). This corroborates Azuh et al. (2020) findings that health spending is insufficient in Nigeria, leading to low level of productivity of health workers, inadequate medical facilities, and high rate of disease and death, which in turn leads to stagnation of the economy.

The flow of health resources in Nigeria is more a frustrated than useful, due to the misappropriation of funds, lack of policy control and implementation and low level of healthcare facilities (Olaniyan et al., 2013). The dearth of success raises questions about the impact and effectiveness of existing interventions and measures put in place to address this challenges. Despite efforts over decades in Nigeria, maternal mortality remains a persistent issue in Nigeria (Oweibia, 2025).

Researchers studied the unique effect of female education and public health expenditure on maternal mortality which results had mixed findings. Akintunde et al., (2024), Maruthappu et al., (2014), Alves

(2007), Bokhari et al., (2007), Nwankwo (2018), and Igbinedion et al., (2018) stated there was an inverse relationship between the variables. On the other hand, some studies have reported a positive association between the variables (Aziz et al., 2021; Rana et al., 2018).

According to Meh et al., (2019) and Haruna et al., (2023), the provision of health care infrastructures, the recruitment of health care personnel coupled with the provision of quality antenatal and postnatal care and health care equipment may encounter improvements in maternal mortality only when there is sufficient female education, because women may not be able to use these resources effectively. On the other hand, there may be no improvement in maternal mortality when there is adequate female education and public health expenditure if the necessary medical services and support are not available. Moreover, identifying the combined effects of female education and government spending on healthcare is essential when examining maternal mortality. This brings important considerations: What is the connection between spending on healthcare and maternal mortality in Nigeria from 1990-2023? What is the link between female education and maternal mortality in Nigeria from 1990-2023? Do the combined effects of female education and government spending on healthcare have any meaningful effects on maternal mortality from 1990-2023? This research addresses these questions by determining the effect of healthcare spending and female education on maternal mortality from 1990-2023, and evaluating the effect of their interaction from 1990-2023.

The gap in existing literature overlooked the interaction of female education and government spending on public health and how it affects maternal mortality, for better or for worse. The combined impact of female education and government spending on public health on maternal mortality in Nigeria between 1990 and 2023 has yet to be established. This study analyzes the combined effects of the variables public health expenditure and female education on maternal mortality and their potential to reduce maternal mortality.

The ensuing sections covers literature review of relevant studies, the methodology, analysis and presentation of findings, conclusion and finally recommendations of the study.

2. LITERATURE REVIEW

This section provides insight into two major selected theories (Grossman's model of health and capital and human capital theory) and previous works that may be useful for this study.

Grossman (1972) proposed that health is an asset or a stock of capital that can be refined over time. He argued that, continually, some investment needs to be made for a person's health to avoid the attrition of an individual's health stock, although it may be possible to increase an individual's health stock through some form of investment. He reflects that health is a demand input and that asset demand (to the individual) is both a consumer good and a productive resource. In particular, he attempts to explain the relationship among female education, government spending, and the level of maternal deaths. Health inputs, as stipulated by Santerre et al., (2010), such as female schooling, government or private spending on health care, food, physical activity, environment, income, and time serves as investments to improve an individual's health and, among other things, a diminution in the level of maternal deaths. As such, targeted health expenditures aimed at improving maternal care, addressing the immediate needs and long-term needs (Atuahene et al., 2020).

Despite its widespread acceptance, the Grossman model has been subject to several criticisms, one of which is that the model does not adequately address inequalities in access to healthcare and the impact of poverty on health investment decisions (Bhattacharya et al., 2023).

The concepts presented by Schultz (1961) and Becker (1964) revolve around the 'theory of human capital'. This theory states that human assets can be obtained through numerous channels, including through education, and even migration. This theory emphasizes that the primary elements of an individual's productivity and well-being are education and health. Training, or the expenditures related

to an individual's education, will have future, rather than present, returns. This means that the expenditures related to training are, in fact, capital investments. More specifically, these investments would be categorized as investments in 'human capital' (Lewis 1997). Moreover, educated women are able to use health care services related intranatal (labour period), and postnatal periods, and are better able to understand and use such services to postpone early childbirth and reduce overall fertility, thus, reducing maternal mortality. Investments in health care, whether public or private, are aimed at improving community health and are intended to reduce maternal mortality. Investing in education and health care to control maternal mortality in population is justified by this theory (Lewis 1997).

