

## EFFECT OF FEMALE EDUCATION ON MATERNAL MORTALITY IN NIGERIA

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### Abstract

*One of the numerous health problems Nigeria is faced with is maternal mortality. Despite the nation's recorded improvements, it still has some of the worst maternal health statistics in the world. The level of education of women is identified as one of the factors that influences maternal health. However, there is serious regional disparity in female literacy and maternal deaths in Nigeria. This study aimed at examining the effect of female education on maternal mortality in Nigeria. The Autoregressive Distributed Lag (ARDL) method of estimation was employed. The findings indicated that the coefficient of female literacy rate is negative and significant. That is, the level of education significantly reduces the level of maternal mortality in Nigeria for the period under study. The coefficient of the controlled variable is positive although insignificant, which means that increase in labour force participation by pregnant females could increase maternal deaths if not checked. The study recommended that the country's policy on education of children, especially the girl child should be aggressively implemented across all the tiers of government in order to increase their literacy level and reduce maternal mortality in the country. Also, all employers of labour in Nigeria, need to ensure that pregnant women go on maternity leave early enough and discourage them from waiting till they give birth before they start their leave.*

**Keywords:** Female education, Labour force participation rate, Maternal mortality

### Introduction

Education plays a very important role in a country's economic development. A more educated mother for example, is likely to practice healthy lifestyle behaviors, such as good nutrition and hygiene. Mothers that are more educated are likely to visit the doctor, be more confident in asking health care questions, and understand the potential risks during their pregnancies. Educated mothers are expected to apply healthy behaviors in their families and pass on these ideas about good nutrition, exercise, and other health related issues (Dayal, 2013).

Female education plays a vital role in economic development, because the children of educated women get better education, get better health, thus, suffer less morbidity and mortality. Female education does not only lead to the reduction of child mortality but maternal mortality also. The higher the level of female education attained, the lower the maternal deaths (Chowdhury, Botlero, Koblinsky, Mstat, Dieltiens & Ronsmans 2007; Amwonya, Kigossa, & Kizza 2022).

West Africa is said to have the highest rate of maternal mortality as well as the lowest level of girl-child education (Brou, 2022). Nigeria is regarded as one of the countries with the highest maternal mortality rates globally. Furthermore, maternal mortality rate in Nigeria is more than ten times greater than the SDGs' 3, target 1 (Ajegbile, 2023) which is: reduce maternal mortality ratio to less than 70 per 100,000 live births by 2030.

Maternal mortality in Nigeria is negatively influenced by so many problems, such as availability problem. Health care service is not available to all. For example, the nation's health care service delivery is poor – poor universal health coverage. Nigeria ranks 42 out of 100 in universal coverage (Ajegbile, 2023). Other problems are acceptability, as well as affordability of the health care service, which makes a good number of pregnant women give birth without the assistance of a skilled health care provider. Kenneth (2023) stated that only 43.4 percent of births in rural areas in Nigeria were assisted by health care professionals. Affordability and especially acceptability problems can greatly be reduced by female education.

Female literacy rate in Nigeria increased from 60.01% in 2010 to 71.35% in 2021, which shows that the rate improved by 18.9% within the period 2010 – 2021 (Globaldata, 2022). Similarly, maternal mortality rate also reduced by 16.76% between 2010 and 2019 (World Bank, 2019). The nation contributed nearly 20% of all global maternal deaths between 2005 and 2015, she currently contributes 10% of such deaths, the nation has moved from being the second largest contributor of maternal deaths on earth, to the fourth largest (World Health Organization, 2019; UNICEF, 2021).

However, the national improvement could be a reflection of some regions, because there is regional disparity in maternal mortality as well as female literacy in Nigeria. For instance, in 2018, female literacy rate in North West was 29%, North East, 31.8%, North Central, 49.6%, South South, 79%, South East, 79.3% and South West was 80.6% (Statista, 2019); whereas an analysis of 2008, 2013 and 2018 data revealed that, maternal mortality ratio was higher in Northern regions of Nigeria compared to their Southern counterparts, North East specifically had the highest maternal mortality ratio, while, South West consistently had the lowest (Babajide, Akinyemi & Ayeni, 2021). Furthermore, Nigeria's maternal deaths are under-reported (Onyeji, 2020).

