

Does Zonal Disparity in Maternal Education Explain the Inequality in Child Health Outcomes Across Nigeria's Six Geopolitical Zones?

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Abstract:- This study tries to investigate the differential effect of maternal education on under-five mortality across the six geopolitical zones in Nigeria. The study utilized data from the Nigeria Demographic and Health Survey (NDHS), 2013 in its analysis. A multinomial logistic regression was estimated to examine the disaggregated effect of maternal education, household wealth index and religion on under-five mortality in each of the six zones in the country. Our findings suggest that maternal education and wealth status have greater explanatory power on inequality in under-five mortality rates in Nigeria than religion. The study results indicate that maternal education significantly explains the zonal disparity in under-five mortality with Northeast and Northwest where maternal education is lowest while in regions where maternal education is high, the other socioeconomic status of women determines the health outcomes for under-five children.

Keywords:- Maternal Education, Mortality, Zonal Disparity, Multinomial Logit.

I. INTRODUCTION

Childhood morbidity and under five mortality are essential indicators for child health and well-being, often used as broad indicators of social and economic development of nations Abimbola O. (2013). Maternal education predicts to a great extent, the chance of a child's survival beyond the fifth birthday. The existing high level of vulnerability among women in various parts of the country which could be due to poor levels of education, exposes their children to greater chances of morbidity and mortality. According to the UN Inter-agency Group for Child Mortality Estimation, (UN, IGME, 2017 Report), Sub-Saharan Africa remains the region with the highest under-five mortality rate in the world. The Report stated that in 2016, the region had an average under-five mortality rate of 79 deaths per 1,000 live births which translates to 1 child in every 13 dying before his or her fifth birthday – 15 times higher than the average ratio of 1 in 189 in high-income countries, or 20 times higher than the ratio of 1 in 250 in the region of Australia and New-Zealand.

Due to the importance of childhood mortality as a crucial measure of national development, different scholars have embarked on research to investigate empirically, the association between women education and child survival;

the result of such studies have been very revealing and quite educating. A study conducted in Kenya, Senegal, Nigeria, and India on regional differentials in infant and child mortality in urban settings using the Measurement, Learning and Evaluation Survey, in ten years prior to the survey (Jeremiah, M.S, Shea, O.R, & George, T.B, 1994).

The result indicated that infant mortality was higher in urban than rural areas, this was attributed to increase in informal settlements in urban areas as a result poor socioeconomic conditions which resulted in poor health conditions especially among mothers and children and low education levels among mothers resulted in poor infant and child feeding practices (MLE, project 2010).

Natarajan and Devaki. (2013) using structured interview of 449 mothers who had children falling within the age group of 0-5 years to find whether maternal education really improves child health. The study was to analyze the impact of maternal education on nutritional status, morbidity factors – diarrhea, respiratory infections, and personal hygiene.

Employing descriptive method of analysis, the study concluded that maternal education has a positive influence on the health of the child by improving the nutritional status of the child but however, it does not affect the morbidity factors and does not play a role in improving the personal hygiene. Ripon et al (2014) studied the impact of maternal education on child health in Bangladesh using data from Household Income and Expenditure Survey HIES 2010, collected by Bangladesh Bureau of Statistics; the result from OLS regression showed that while father's education is positively correlated with child immunizations, mother's education is more critically associated with longer term health outcomes.

Evidence from national survey Reports (NDHS, 2013 and MICS, 2016/17) indicates that there persists a high-level inequality in the level of women education in Nigeria with the disadvantaged regions, mostly the Northern part of the country, also recording low levels of vaccine coverage, high prevalence rate of childhood diseases as well as very low probability of child survival. The NDHS, 2013 further suggested that the prevailing rates of childhood morbidity and under-five mortality in Nigeria could be attributed to the years or levels of education especially among women of childbearing age.