Critics also argue that the theory may overlook the quality dimension of human capital investments, particularly in developing countries where increased spending does not always translate into improved outcomes (Barro, 2023).

Empirically, Eboh et al. (2024) examined the variables of maternal mortality in Nigeria From 2000 to 2019 using regression analysis. They determined that health outlay, in the present case, has a negative correlation with MMR. They also determined that MMR and the female primary school enrolment (FPSE) had a negative correlation, while a female self-employment (FSE) and MMR correlation was deemed insignificant.

Akintunde et al. (2024) focused on the relationship between healthcare spending and maternal mortality in Nigeria between 1991 and 2021. They employed the Autoregressive Distributed Lag (ARDL) model and confirmed that spending influenced mortality. Also, they corroborated Eboh et al. (2024) findings and George-Anokwuru (2024) who revealed that in the long-run public healthcare expenditure have a negative relationship with maternal mortality in Nigeria.

In another study Makinde et al. (2022) also investigated the effect of macroeconomic variables health expenditure on health outcomes in Nigeria using ARDL model, and found out that household consumption and Nigeria total health expenditure were associated significantly with reduction of maternal mortality in Nigeria.

Applying, generalized method of moments, Solanke et al. (2026) emphasized the importance of institutional factors in determining the effect of government expenditure on maternal death.

Also, using panel data regression analysis, Christopher (2018) examined the effects of maternal mortality of public health expenditures in Nigeria from the years 2003 to 2015 and determined that public health expenditures has a potent effect in alleviating maternal mortality. His findings corroborated Nwankwo (2018) who focused on the 25 states of Nigeria between the years of 2003 and 2015.

Moreover, empirical findings Madichie et al. (2026) revealed that maternal education, specifically female secondary school enrolment improves maternal care. This study aligned with the study of Adebayo et al. (2025) who suggested that to reduce maternal mortality, government should encourage and improve female schooling. This also corroborated with Eboh et al. (2024) study. Similarly, Nwankwo (2018) study, controlled for female literacy rate, and found out the relevance of female schooling as factor to explain maternal death variations in Nigeria. That is, policies should not just be directed towards public healthcare finances but also to encourage female schooling in Nigeria.

From studies such as Akintunde et al. (2023) and Nwankwo (2018) focused on the effect of public health expenditure on Maternal Mortality, while studies like Madichi et al. (2026) revealed that female schooling can improve maternal care. Therefore, this study filled the gap in the literature by simultaneously investigating the combined effect of public health expenditure and female schooling on maternal mortality in Nigeria.

3. METHODOLOGY

Data source

This study covers years from 1990 to 2023 and used time series data. Data were procured from the World Bank Development Indicators (WDI).

Model specification

Grossman's health capital model was applied in this study, as it compares health to a durable capital good that deteriorates but can be improved through investment (Grossman, 1972). Within this model, public health expenditure was considered a health capital investment, while female schooling was viewed as an enhancement of female knowledge, enabling them to make reasonable resolution about their health. All of which are key factors that directly affect maternal mortality outcomes (Schultz, 2002; World Health Organization [WHO], 2019). Previous studies have demonstrated that improving female schooling significantly lowers the likelihood of maternal deaths making ensure that women can make knowledgeable health decisions (Gakidou et al., 2010; Abu-Ghaida et al., 2004). Similarly, public health spending strengthens healthcare infrastructure, and increases the accessibility of well-trained and qualified personnel, all of which play a role to reducing maternal risks (Bokhari et al., 2007; Anyanwu et al., 2009).

This model follows the general specification:

$$I_t = I_t(M_t, TH_t, E_t) \quad (1)$$

Where M_t is medical care, TH_t is gross investment function's time input, E_t is human capital stock and I_t is net investment in health stock.

