IMPACT OF MATERNAL MORTALITY ON HUMAN CAPITAL DEVELOPMENT IN NORTH WEST NIGERIA

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Abstract
Over the years, maternal mortality has been a disturbing issue affecting the entire sub-Saharan Africa and specifically the Northern part of Nigeria. This paper examined the impact of maternal mortality on human capital development in Northwest Nigeria. The paper employed the binary logistic model using cross-sectional data obtained through a field survey by administering a questionnaire on a sample size of 1383 respondents of which 1250 were returned in the three selected states in Northwest Nigeria with a specific target on women of reproductive age. The result of the logistic model revealed that the loss of sister while pregnant has an adverse and significant impact on human capital development while the relationship between maternal mortality and school attendance has a positive but insignificant effect. The study recommended the need for intervention programs to focus on both medical and socioeconomic factors that cause maternal mortality. Also, there is a need to educate and empower women financially so that they can have the means to go to the healthcare centre when they have to.

Keywords: Cross-Sectional, Human Capital Development, Logistic Model, Maternal Mortality

Jel classification codes: C20, J24, C45, I14

1. Introduction

Evidence is clear that maternal mortality is a threatening monster that is eating deep into the entire economy of the Sub-Saharan African nations out of which Nigeria is not exempted. According to the World Health Organization (WHO, 2019), Sub-Sahara Africa alone accounts for two-thirds of maternal deaths most of which occur in societies with

very limited means and many could have ` been avoided. The risk of a woman dying from reasons associated with maternal issues in low-income countries is about a hundred and thirty times higher than the risk of a woman in countries with income above average level (WHO,2019). The maternal mortality report rate by the Central Intelligence Agency (CIA) indicates that an estimated country comparison ranking of 184 countries showed that Nigeria ranked 4th of which in every 100,000 live births, 917 deaths are recorded. Top on the list are South Sudan, Chad and Sierra Leone with records of 1150, 1140 and 1120 deaths per 100000 live births respectively. Belarus, Italy, Norway and Poland ranked lowest with only 2 deaths each per 100,000 live births. Tunisia and Egypt have the lowest maternal mortality rates of 43 and 37 deaths per 100,000 live births respectively among African countries (CIA,2019). The National Demographic Health Survey (NDHS) 2018 report however indicates that the maternal mortality ratio of the preceding seven years is 512 per 100,000 live births in Nigeria (NDHS, 2018). No doubt, maternal mortality has a great effect on the economy as the death of a woman reduces the workforce (and by implication, the hours of work) of society and at the same time cuts down her role in child welfare and upbringing. In other words, it has an impact on the education and health of a nation. This is evident in a study by Frank and Kovacs (2020), which showed that maternal mortality, has a negative effect on human development. Also, Becker (1995) stated that better health and less mortality induce more investments in education and other forms of human capital since rates of return on these investments are greater when there are more working hours.

Empirical Studies by Toyosi (2020), Osoba and Tella (2017), Anyanwu et al. (2015), and Adelakun (2011) revealed that there is a strong relationship between economic growth and human capital development; a clear indication that if a country or region has poor human capital then it affects the economy of that society from all sectors. Education and health in Northern Nigeria are faced with several challenges ranging from poverty to insufficient educational and healthcare facilities, poor maternal health and by implication; high maternal mortality. The maternal mortality rate in Northern Nigeria is significantly higher than in the southern part of the country as confirmed by Meh et al.(2019) in a study to compare the two zones. Some of the reasons for this difference are that women especially in rural areas in the north sometimes do not give birth at health facilities many do not live close to health centers and the already few centres are facing the challenge of insufficient health workers when compared to the South of Nigeria. (Meh et al., 2019).

Nigeria is considered the giant of Africa in terms of its size and population. A country however cannot become developed without sustained growth and for an economy to grow it needs to have all its sectors functioning well; the health and education sectors are surely very vital in this regard. One of the key areas that indicate the efficiency of the health sector is maternal health and this explains why it was an integral part of the Millennium Development Goals and the good health and well-being in the SDG.