Consequently, under-five mortality among children born to mothers with no education which was about (180 deaths per 1,000 live births); is almost twice that of children born to mothers with secondary education (91 deaths per 1,000 live births) and three times that of children born to mothers with more than secondary education (62 deaths per 1,000 live births) (NDHS, 2013). This linkage is traceable to poor healthcare facility utilization, malnutrition in children, low levels of vaccination coverage, unsafe water, poor sanitation and hygiene; which are likely not unconnected to low levels of maternal education. In a study by Anyamele et al. (2017), inequality in child health outcomes exists across the six geopolitical zones in Nigeria with more of the

disadvantaged children coming mostly from the Northern part of the country. In this part of the country, the level of women educational attainment is low when compared with their counterparts from the Southern part (Multiple Indicator Clustery Survey-3, 2017).

It is against this backdrop that this study seeks to examine and analyze the differential effect of maternal education on regional variation in child health outcome in Nigeria, to inform evidence-based vulnerability mapping and intervention planning especially as it concerns the upscale of girl child education equitably within the various geopolitical divides in Nigeria.

II. CONCEPTUALIZATION

The motivation behind the present study derives from the thinking that before a child mortality occurs, such a child probably would pass the stage of falling sick (morbidity) and if the situation is not effectively managed, the chances that it could result to death is invariably increased.