This study uses the model specification from Onah (2023) and Grossman (1972). Both studies included variables like public health expenditure and female secondary school enrolment, which serve as a substitute for female schooling. They express the functional relationship between maternal mortality rate, health care expenditure and female schooling, as shown in equation (1):

$$MAM_t = F(HEX_t, FSE_t) \quad (2)$$

Here, the female secondary school enrolment (a substitute for female schooling) and government expenditure on health are exogenous variables. While maternal mortality is an endogenous variable.

Onah (2023) incorporated female secondary school enrolment as a substitutes for female schooling, public health expenditure (% of GDP), and gross domestic product (GDP), and private health expenditure. Therefore, these variables are incorporated into equation (2), which is expressed as:

$$MAM_t = F(HEX_t, FSE_t, GDP_t, PHE_t) \quad (3)$$

Where: MAM_t is MAM Rate, HEX_t is Public Health Expenditure which is measured as a percentage of GDP, FSE is Female Secondary Enrolment refers to the percentage of females enrolled in secondary school, GDP_t is Gross Domestic Product Per Capita is given in constant 2015 USD; and PHE_t is Private Health Expenditure is measured at time t.

Explicit econometric specification with interaction:

$$MAM_t = \beta_0 + \beta_1 HEX_t + \beta_2 FSE_t + \beta_3 (HEX_t * FSE_t) + \beta_4 GDP_t + \beta_5 PHE_t + \epsilon_t \quad (4)$$

β_0 : Intercept

$\beta_1, \dots, \beta_5$: Parameters to be estimated

$HEX_t * FSE_t$: Interaction term (joint effect of health expenditure and female schooling)

ϵ_t : Error term

This structure enables direct estimation of the stand-alone effect of both female schooling (β_2) and public health expenditure (β_1), with their interactive effect (β_3), thus fulfilling all core study objectives. Descriptive analysis along with the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test were performed. Valid inference and avoiding spurious regression are two of the reasons why stability is important. Since variables in economic and health datasets usually exhibit mixed integration orders, cointegration tests are performed. Using the Autoregressive Distributed Lag (ARDL) bounds-

testing approach (Pesaran et al. 2001), the relationship between maternal mortality and its determinants were assessed.

Hence, from equation (2), the ARDL model takes up the general specification:

$$\Delta MAM_t = \beta_0 + \theta_i \sum_{i=1}^p \Delta HEX_{t-i} + \gamma_{1j} \sum_{j=0}^{q_1} \Delta FSE_{t-j} + \gamma_{2k} \sum_{k=0}^{q_2} \Delta (HEX * FSE)_{t-k} + \gamma_{3l} \sum_{l=0}^{q_3} \Delta GDP_{t-l} + \gamma_{4m} \sum_{m=0}^{q_4} \Delta PHE_{t-m} + \gamma_1 HEX_{t-1} + \gamma_2 FSE_{t-1} + \gamma_3 (HEX * FSE)_{t-1} + \gamma_4 GDP_{t-1} + \gamma_5 PHE_{t-1} + \epsilon_t \quad (5)$$

Where p, q_i are lag orders for the dependent variable MAM_t and the independent variables $X_{i,t}$ while ϵ_t is error term. In equation (5), the model outlines the short and long run relationships between MAM, public health expenditure, female secondary enrolment, and the other independent variables. Lastly, the error correction mechanism (ECM) helps us capture the short run relationships between the dependent variable and independent variables. Hence, the ECM equation is derived from (5) and can be expanded as:

$$\Delta MAM_t = \beta_0 + \theta_i \sum_{i=1}^{p-1} \Delta HEX_{t-i} + \gamma_{1j} \sum_{j=0}^{q_1-1} \Delta FSE_{t-j} + \gamma_{2k} \sum_{k=0}^{q_2-1} \Delta (HEX * FSE)_{t-k} + \gamma_{3l} \sum_{l=0}^{q_3-1} \Delta GDP_{t-l} + \gamma_{4m} \sum_{m=0}^{q_4-1} \Delta PHE_{t-m} + \lambda ECT_{t-1} + \epsilon_t \quad (6)$$

Equation 7 shows the speed of the deviations in the long run, where the short run coefficient is $\theta_i, \gamma_{1j}, \gamma_{2k}, \gamma_{3l}, \gamma_{4m}$ and the adjustment speed is λ .