The under-reporting of maternal deaths, which implies that the clear picture of the problem is not fully revealed, as well as the regional disparity with respect to female education and maternal deaths in the nation necessitated this research. Furthermore, the fact that Nigerian girls have recently become victims of kidnappers and sexual predators who have turned some girls schools (especially in the north) their targets, threatens to worsen the regional disparity. Based on this background, the impact of female education on maternal mortality in Nigeria is examined.

### **Empirical Literature Review**

Sajedinejad, Majdzadeh, Vedadhir, Tabatabaci, and Mohammad (2015), studied the role of many distant macrostructural factors affecting maternal mortality at the global level. They used 10 explanatory variables and found education, private sector/trade and governance as the most important macrostructural factors associated with maternal mortality. Education revealed a negative effect on maternal mortality. Which means that, increase in education led to reduction in maternal mortality.

Koonin, Atrash, Lawson, and Smith, (1991), found in a similar study that in the United States, the risk of maternal mortality is higher among women who were older (those above 40 years) than younger women, not married than married women, who had not received any prenatal care than those who had and those who had lower levels of education than higher levels. Extending the years of schooling among women in Peru, reduced the probability of several maternal health complications, (Mendeley, 2017).

Reversing the variables, Jayachandran and Lleras-Muney (2009) rather reported that in Sri Lankan areas with declines of maternal mortality, for every extra year of life expectancy, literacy and years of education increase by 2% and 3% respectively. In this study, declines in maternal deaths, rather increase female education.

In Matlab, Bangladesh, reduction in maternal mortality was more in the group with more than 8 years of schooling compared with no schooling (Chowdhury, Botlero, Koblinsky, Mstat, Dieltiens & Ronsmans 2007). Furthermore, maternal mortality rate reduced within 1998 – 2001 in Bangladesh, and one of the favourable changes associated with the decline was substantial improvement in the education levels of women of reproductive age (Arifeen, Hill, Ahsan, Jamil & Nahir, 2014).

Magadi, Diamond and Madise (2001) in their study of some Kenyan hospitals, observed maternal age, antenatal clinic attendance and educational attainment as characteristics that have significant association with maternal mortality. Pillai, Maleku and Wei [2013] found negative relationship between rates of change in female literacy and maternal mortality ratios in selected developing countries. This means that improvement in female literacy reduces maternal deaths. Furthermore, Amwonya, Kigosa and Kizza (2022) used OLS, 2SLS and Regression Discontinuity Design (RDD) model to explore female education and maternal health utilization in Uganda. They found that female education had a positive impact on maternal health care utilization.

Examining the panel data of 108 countries (Nigeria inclusive) over 20 years, revealed that a country that moves from 0 -1 year of education reduces its maternal mortality by 174 deaths per 100,000 births, while a country that moves from 7 to 8 years of education reduces maternal mortality by 15 deaths per 100,000 births ( Bhalotra & Clarke, 2013). This result is in harmony with that of Chowdhury, Botlero, Koblinsky, Mstat, Dieltiens and Ronsmans (2007) – which stated that the higher the level of education attained, the lower the maternal deaths.

Ujah, Aisien, Mutihir, Vanderjagt, Glew and Ugwu (2005) found that unbooked as well as illiterate women had very high association with maternal mortality ratio in North-Central Nigeria. Okonta, Okali, Otoide and Twomey (2009) explored the causes of and risk factors for maternal deaths in a rural Nigerian referral hospital and found some of the significant risk factors as age below 15, low socio-economic class, being unbooked and lack of formal education, as well as delay in accessing health facility. Ujah, Aisien, Mutihir, Vanderjagt, Glew and Ugwu (2005) found illiteracy, non-utilisation of antenatal services and Hausa-Fulani ethnic group as risk factors for maternal mortality in Jos, Nigeria. Finally, women involved in maternal deaths in Calabar, Nigeria, had the least level of education and were mostly unemployed (Agan, Archibong, Ekabua, Ekanem, Abeshi, Edentekhe, & Bassey, 2010).

Lack of education and exposure, as well as reliance on the advice of relatives/other rural women in the immediate environment, indirectly contributed to maternal mortality. These were the findings of the study conducted by Asogwa, Jemisenia and Asogwa (2022), who used qualitative research design in their study, which was aimed at finding out what rural women in Nsukka, Nigeria, know about maternal mortality . From the foregoing, the few reviewed studies conducted in Nigeria, focused on identifying the risk factors (one of which is the level of education) for maternal mortality. However, this study focused on the causal relationship that exists between female literacy and maternal mortality in Nigeria.