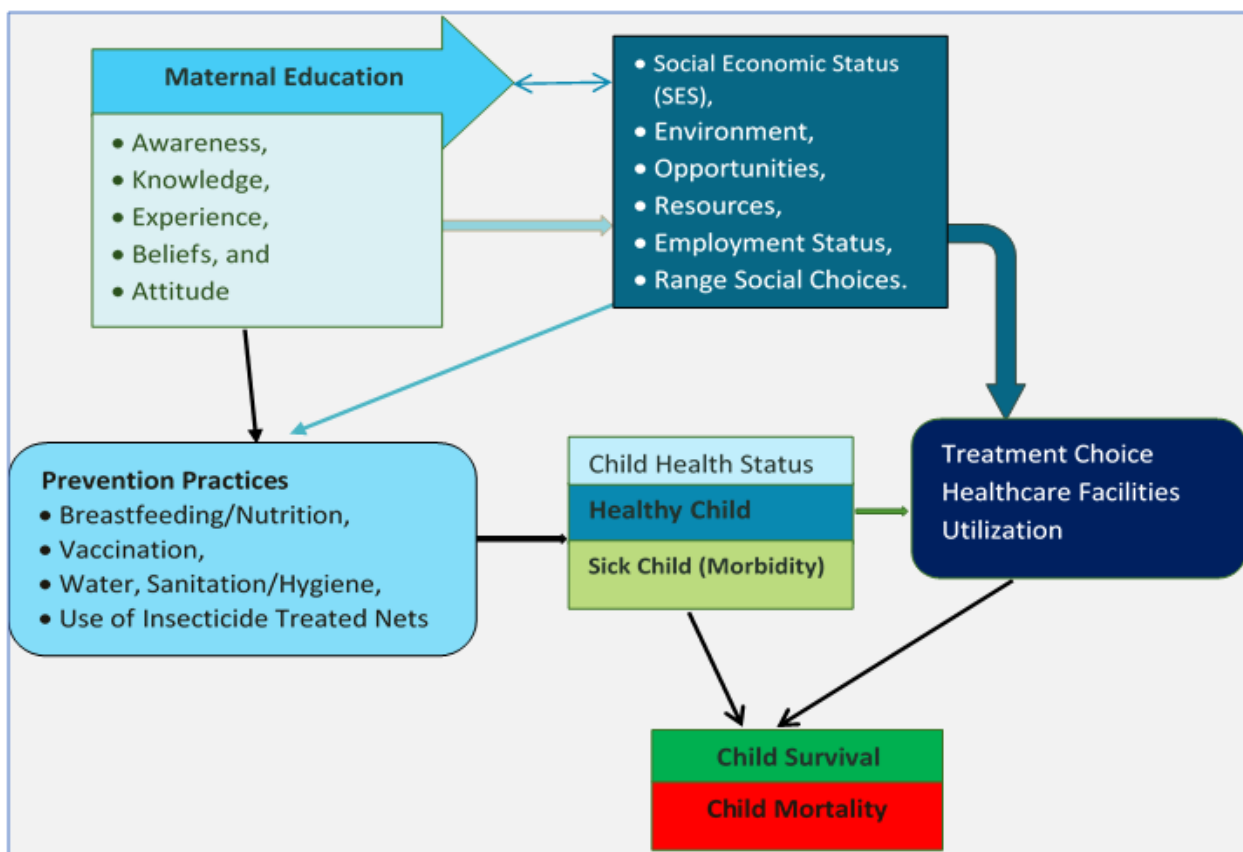


Fig 1 Conceptual Framework

Source: Adapted from Mosley and Chen Model (1984)

This follows the analytical framework used by Grossman, 1972; Caldwell 1979, and Mosley and Chen (1984), which focused on the interactions existing between mother’s education and child health outcomes. As presented below, the study conceptualization suggests that a bidirectional connection exist between maternal education and socio-economic status of women which from evidence has been proved to influence child health and mortality both directly and indirectly.

Intuitively, maternal education increases the experience, knowledge and ability to manage infantile health outcomes by its variable influence on the range of choices open to the child’s mother or parents especially as it pertains to nutrition, water, sanitation & hygiene (WASH), choice of healthcare facilities and services to be adopted, healthcare facility utilization, quality of treatment accessible, openness to vaccination, as well as other environmental conditions that correlate with the social economic status (SES) of the family.

III. DATA AND METHODOLOGY

This study utilized secondary data from the Nigeria Demographic and Health Survey (NDHS) conducted in 2013 having obtained permission from ICF Macro Inc., USA before downloading the datasets. It provided information about women aged 15 – 49 and children of age 0 – 5 years across Nigeria. The information in the sample survey included maternal education and child mortality at the national, geopolitical and state levels across rural and urban settlements. A nationally representative sample of 38,948 women in all selected households and 17,359 men age 15–49 in half of the selected households were interviewed. All women aged 15-49 who were either permanent residents of the households in the 2013 NDHS

sample or visitors present in the households on the night before the survey were equally interviewed.

The 2013 NDHS sample was selected using a stratified three-stage cluster design consisting of 904 clusters, 372 in urban areas and 532 in rural areas while the total number of households interviewed was 40,680, 16,740 from urban areas and 23,940 from rural areas. Specifically, a fixed sample take of 45 households were selected per cluster.

To determine the extent to which zonal disparity in maternal education account for much of the variations in child health outcomes across the six geopolitical zones in Nigeria, we employed a multinomial probit model of the form presented below:

$$UMGZ_i = C + \alpha MyEd_i + \beta + \beta Bs_i + \gamma Wm_i + \varepsilon_i \dots \dots \dots (1)$$

In the above model, $UMGZ_i$ which denotes under-five mortality in each geopolitical zone, is the dependent variable and considering that there are six geopolitical zones in Nigeria, this dependent variable is not binary hence the use of multinomial logit. The model seeks to principally investigate the effect of maternal education and other proximate variables on the level of under-five mortality in each region in Nigeria. The explanatory variables used in the above model include:

MyEd = Maternal Year in Formal Education, Bs = Belief System or Religion, and Wm = Index of Wealth.

The multinomial Logit model is a generalization of the logit model used when there are several possible categories that the dependent variable falls into. The six geopolitical zones in Nigeria which formed the dependent variable as implied in the third objective, are not binary but has six categories which the dependent variable could fall into.