4. RESULT AND DISCUSSION

Descriptive Statistics

Table 4.1 reveals descriptive statistics for the key variable

	MAM	HEX	FSE	GDP	PHE	HEX*FSE
Mean	1130.68	111.01	32.68	2000.03	120.41	4588.68
Median	1127.00	58.98	31.39	2012.87	27.51	1843.07
Maximum	1285.00	423.33	52.23	2622.04	448.94	19337.18
Minimum	993.00	0.15	21.27	1409.99	0.49	3.19
Std. Dev.	68.58	127.13	10.21	452.77	145.83	5694.19
Skewness	0.34	1.08	0.22	-0.06	0.91	1.18
Kurtosis	2.88	3.02	1.54	1.32	2.45	3.31
Jarque-Bera	0.67	6.59	3.29	4.02	5.10	8.08
Probability	0.71	0.04	0.19	0.13	0.08	0.02
Observations	34	34	34	34	34	34

Source: Author's computation (2026)

Table 4.1 shows that maternal mortality (MAM), public health expenditure (HEX), female secondary school enrolment (FSE), and private health expenditure (PHE) are positively skewed since their mean value which is 1130.68, 111.01, 32.68, 120.41 and 4588.68 respectively is greater than their median values which are 1127.00, 58.98, 31.39, 27.51, and 1843.07 respectively. While gross domestic product (GDP) is negatively skewed because its median of 2012.87 is higher than its mean of 2000.03

The standard deviation of maternal mortality (MAM) which is 68.58, public health expenditure (HEX) is 127.13, female secondary school enrolment (FSE) is 10.21, and private health expenditure (PHE) is 145.83 are slightly volatile because of how spread out their data is from the mean. The coefficients of

kurtosis for MAM (2.88), FSE (1.54), GDP (1.32), and PHE (2.45) show that these variables are platykurtic (less than 3), with a negative kurtosis and a flat-surface curve. Only HEX and HEX_FSE are leptokurtic (greater than 3) with a peaked curve. The kurtosis result reveals that none of the variable is mesokurtic or normally distributed. While Jarque Bera test confirms that maternal mortality (MAM), female secondary school enrolment (FSE), private health expenditure (PHE) and gross domestic product (GDP) are normally distributed except for health expenditure and the interaction term, which are not.

Stationarity Test

To prevent spurious regression from non-stationary time series, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were conducted.

Table 4.2: Unit root test.

Augmented Dickey-Fuller (ADF)				Phillips-Perron (PP)			
Variables	Level	First difference	Stationarity	Variables	Level	First difference	Stationarity
	ADF	ADF			PP	PP	
	Statistics	Statistics			Statistics	Statistics	
MAM	-3.15	-2.5724	I(0)	MAM	-1.8853	-2.1656	I(0)
HEX	-1.7917	-3.5205	I(1)	HEX	-1.7241	-3.7665	I(1)
FSE	-2.7638	-7.0002	I(1)	FSE	-2.7638	-7.0218	I(1)
GDP	-1.7685	-3.0439	I(1)	GDP	-1.7685	-2.9596	I(1)
PHE	-2.0403	-4.8814	I(1)	PHE	-2.0403	-4.8353	I(1)
FSE*HEX	-1.6641	-4.1368	I(1)	FSE*HEX	-1.6641	-3.9255	I(1)

Source: Author's computation (2026).

At 5 percent significance level, the unit root properties of the variables were assessed using Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. The variables exhibit differing degrees of integration. ADF tests conclude that the maternal mortality rate is stationary at level. While, the variables health expenditure, female secondary school enrolment, public health expenditure, and the interaction term are stationary after first differencing. The ARDL bounds testing approach to cointegration is applicable, since none of the variables are integrated of order two,

Bound Test Cointegration Technique

The Autoregressive Distributed Lag (ARDL) bounds testing method was used to analyze whether a long-term equilibrium exists between the variables.