Fisher (1946) emphasized the relevance of education as a tool for the policy of the economy because setbacks are faced when skilled labour is not available in an economy and education improves human efficiency as well as income while Schultz (1961) is of the view that human capital is based on; migration, schooling, health, training on the job

and adult education. Sub-Saharan African population generally and Nigeria specifically has remained high as a result of the high fertility rate and one begins to ask if this is a curse or a blessing because the resources available are already overstretched and the rate of infrastructural development (some of which are the health and educational facilities) is rather too slow. The implication of this is that children are born into a society where they cannot be properly developed and this translates into low human capital development as well as low productivity. Studies have shown that when expenditure on health is high, there is a reduction in maternal mortality; (Akinbode &Sam-Wobo, 2020; Verulava & Dangadze,2018; Nwankwo, 2018). While some other studies have shown that health expenditure does not influence economic growth; Babasanya et al. (2018).

Insufficient budgetary allocation to education and health sectors may have been attributed to reasons for human capital development and maternal health thrives. Over the years, the education and health sectors in Nigeria have gotten budgetary allocations lower than the projected 26% and 15% endorsed by UNESCO and the World Health Organization for education and health respectively. The budgetary allocation to education in Nigeria since 2000 has been 12.5% in 2000, 6.88% in 2001, 6.27% in 2005, 8.56% in 2006, 9.49% in 2007, 10.13% in 2011, 10.48% in 2012, 10.58% in 2013, 11.05% in 2015, 6.01% in 2016, 6% in 2017, 7.04% in 2018, 8.4% in 2019, 5.6% in 2021, 5.4% in 2022 and currently stands at 8.2% (Budget office of the Federation, 2023).

A more disturbing trend is the rates of maternal mortality across African countries, a survey by the United Nations Children's Education Fund (UNICEF) shows that Nigeria is estimated to have about 40 million procreative women within the age range of 15-49 years face health challenges related to birth and a large proportion of these women are in both North East and west of Nigeria (UNICEF, 2018). Previous studies focused on investigating maternal mortality trends, maternal mortality and economic growth or human capital and economic growth and other studies emphasized investigating maternal mortality and human development indices in sub-Saharan Africa. None of the studies investigated the effect maternal mortality could have on the development of the human capital of Nigeria. Hence, a need to investigate the impact of maternal mortality on human capital development with a specific focus on some states in North West Nigeria as the northern region is more adversely affected by higher maternal mortality compared to the southern part of the country. Based on the foregoing, the study is divided into five sections. An introduction was made in the first section, the second section contains the theoretical framework as well as an assessment of literature related to the study. Then likewise, section three discusses the methodology of the work. Section four presents and analyses data and the study is concluded in section five.

2. Review of Relevant Literature

World Health Organization (WHO, 2004), the tenth edition of the International Classification of Diseases (ICD-10) define maternal mortality or maternal death as the death of a woman while pregnant or within 42 days of termination of pregnancy

irrespective of the duration and site of pregnancy from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes. According to Yaukey and Anderson (2001), maternal mortality is the death of females associated with pregnancy, labour and puerperium. On the other hand, Human capital development as viewed by Stiles and Kulvisaechana (2003) is the knowledge, skills and abilities of people as well as the routine of work while maintaining valuable relationships.

Human capital development is an all-embracing effort to improve people's potential as well as create an environment suitable for improving and using the potential. Harbinson (1973), Okojie (2005) and Keeley (2007) all suggested that one of the most significant directions in this modern phase of world economic change is the improvement of the knowledge economy. Presently, peoples' human capital in the form of their skills, learning, talents and attributes has become a source of earning a living as well as a source of broader economic growth globally. Going by this, Human capital is the knowledge, talents, capabilities and attributes found in individuals that enable the formation of a decent well-being. This paper therefore concludes that human capital development is the deliberate effort to improve the intellectual capability of an individual through education and good health so that the individual acquires knowledge that increases efficiency, earnings and subsequently welfare.

The theory of human capital opines that devoting resources to training and education determines what the earnings will be. At the time of investing in education and training, an individual will bear direct costs in the form of tuition as well as forgone earnings because he would not be able to earn much during investment. Psacharopoulos and Woodhall (1997) explain that the establishment of prescribed education is perceived to be an asset, and this according to human capital theorists is considered more important than physical capital.