The Multinomial Logit Model is presented below:

$$P(y_i = j) = P(U_{ij} \geq U_{ik} | \chi, \forall K \neq j) = P(\varepsilon_{ik} - \varepsilon_{ij} \leq \chi'_{ij} \beta_k | \chi, \forall K \neq j) \dots \dots \dots (2.1)$$

$$P(y_i = j) = \frac{\exp(\chi'_{ij} \beta_j)}{\sum_k \exp(\chi'_{ik} \beta_k)} \dots \dots \dots (2.2)$$

$$P(y_i = 0) = \frac{1}{1 + \sum_k \exp(\chi'_{ik} \beta_k)}, K = 1, \dots \dots \dots, J \dots \dots \dots (2.3)$$

The multinomial logit model is formed with under-five mortality in each of the six geo-political zones in Nigeria. To present the multinomial logit model in general, we have:

$Y_{ij} = 1$, represents cases of under – 5 mortality in region j , ($j = 0, 1, 2, 3, 4, 5$ and 6)

$Y_{ij} = 0$, if otherwise

Further, let

$$\pi_{ij} = \Pr(Y_{ij} = 1), \text{ where } Pr \text{ stands for probability}$$

Therefore, $\pi_{i0}, \pi_{i1}, \pi_{i2}, \pi_{i3}, \pi_{i4}, \pi_{i5}$, and π_{i6} , represent the probabilities that under-five mortality occurs in region 1, 2, 3, 4, 5 and 6; while π_{i0} , is the probability that under-five mortality did not occur. The dependent variable therefore, is the dummy of the occurrence of under-five mortality in each of the six geo-political zones in Nigeria. Given that this study is employed disaggregated analysis, the effects of maternal education, religion and wealth on under-five mortality in each of the region was individually examined through the application of the multinomial logistic regression.

Therefore, we derive the following estimates of the probabilities for the seven possible outcomes.

$$\pi_{i0} = \frac{1}{1 + e^{\alpha_1 + \beta_1 X_i} + e^{\alpha_2 + \beta_2 X_i} + e^{\alpha_3 + \beta_3 X_i} + e^{\alpha_4 + \beta_4 X_i} + e^{\alpha_5 + \beta_5 X_i} + e^{\alpha_6 + \beta_6 X_i} + e^{\alpha_7 + \beta_7 X_i}} \dots\dots\dots (3.1)$$

$$\pi_{i1} = \frac{e^{\alpha_2 + \beta_2 X_i}}{1 + e^{\alpha_1 + \beta_1 X_i} + e^{\alpha_2 + \beta_2 X_i} + e^{\alpha_3 + \beta_3 X_i} + e^{\alpha_4 + \beta_4 X_i} + e^{\alpha_5 + \beta_5 X_i} + e^{\alpha_6 + \beta_6 X_i} + e^{\alpha_7 + \beta_7 X_i}} \dots\dots\dots (3.2)$$

$$\pi_{i2} = \frac{e^{\alpha_3 + \beta_3 X_i}}{1 + e^{\alpha_1 + \beta_1 X_i} + e^{\alpha_2 + \beta_2 X_i} + e^{\alpha_3 + \beta_3 X_i} + e^{\alpha_4 + \beta_4 X_i} + e^{\alpha_5 + \beta_5 X_i} + e^{\alpha_6 + \beta_6 X_i} + e^{\alpha_7 + \beta_7 X_i}} \dots\dots\dots (3.3)$$

$$\pi_{i3} = \frac{e^{\alpha_4 + \beta_4 X_i}}{1 + e^{\alpha_1 + \beta_1 X_i} + e^{\alpha_2 + \beta_2 X_i} + e^{\alpha_3 + \beta_3 X_i} + e^{\alpha_4 + \beta_4 X_i} + e^{\alpha_5 + \beta_5 X_i} + e^{\alpha_6 + \beta_6 X_i} + e^{\alpha_7 + \beta_7 X_i}} \dots\dots\dots (3.4)$$

$$\pi_{i4} = \frac{e^{\alpha_5 + \beta_5 X_i}}{1 + e^{\alpha_1 + \beta_1 X_i} + e^{\alpha_2 + \beta_2 X_i} + e^{\alpha_3 + \beta_3 X_i} + e^{\alpha_4 + \beta_4 X_i} + e^{\alpha_5 + \beta_5 X_i} + e^{\alpha_6 + \beta_6 X_i} + e^{\alpha_7 + \beta_7 X_i}} \dots\dots\dots (3.5)$$