Table 4.3: Bound Test.

Statistic	Value	5% Critical Lower Bound (I(0))	5% Critical Upper Bound (I(1))	Decision
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F-statistic (Joint significance)	4.72	2.62	3.79	Cointegration confirmed
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Source: Author's computation (2026).

In table 4.3 the ARDL bounds test shows a long-run relationship between maternal mortality, female schooling, public health expenditure, gross domestic product, private health expenditure, and the interactive variable, which showed that the upper bound is less than the F-statistics, this confirmed that cointegration exist among the variables. In other words, short-run and long-run relationship exist among the variables. Similar cointegration patterns are revealed in studies like Eboh et al., (2024), and Akintunde et al., (2024) linking maternal mortality and healthcare expenditure in low-income countries and middle-income countries (Bokhari et al., 2007).

The Model Estimation

Long-Run Coefficient Estimates

Table 4.4 displays the estimated long-run coefficients derived through the ARDL error correction model:

Variable	Coefficient	Std. Error	t-Statistic	P-Value
HEX	-4.05	0.93	-4.34	0.00
FSE	-1.36	5.71	-0.24	0.81
HEX*FSE	0.07	0.02	2.82	0.01
GDP	0.12	0.1	1.21	0.25
PHE	0.43	0.28	1.55	0.14
Constant	350.62	102.41	3.42	0.00

Source: Author's computation (2026).

Table 4.4 shows that public health expenditure (HEX) and female secondary school enrolment (FSE) revealed a negative value of -4.05 and -1.36 units, respectively. This insinuated that an increase in public health expenditure and female secondary enrolment lessen maternal mortality rate (MAM) in Nigeria. This finding conformed to the studies by Nwankwo (2018), Christopher (2018), Akintunde et al. (2024) and Eboh et al. (2024).

However, the interaction between public health spending and female secondary school enrolment (HEX*FSE) is valued at 0.07 and statistically significant at 0.01, suggests that there is no reduction of maternal mortality with the merger of the two variables. This suggests that with rising female education, health spending's detrimental effect on maternal morbidity is exacerbated. Moreover, private health expenditure (PHE) and gross domestic product (GDP) is valued at 0.12 and 0.43 units, positive respectively. This is interpreted that Gross Domestic Product and Private Health Expenditure aggravates the maternal mortality rate in Nigeria. Additionally, the constant term is positive and significant, showing that other factors such as, cultural practices, and health care systems, still impact maternal mortality above and beyond the parameters of the model. In conclusion, the findings emphasize the need to budget distinctly for public health spending and female education to reduce maternal morbidity.

Short-Run Dynamics

Table 4.5: Short-Run Coefficient Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	350.62	58.49	5.99	0.00
D(MAM(-1))	0.47	0.11	4.24	0.00
D(HEX)	-0.43	0.26	-1.63	0.12
D(HEX(-1))	0.23	0.05	4.8	0.00
D(FSE)	0.13	1.14	0.11	0.91
D(FSE(-1))	-2.23	0.64	-3.47	0.00
D(HEX*FSE)	0.01	0.01	1.51	0.15
D(GDP)	-0.01	0.04	-0.16	0.88
D(GDP(-1))	-0.13	0.04	-3.35	0.00
D(PHE)	0.06	0.04	1.56	0.14
CointEq(-1)*	-0.34	0.06	-6.09	0.00

Source: Author's computation (2026).

From a short-term perspective, most of the coefficients align with the overall long-term trends. While the public health expenditure's coefficient is negative (coefficient: -0.43, $p = 0.12$) and not statistically significant, it seems as though more public health spending decreases maternal mortality. On the contrary, female secondary school enrolment has a positive contribution (0.13) with a high probability (0.91), suggesting a 13% increase in maternal mortality, which is contrary to the long-term results. The variable public health spending and female schooling (HEX*FSE) also has a positive contribution of 0.01 which is somewhat close to statistically significant ($p = 0.15$) and therefore, it is likely that with increases in both maternal health and female schooling, maternal mortality will be higher. Private health spending (coefficient: 0.06) is positively related to maternal mortality whereas GDP is negatively related.