### Theoretical Background

Grossman's health production theory stated that individuals maximize their utility subject to the household income and production technology (technology here refers to health inputs). Grossman pointed out that other goods (such as education) aside medical care could also be in the production function (Berger & Messer, 2002). Simply put, the model linked health inputs of an individual to his health status; which means that, health status is determined by health inputs, health expenditure, or investment on health. In this study, education is regarded as health input, maternal mortality as health outcome. That is, female education is regarded as health input that could improve maternal health.

### Methodology

Secondary data were sourced. The data for this study were collected from World Bank and National Bureau of Statistics (NBS). Female literacy rate (FLR), which is the proxy for female education and the control variable - female labour force participation rate (FLFPR) were employed as the independent variables, while maternal mortality rate (MMR) as the dependent variable. The following model was specified:

$$\text{MMR} = F(\text{FLR} + \text{FLFPR}) \dots \dots \dots (1)$$

The specified model was transformed into a linear multiple regression model:

$$\text{MMR}_t = \beta_0 + \beta_1 \text{FLR}_t + \beta_2 \text{FLFPR}_t + \mu_t \dots \dots \dots (2)$$

Where:

MMR = Maternal Mortality Rate

$\beta_0$  = intercept of the function

FLR = Female Literacy Rate

FLFPR = Female Labour Force Participation Rate

$\mu$  = the error term

$t$  = current time period

In order to obtain the numerical values of the different variables and to reduce the effect of unit measurement in the data, the model is re-specified in the following log linear form:

$$\log \text{MMR}_t = \beta_0 + \beta_1 \log \text{FLR}_t + \beta_2 \log \text{FLFPR}_t + \mu_t \dots \dots \dots (3)$$

This study employed Augmented Dickey Fuller (ADF) method as one of the so many methods of testing for unit root. This is because it is an improvement over, for example, the Dickey Fuller (DF) method which does not add the lagged value of disturbance term in the equation to take care of serial correlation, but the ADF does. The null hypothesis:

$H_0: \delta = 0$  (time series data is non-stationary).

Where:  $\delta = \rho - 1$

The decision rule is that: When ADF value > critical value, reject  $H_0$ .

The ARDL bounds test developed by Pesaran and Shin (1999) and later Pesaran, Shin and Smith (2001) was employed to test the existence of co-integration, or the presence of long run relationship in the model. The null hypothesis is:

No long-run relationships exist (all the coefficients equal zero). While the alternate is: Long-run relationships exist (at least one of the coefficients is not equal to zero).

The computed F-statistic is compared with the Pesaran F- statistic values (I0 bound and I1 bound). The Decision rule is:

- i) If computed F- statistic > upper critical bounds, I1,  $H_0$  is rejected.
- ii) If F-statistic < both the upper and lower bounds,  $H_0$  cannot be rejected.
- iii) When F-statistic lies between the critical lower and upper bounds values, the test is inconclusive.

The main technique of estimation used was the simple Autoregressive Distributed Lag (ARDL) regression model. As pointed out by Narayan (2004); Harris and Sollis (2003), the ARDL approach is preferred to other traditional approaches to cointegration tests because it has some important advantages:

- i. All the variables do not have to be integrated of the same order
- ii. It is efficient in the case of small and finite sample data sizes.
- iii. It provides both the short-run and long-run estimates simultaneously.

Since this study's variables are not integrated of same order and the sample size is small, ARDL approach to cointegration was adopted. In line with ARDL specifications, model 3 is further re-specified as:

$$\Delta \log \text{MMR}_t = \beta_0 + \beta_1 \Delta \log \text{MMR}_{t-1} + \beta_2 \Delta \text{FLR}_{t-1} + \beta_3 \Delta \text{FLFPR}_{t-1} + \Theta_1 \log \text{MMR}_{t-1} + \Theta_2 \text{FLR}_{t-1} + \Theta_3 \text{FLFPR}_{t-1} + \mu_t \quad (4)$$

Where:

$\Delta$  = The first difference operator

log = Natural logarithm

p = Lag order selected

$\beta_i$  = Short-run dynamic coefficients

$\Theta_i$  = Long-run coefficients

t-1 = previous time period

The Error Correction Model (ECM) representation of the ARDL model specified is:

$$\Delta \log \text{MMR}_t = b_0 + b_2 \Delta \text{FLR}_{t-1} + b_3 \Delta \text{FLFPR}_{t-1} + \lambda \text{ECM}_{t-1} + \varepsilon_t$$

Where:

$\lambda$  = Coefficient of ECM, representing the speed of adjustment to long run equilibrium.