$$\pi_{i5} = \frac{e^{\alpha_6 + \beta_6 X_i}}{1 + e^{\alpha_1 + \beta_1 X_i} + e^{\alpha_2 + \beta_2 X_i} + e^{\alpha_3 + \beta_3 X_i} + e^{\alpha_4 + \beta_4 X_i} + e^{\alpha_5 + \beta_5 X_i} + e^{\alpha_6 + \beta_6 X_i} + e^{\alpha_7 + \beta_7 X_i}} \dots\dots\dots (3.6)$$

$$\pi_{i6} = \frac{e^{\alpha_7 + \beta_7 X_i}}{1 + e^{\alpha_1 + \beta_1 X_i} + e^{\alpha_2 + \beta_2 X_i} + e^{\alpha_3 + \beta_3 X_i} + e^{\alpha_4 + \beta_4 X_i} + e^{\alpha_5 + \beta_5 X_i} + e^{\alpha_6 + \beta_6 X_i} + e^{\alpha_7 + \beta_7 X_i}} \dots\dots\dots (3.7)$$

Note that in Equations (1.2) through (1.7), we use X to denote the regressors which have been defined above. Although the same regressors appear in each response probability expression, their co-efficient will not necessarily assume the same values. Equations (1.2) through (1.7), which in the form presented above are nonlinear in nature, were converted to linear functions, which define the multinomial logit relative risk ratio. The relative risk ratio in this study gives us the probability that under-five mortality will likely occur in a region when compared with the alternative outcomes, relative to other regions in the country.

below presents the socio-demographic characteristics of the women of child bearing age who constitute the respondents for the study. The distribution shows that only 4.9% of the women attended higher education spending on the average 16 years in formal education while 52.8% of the respondents never attained any formal education; while the remaining 25.5%, and 16.8% attended only primary and secondary education respectively.

The table shows that majority of respondents about 77.1% have Islam as their religious belief, 65.4% of the mother reside in rural areas while 34.6% are urban dwellers. Also, a greater percentage of the respondents, about 65.4%, are from the northern Nigeria, while the remaining 34.6% are from the southern part of the country with the South East having one thousand five hundred and sixty-seven (1567) maternal women representing 8.4% being the least share of women in the sample.

IV. ANALYSIS AND DISCUSSION OF RESULT

In this study, we employed both descriptive statistics and an econometric model to analyze the disaggregated effect of disparity in maternal education on under-five mortality across Nigeria’s six geopolitical zones. Table 1

Table 1 Selected Socio-Demographic Characteristics of Respondents

| Variables and Categories | Number of Observations | Percentages |
|--|------------------------|-------------|
| Age Group (Mother’s Age in Years) | | |
| 15 - 24 | 4735 | 25.5 |
| 25 – 34 | 8768 | 47.2 |
| 35 – 49 | 5060 | 27.3 |
| Maternal Level of Education | | |
| No formal Education | 9809 | 52.8 |
| Primary Education | 4732 | 25.5 |
| Secondary Education | 3114 | 16.8 |
| Higher Education | 908 | 4.9 |
| Place of Residence | | |
| Urban | 6418 | 34.6 |
| Rural | 12145 | 65.4 |
| Geo-Political Zone | | |
| North Central | 2897 | 15.6 |
| North-East | 3631 | 19.56 |
| North-West | 5605 | 30.2 |
| South-East | 1567 | 8.4 |
| South-South | 2341 | 12.6 |
| South-west | 2522 | 13.6 |
| Religious System | | |
| Christian | 4251 | 22.9 |

| Variables and Categories | Number of Observations | Percentages |
|----------------------------------|------------------------|-------------|
| Islam | 14312 | 77.1 |
| Wealth Index | | |
| Poor | 12567 | 67.7 |
| Middle | 4975 | 26.8 |
| Rich | 1021 | 5.5 |
| Sources of Drinking Water | | |
| Improved Water Sources | 10119 | 54.5 |
| Unimproved Water Source | 8444 | 45.5 |
| Use of Mosquito Nets | | |
| Yes | 3972 | 21.4 |
| No | 14591 | 78.6 |
| Handwash Place | | |
| Observe Handwash | 6876 | 37.0 |
| Do not Observe | 11687 | 63.0 |