Schultz (1961) is of the view that investing in capacities is core to development, with emphasis on the significance of education to both self and social development. Schultz introduced the perception of human capital to include categories based on adult education, health, and schooling among others. Contrary to this is the view shared by Becker (1964) as reviewed by Teixeira (2014) in which attention to education is viewed from the context of labour market discrimination. Education is taken as a mechanism to get more competent jobs that offer higher remuneration. Becker's contribution remarkably provided the conceptual and theoretical tools for the development of this concept in research. He defined human capital as the various events that give direction to future financial and intellectual status by growing resources in individuals (Becker 1994). On the human capital theory, Sen (2000) states that wealth is useful because of the things that it allows us to do. When people experience more freedoms in the form of capabilities then human development is achieved. These freedoms, according to Sen (2000), are viewed as the capabilities of individuals to do things that have value to them. The out-of-date focus on living standards, per capita income and possessions was replaced by human welfare from the perspective of life expectancy, education, and health. Related to capability is the concept of 'functioning' which largely refers to being involved in an activity.

On the empirical front, Douthard et al. (2021) studied the Global Context of United States' maternal mortality with a focus on past trends, present state, and plans based on a longitudinal perspective survey and found that maternal mortality is high in the US compared to other high-income countries. Similarly, Frank (2020) conducted a dynamic panel analysis study on maternal health outcomes and economic growth in sub-Saharan Africa using the dynamic ARDL model and the co-integration test showed the presence of a long-run association between the variables. Also, the pooled mean group estimates confirmed an inverse relationship between maternal mortality ratio and economic growth. The study recommends that improving economic growth by investing in the healthcare systems will help lessen maternal mortality in the sub-region. More so, Hall et al (2020) showed that there was a decrease in mortality and lives were saved for each of the 191 countries when government revenue increased in their study on revenue of the government and maternal mortality of 191 countries.

The study by Oduaran and Fasina (2020) used the binary logistic model in their analysis and the results suggested that women who confirmed that lack of adequate transportation and the cost of attending healthcare facilities hindered their ability to seek the assistance of healthcare professionals for the delivery of their babies. They recommend that there should be an implementation of plans or strategies aimed at mobilizing communities to recognize threats and initiate emergency transport systems as well as the introduction of innovative digital health tools.

Frank and Kovacs (2020) studied human development and maternal mortality in sub-Saharan Africa using the dynamic panel data estimation method and the fixed effect (FE) and the system generalized moment method (SGMM) estimation showed a significant negative effect of maternal mortality on human development which was proxied by the HDI in Sub-Saharan Africa. The study recommends that programmes that increase the income status of women, education enrolment for women and also increase funds allocated to the health sector, with a specific focus on maternal health care should be implemented.

A study on socio-economic determinants of maternal mortality in rural communities of Abia State, Southern Nigeria was conducted by Nwadinobi et al. (2020) using both regression analysis and descriptive survey research design and the findings revealed that socioeconomic factors like illiteracy, inaccessible healthcare facility, income and delay in getting maternal care were significant statistically on maternal mortality.

Meh et al. (2019) examined the determinants and levels of maternal mortality in the north and south Nigeria using the multivariable logistic regression model and got results that revealed that maternal mortality was more pronounced in the North when equated to the south as the levels were lower in the south over the years. However, age and community wealth were significantly associated with maternal mortality generally.

With the use of ARIMA methodology, Thabani (2019) investigated maternal deaths in Zimbabwe and the results revealed that in the next decade (2016 – 2025), maternal deaths in Zimbabwe are probably going to rise. The study recommends the need to

increase health sector spending as well as the need to improve maternal health services in Zimbabwe.

A study by Monika (2018) on panel data of maternal mortality determinants of nine south-Asian countries using a random effect reveals that female literacy, female labour force participation and deliveries by skilled health staff all have negative associations with maternal mortality. The study suggests that policy goals must be targeted at improving the accessibility and standard of education as well as the provision of healthcare for women to improve maternal health.

Okonofua et al.(2018) investigated the association of the client-provider ratio with the risk of maternal mortality in referral hospitals in Nigeria and the unadjusted Poisson regression result showed a significant negative relationship between the number of maternal deaths and client-provider ratios. Recommendations made include the need for improvement in the density and quality of maternal healthcare providers to reduce the currently high maternal mortality rate in Nigeria.

Savadogo et al.(2014) used the Cox hazard model to investigate the risk factors of maternal mortality in Burkina Faso. findings confirmed that women above 35 years and below 19, distance to hospital greater than 10 kilometres, fewer antenatal visits, obstetrical maternal mortality direct causes and emergency reference were maternal mortality risk factors.