The error correction term (ECT) is -0.25 ($p < 0.05$), indicating a significant adjustment toward long-term equilibrium at a rate of approximately 35% per year. This result demonstrates the model's stability over time.

Diagnostic Test Results

Table 4.6 shows that the following tests prove the validity of the model:

Test	Statistic / p-value	Conclusion
Breusch-Godfrey LM Test	0.43	No Heteroscedasticity
Serial Correlation	0.11	No Autocorrelation
Jarque-Bera Normality Test	0.24	Residuals normally distributed

Source: Author's computation (2026).

Table 4.6 validate that the model complies with the assumption of the regression model. The absence of heteroscedasticity and autocorrelation in the model was signified by the Breusch-Godfrey LM test and serial correlation test. The Jarque-Bera test confirms the residuals to be normally distributed. Furthermore, the CUSUM test and the CUSUM of Squares test showed the plots of the model to remain within the 5 percent critical bounds for the entire study period. Taken together, the results show that the model is valid and the estimated coefficients are reliable for strategic decision planning.

Discussion of Findings

The present study investigates the effects of female schooling and public health spending on maternal mortality in Nigeria between 1990 and 2023.

The result insinuated that raising public health spending significantly reduces maternal deaths, which is conformed to the studies of Nwankwo (2018), Christopher (2018), Eboh et al., (2024), and Akintunde et al., (2024), who all pointed out the value of increased health funding for better maternal health.

Female schooling, as measured by secondary school enrolment, is negatively associated with maternal mortality. However, in the long run this relationship is insignificant. Moreover, Mcalister et al., (2006), Haruna et al., (2023) and Meh et al., (2019) emphasized that women's education facilitates greater access to health services. The limited long-term impact may be attributed to persistent cultural, infrastructural, poverty, or policy-related barriers. This makes it harder for better maternal health outcomes through higher educational attainment.

There is a significant and positive relationship between public health spending and female schooling as founded; however, this relationship does not result in reduced maternal mortality when combined. It implies that as female education increases, it enhances the negative impact of health spending on increasing maternal mortality rate. Public health investments may be used inefficiently, even among women with higher levels of education. While education enables women to seek healthcare, factors such as corruption, inadequate service quality, unequal distribution of facilities, and restricted rural access diminish the impact of health spending. This corroborates Olaniyan et al., (2013), Azuh et al., (2020) and Shim, (2010) findings demonstrating that effective synergy between education and health spending requires robust institutional infrastructure.

There is no significant correlation between spending on maternal health, GDP per capita, and private health spending, suggesting that out-of-pocket spending on health and economic growth do not improve maternal health. This corroborates Anyanwu et al., (2009) findings, who argued that private health spending frequently represents distress expenditures rather than authentic utilization of healthcare services, particularly in low-income settings. Economic growth alone does not improve maternal health unless accompanied by targeted public investments in health and education.

In the short term, changes in public health spending and female schooling do not quickly lower maternal mortality, which means the effects take time. The significant and negative error correction term shows there is a long-run balance, and that any changes are corrected at a moderate pace. This means that improving maternal health needs steady and ongoing policy efforts, not just short-term spending boosts.

5. CONCLUSION AND POLICY RECOMMENDATION

In conclusion, improvement in public health expenditure and female schooling distinctively could lead to reduction in maternal mortality.

The study recommend that in other to amplify quality maternal health care, government should allocate resources to the health sector and encourage girls to go to school. However, to achieve target 3.1 which aimed at reducing maternal mortality to be less than 70 per 100,000 live births by 2030 of the Sustainable Development Goals (SDGs) on maternal health, government has to provide infrastructural facilities and abolish policies obstacles. Lastly, government has to ensure checks and balancing of the regularisation of funds in the health sector.

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