NDHS, 2013

V. RESULT OF THE MULTINOMIAL LOGIT

Presented in the Table 2 below is the result of the multinomial logit model used to investigate whether zonal disparity in maternal education accounts for the observable inequality in under-five mortality rate in Nigeria. The result from the multinomial logit clearly shows that maternal education to a large extent explains the variation in under-five mortality across the six geopolitical zones in Nigeria. With the base outcome being zero, which represents the absence of under-five mortality in the six geopolitical zone, the result shows that maternal education has varying degree and nature of influence on under-five mortality for the different geopolitical zones in Nigeria.

Table 2 Multinomial Logit Model of Zonal Disparity in Maternal Education and Under-Five Mortality

| Zonal-U5 Mortality | Mlogit1 | | Rrrmlogit1 | |
|----------------------|------------|----------|------------|----------|
| 0 | | | | |
| North Central | | | | |
| mothereduys | -0.000980 | (0.0242) | 0.999 | (0.0242) |
| wealthdummy | -0.336 | (0.237) | 0.714 | (0.169) |
| religion | 0.165 | (0.218) | 1.180 | (0.257) |
| _cons | -4.761*** | (0.136) | | |
| North East | | | | |
| mothereduys | -0.0764*** | (0.0201) | 0.926*** | (0.0186) |
| wealthdummy | -1.275*** | (0.226) | 0.280*** | (0.0633) |
| religion | -0.779*** | (0.178) | 0.459*** | (0.0817) |
| _cons | -3.099*** | (0.0652) | | |
| North West | | | | |
| mothereduys | -0.114*** | (0.0178) | 0.892*** | (0.0159) |
| wealthdummy | -0.715*** | (0.164) | 0.489*** | (0.0804) |
| religion | -2.705*** | (0.282) | 0.0669*** | (0.0188) |
| _cons | -2.393*** | (0.0476) | | |
| South East | | | | |
| mothereduys | 0.00860 | (0.0260) | 1.009 | (0.0263) |
| wealthdummy | -0.494* | (0.237) | 0.610* | (0.145) |
| religion | 3.402*** | (0.529) | 30.03*** | (15.87) |
| _cons | -7.542*** | (0.504) | | |
| South - South | | | | |
| mothereduys | -0.0257 | (0.0260) | 0.975 | (0.0254) |
| wealthdummy | -0.252 | (0.241) | 0.777 | (0.187) |
| religion | 2.549*** | (0.360) | 12.80*** | (4.605) |
| _cons | -6.591*** | (0.321) | | |
| South West | | | | |
| mothereduys | -0.0157 | (0.0257) | 0.984 | (0.0253) |
| wealthdummy | 1.584*** | (0.289) | 4.873*** | (1.409) |
| religion | 0.300 | (0.244) | 1.349 | (0.329) |
| _cons | -6.095*** | (0.234) | | |

| | | | | |
|----------------|---------|--|---------|--|
| N | 16536 | | 16536 | |
| pseudo R2 | 0.094 | | 0.094 | |
| Log-Likelihood | -5895.0 | | -5895.0 | |

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

From panel 1 of table 2, the result of the multinomial model indicates that in the North Central, none of the socio-economic variables significantly influenced under-five mortality rate while in all the regions in the Southern part of the country, maternal education does not account for the existing rate of under-five mortality. This is in line with the findings of other researchers in the field, (Morakinyo 2017, Adewuyi 2017, and Adedini 2013); which strongly suggest that in regions where maternal education is high, the risk of under-five mortality low and vice versa.