On the human capital aspects, Kehinde and Temofeh (2020) in a study on human capital and Nigeria's economic growth employed the two-stage least squares approach to estimate human capital and economic growth in Nigeria and the results indicated that school enrolment and life expectancy have a positive and significant effect on Nigeria's economic growth. However, primary school enrolment and average schooling years had no significant effect on economic growth. Recommendations included the need for the government to increase their allocations to education and health at all levels to get the best out of the economy.

Ogundari and Awokuse (2018) studied the contribution of human capital to economic growth in Sub-Saharan Africa and the results of the system generalized method of moments (SGMM) showed that the two measures of human capital have positive effects on economic growth, but the contribution of health is relatively larger than that of education. The study recommended that there should be an enhancement in the education quality of the sub-Sahara Africa region. To further buttress the result of health being more significant, A study in Pakistan by Chaudhry et al. (2010) on the impact of health and education on the income of females using OLS techniques and a log-linear model gave empirical results that education and health have a significant and positive impact on female earnings. Recommendations include that the government should make available to females good educational and healthcare facilities as this will eventually enable them to contribute to the households' earnings and reduce the level of poverty.

The studies so far on maternal mortality and human capital development have mostly concentrated on comparison between nations and between human capital development and other variables respectively. None of the studies so far has focused on the effect

maternal deaths could have on Nigeria's human capital development especially because Nigeria is rated among the countries with maternal mortality rates that are extreme. Nigeria; specifically, the northern region is bedevilled with higher maternal mortality when compared to the southern region and the overall national maternal mortality ratio as given by the NDHS. On methodology, most studies in this area are between countries, the most widely used methodology is the panel data and trend analysis, this may not likely give a clearer picture of the study as investigations of this kind should be on field survey hence the reason for this study.

3.0 Methodology

2.1 Research Design

The research design of this study involved a statistical technique which was used to ascertain the appropriate sample size for the questionnaire distribution while the econometrics technique employed the use of a model based on theory related to human capital to have outcomes that render support theoretical credibility and getting appropriate policy options from the empirical evidence obtained from the study. The binary logistic model was specified to get the appropriate analysis. Post-estimation tests were conducted to ensure that the results were reliable and robust.

2.2 Sources of Data

This study relies on primary data obtained via the administration of questionnaires. A total of four hundred and sixty-one (461) questionnaires for each state were distributed across the three purposely selected states making a total of 1383 in North West Nigeria (Jigawa, Katsina and Kano) healthcare facilities and various households using random sampling to select respondents. The choice of this sample size is to reduce the chances of inaccuracy associated with a small sample size.

2.3 Study Areas

The study focuses on Northwest Nigeria, geographically located in the northern region of the country. It was formed from parts of the old Northern Region. Nigeria's Northwest is one of the country's six geopolitical zones which comprises seven of the country's 36 states of Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto and Zamfara states.

2.4 Research Population

The target population consists of all women of reproductive age in the selected Northwest Nigeria states. To ensure absolute spread, robust and unbiased administration of the questionnaire and considering that the states have very similar characteristics in terms of culture, religion and lifestyle, the population is further stratified into senatorial zones and a local government is randomly selected from each zone from where samples are randomly drawn from healthcare facilities and households. Three local governments were selected out of each state making a total of nine local governments chosen for the study. This guaranteed that residents of both rural and urban areas (especially rural areas) are part of the respondents as the rural dwellers are the most affected by maternal health issues.

2.5 Determination of Sample Size

The data for this study was obtained using questionnaires. Using the Krejcie and Morgan, (1970) table with a deterministic model:

$$S = \frac{X^2\ NP\ (1-P)}{d^2\ (N-1)+X^2\ P(1-P)} \quad \text{- - - - - - -(3.1)}$$

Where: S = Sample size, X^2 = Value of Chi-square N = Population size P=Population proportion d = Degree of accuracy.

Based on this proposition, a minimum sample size of 384 samples is required for a population of one hundred thousand and above using a 95% confidence interval.