All the coefficients  $\beta$ , and  $\Theta$ , are expected to be negative. When the coefficients of female literacy rate and female labour force participation rate are negative it means that they reduce the maternal mortality rate. Therefore, maternal mortality rate is expected to respond inversely to increases in female literacy rate and female labour force participation, which implies improvement in maternal health due to increases in female education and income. The a priori expectation is stated symbolically as:

$$\beta_i < 0; \Theta_i < 0$$

## Results and Discussion

The pre-estimation test of unit root, using the Augmented Dickey Fuller approach, was conducted. The test revealed the following results.

**Table 1. Augmented Dickey Fuller (ADF) Unit Root Test Results**

| Variable | ADF         | Critical Value |           |           | Order of Integration |
|----------|-------------|----------------|-----------|-----------|----------------------|
|          |             | 1%             | 5%        | 10%       |                      |
| MMR      | -3.647689** | -2.692358      | -1.960171 | -1.607051 | I(0)                 |
| FLR      | -3.795403** | -4.571559      | -3.690814 | -3.286909 | I(1)                 |
| FLFPR    | -1.989585** | -2.699769      | -1.961409 | -1.606610 | I(1)                 |

**Source: Author's Computation Using EVIEWS 9**

Indicates significance at 1%, at 5% and at 10% levels respectively.

Mackinnon (1996) Critical value for rejection

Note: A variable is stationary at a given level when the ADF value is greater than the critical value.

The unit root test results as presented in table 1, revealed that maternal mortality rate (MMR) was stationary at level  $I(0)$ , while female literacy rate (FLR), as well as female labour force participation rate, were stationary at first differencing  $I(1)$ . The ARDL bounds test was conducted. The result is presented in table 2.

**Table 2. Bounds Test Result**

| F-statistic test                        | Value    | K      |
|-----------------------------------------|----------|--------|
|                                         | 4.416804 | 2      |
| Critical value bounds by Pesaran (2001) |          |        |
| Significance                            | $I(0)$   | $I(1)$ |
| 10%                                     | 3.17     | 4.14   |

**Source: Author's Computation Using EVIEWS 9**

Since the F-statistic value (4.416804) as revealed on table 2, is greater than the upper (4.14) bounds at 5% level of significance, it means that there is a long run relationship between maternal mortality rate and the explanatory variables within the study period. In other words, the bounds test result implies that there exists a long run relationship among maternal mortality rate on one hand and female literacy rate, as well as female labour force participation rate on the other hand. Table 3 reveals the long run estimates.

**Table 3. Long run ARDL estimation result**

| Variable | Coefficient | t-Stat    | Probability |
|----------|-------------|-----------|-------------|
| FLR      | -0.014090   | -6.098181 | 0.0259      |
| FLFPR    | 0.015352    | 1.641287  | 0.2424      |
| C        | 7.076133    | 11.028808 | 0.0081      |

**Source: Author's Computation Using EVIEWS 9**

The long run estimates of the ARDL model revealed that the coefficient of female literacy rate (FLR) has a negative effect on maternal mortality within the study period. The result (-0.014090) indicated by the coefficient of FLR means that a percentage increase in female literacy rate leads to a percentage decrease in maternal mortality rate. It conforms to the a priori expectation of the study. The probability value (0.0259) also means that this effect is significant since the value is less than 5% level of significance. Thus, it is observed that female literacy reduced maternal deaths, because a literate woman is expected to be more receptive to health care services, can read warnings on drugs and avoid some complications, can adhere to nutritional guide. This finding is in line with the study of Pillai, Maleku and Wei (2013); Arifeen, Hill, Ahsan, Jamil and Nahir, (2014); Bhalotra and Clarke (2013); and Chowdhury, Botlero, Koblinsky, Mstat, Dieltiens and Ronsmans (2007), who found that the rates of change in female literacy and maternal mortality ratios are negatively related.