Most of these studies found that maternal education functions as a fulcrum that significantly controls the outcomes of the variables that affect under-five mortality. From panel 2 and 3 of table 2, the result shows that in the North - East and North West, if maternal education increases by one unit, the risk of under-five mortality relative to a child not dying; would be expected to decrease by a factor of 0.926 and 0.892 respectively, given that the other variables in the model are held constant.

These two regions are also the regions with the lowest level of maternal education and the findings support the hypotheses that the lower the level of maternal education, the higher the probability of under-five mortality. The result from panel 4 to 6, shows that maternal education does not significantly affect under-five mortality in all the three geopolitical zones in southern Nigeria. This is plausible given that discrimination against women in term of education is quite low in these regions, thus existing levels of under-five mortality could be attributable to factors other than maternal education.

Another critical variable in the model that showed differential effects on influencing the probability of under-five children survival is wealth index. The result suggests that the wealth status of women significantly determines the risk of under-five mortality in the North East, North West, South East and South West.

For instance, the result shows that in the North East, North West regions, if the index of household wealth increases by one unit, the relative risk of under-five mortality occurring relative to it not occurring, decreases by a factor of 0.28 and 0.49 respectively while in the result from the Southern part of the country shows that additional level of family wealth significantly reduces the risk of under-five mortality in the South East by a factor of 0.61 at $p < 0.05$ level of significance while in the South West, an increase in a family's wealth index decreases the risk of under-five deaths relative to survival by a factor of 4.87, given that the other variables in the model are held constant.

VI. CONCLUSION AND POLICY IMPLICATIONS

The findings of this study provide further empirical evidence that maternal education is crucial if Nigeria will achieve the UN SDGs on or before the year 2030. Intuitively, for maternal education to be effective, it must drive the other socio-economic determinants of childhood morbidity and under-five mortality. Also, our findings suggest that maternal education is the bane of the widespread inequality in under-five children health outcome that exist across the six geopolitical zones in Nigeria. Therefore, to curb the menace of under-five mortality, the policy thrust of government should be tailored towards addressing observable imbalances in the opportunity for educating the girl-child across the length and breadth of Nigeria. Based on the findings of the study, the following recommendations are compelling:

This study strongly recommends the promotion of girl-child education especially in regions where the girl-child is at a disadvantageous situation. This could be done through focused advocacy by religious leaders and traditional rulers with government removing the existing blockages to girl-child enrolment and secondary school completion rate. The study further recommends that zonal-specific policy interventions that addresses the peculiarity of the cultural differences are needed to improve child health in Nigeria.

Improving the enrolment of girls in school will have implications on maternal education in future. Otherwise, mothers who have not attended school could be given a window of opportunity through adult education classes. An improvement in the enrolment of the girl child in schools will not only raise the age at marriage and the age at first baby birth of the potential mothers but will also reduce the chances of harmful adolescent pregnancies.

This study examined the role of maternal education in reducing childhood morbidity and under-five mortality in Nigeria. An attempt is also made to investigate whether maternal education significantly explains the regional disparity in under-five mortality in Nigeria. The model result showed that educating the girl child could reduce the risk of under-five mortality provided that such education influences the wealth status of mothers or would-be mothers and moderates the influence of religion in stimulating better decision making and proper care-giving principles which ensures that preventable diseases do not prevail in households and when by chance, childhood morbidity arises, such conditions will not end up claiming the life of such a child.

The findings further suggest that though maternal education plays a dominant role in influencing childhood morbidity and mortality, the coordinate blend of other socio-economic cum environmental variables as well as maternal demographic characteristics such as maternal age at birth, child's age, hygiene/handwash attitude, place of residence, region of residence and wealth index; is crucial for maternal education to be effective.

Furthermore, maternal education cannot supersede the socioeconomic and environmental effect on child health outcomes. Moreover, maternal education lessens its predictive ability as soon as other social determinants are introduced. Therefore, maternal education is a necessary but not the sufficient condition for achieving the level of reduction in under-five mortality required for Nigeria to meet the SDGs targets by 2030.

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