The coefficient of the control variable, female labour force participation rate (FLFPR) had a positive effect on maternal mortality rate within the study period, this is not in line with the apriori expectation of the study. Since the probability value (0.2424) is above 5% level of significance, however, the effect is not significant. The positive sign implies that pregnant females who participate in the labour market, especially hard labour, may not be given enough time to rest (maternity leave) before putting to bed. Those that are self-employed may not be willing to go on maternity leave on time, till when the individual is very close to delivery or when she has delivered, which may expose such individual to some risks. This finding implies that labour (work), has the tendency to increase the risk of maternal mortality.

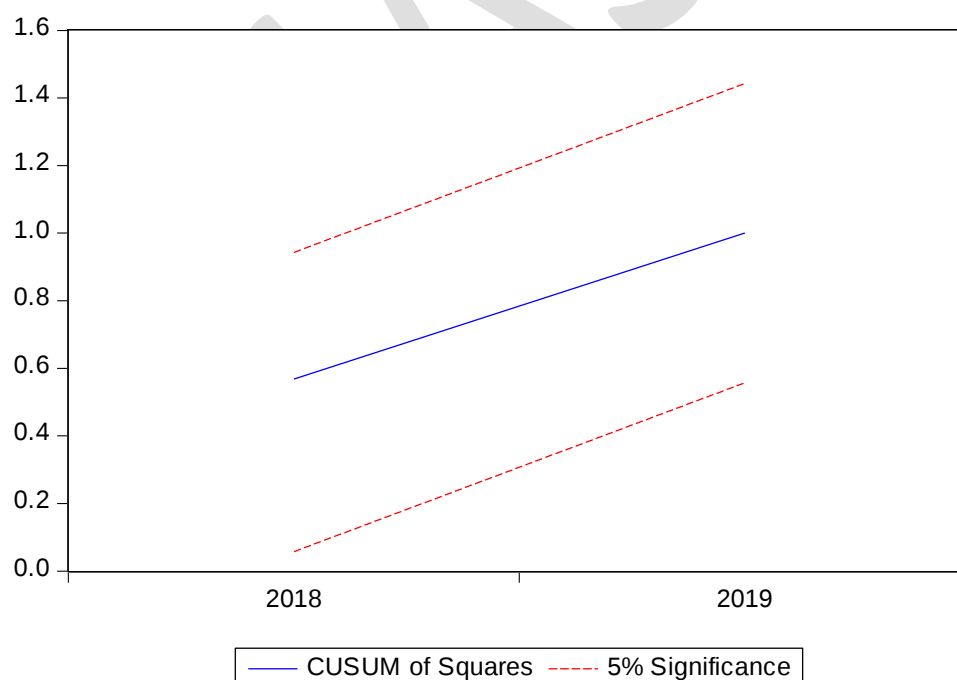
The post estimation test results are revealed on Table 4 as well as Figure 1.

**Table 4. Post Estimation Diagnostic Test Results**

| Tests        |             | Coefficient | Probability |
|--------------|-------------|-------------|-------------|
| Normality    | Jarque Bera | 1.167763    | 0.557729    |
| Ramsey RESET | F-stat.     | 2.038010    | 0.3890      |

**Source: Author's Computation Using EVIEWS 9**

The probability value (0.557729) of the Jarque Bera test, which is above 5% level of significance indicated normally distributed residuals. Ramsey RESET also showed that the model is correctly specified, since its probability value (0.3890) is above 5% level of significance. Furthermore, figure 1 shows that the stability test of cumulative sum (CUSUM) is stable, because the plot of the chart lies within the two critical bounds at 5% level of significance.



**Figure 1: CUSUM test result**

### Conclusion and Recommendations

Based on the empirical findings, it is concluded that the increase in education leads to decrease in maternal mortality. Also, increase in labour participation by pregnant females could increase maternal deaths.

Based on the findings of the research, the study recommended that:

1. Female education needs to be consciously and aggressively encouraged by the government, and all stakeholders in the combat against maternal mortality in Nigeria. The country's policy on education of children, especially the girl child should be aggressively implemented across all the tiers of government in order to increase their literacy level and reduce maternal mortality in the country.
2. The policy on maternity leave in Nigeria, requires more attention. The government as well as all employers of labour, need to ensure that pregnant women go on leave early enough and discourage them from waiting till they give birth before they start their leave. Private organisations need to put an incentive package on ground so as to encourage pregnant women in the private sector (especially those involved in hard labour like breaking of rocks in Nigeria) to withdraw from work early enough.

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