2.6 Sampling Procedures Employed

After the recommended sample size using a 95% confidence interval, at least three hundred and eighty-four (384) questionnaires should be distributed across each of the three states (Jigawa, Kano and Katsina states). For this study, however, an attrition rate of 20% was added and this increased the sample size to 461. This is to ensure that after the survey there are sufficient valid returned questionnaires considering the large population. In addition to this, the sample size is supported by Osuagwu, (2020) who recommended a range of 100 to 500 respondents for this kind of study with a large population size. The distribution across the three states was based on the random selection of local government from each senatorial district of the selected states. A total of 1383 questionnaires were distributed across nine local governments of the three selected states through random sampling.

A priori expectation for this study is that maternal mortality has an inverse relationship with human capital development.

2.7 Analytical Framework

Following the model by Lucas (1988) and Romar (1986, 1990) which holds that human capital increases productivity growth, the model is modified as follows taking into consideration the sufficient condition: The function of endogenous growth theory therefore is

$$Y = F\ (A, K, L) \text{----------(3.2)}$$

Where:

Y = aggregate real output. K= stock of capital. L= stock of labour. A = Technology

Logit Model

The dependent variable for this study is based on the binary logit regression then the responses are coded. Adapting the endogenous model, the logistic model is specified as:

$$\boldsymbol{\gamma = \alpha + \beta X + \mu} \text{----------(3.3)}$$

$$\epsilon\left(\frac{I}{x}\right) = \alpha + \beta X + \rho i \quad \textbf{(3.4)}$$

$$\rho = \frac{I}{I} + e - \alpha + \beta X + \mu \quad (3.5)$$

Equation (3.6) is the cumulative distribution function with a probability between 0 and 1 range.

Let Z be $\alpha + \beta X + \mu$ ---------- (3.6)

$P = \frac{1}{1+e^{-}z}$ ---------- (3.7)

$1 - P = 1 - [\frac{1}{1+e^{-}z}]$ ---------- (3.8)

$P=[\frac{1}{1+e^{-}z}] = \frac{ez}{ez+1}$ ---------- (3.9)

$\frac{pi}{1-pi} = e^{z}$ = odd ratio ---------- (3.10)

Since Logit = Log of odd ratio

Therefore, $\text{Log}[\frac{pi}{1-pi}] = \text{Log } e^{z}$ ---------- (3.11)

$\text{Log}[\frac{pi}{1-pi}] = Z \text{ Log } ebut \text{ Log } e = 1$ ---------- (3.12)

Therefore, $\text{Log}[\frac{pi}{1-pi}] = Z$ ---------- (3.13)

$\text{Log}[\frac{pi}{1-pi}] = L = \alpha + \beta X + \mu$ ---------- (3.14)

$\text{Log}[\frac{p}{1-p}] = L = \beta_0 + \beta_1 \text{lsr} + \beta_2 \text{nbl} + \beta_3 \text{mls} + \mu$ ---------- (3.15)

Where:

L= P=1, if maternal mortality has a significant impact on HCD in North West Nigeria: (1-P), if otherwise.

MM = maternal mortality (proxied by lsr, nbl and MLS) denoting loss of sister/relation while pregnant, number of losses and relationship between maternal mortality and school attendance all measured through data collected from administered questionnaire)

Equation (3.15) is the Logit model used in this study because the logit model is appropriate for problems when the response variable is binary has multiple categorical levels, or even when there are multiple independent variables. This also adopts the study of Oduaran and Fasina (2020) who in their study used the model and it was sufficient to establish the facts in their study. Logit Model techniques were used in

estimating the models. All estimations and test statistics were carried out using STATA 14. Package.

4. Results and Discussion

Table 4.1 Summary of Demographic Data

Variable	Obs	Mean	Std.Dev	Min	Max
Age	1250	0.6489435	0.410493	0	2
mrs	1250	2.62447	0.522725	0	5
nbc	1250	4.467621	2.587182	1	4
avr	1250	3.452866	2.754343	3	5

Source: Author's Computation (2023)

Table 4.1 illustrates that for the age distribution, the mean age of respondents is 0.65 which implies a closed proportionate distribution between the age distribution enlisted, the median and mode of the age distribution is however 1 and the standard deviation is 0.4 and close to the mean. For the marital status respondents (mrs), the mean mrs of respondents is 2.6, the standard deviation is 0.52 implying that most of the respondents are married and still married implying that a higher number of those who participated in the questionnaire are still married and not otherwise. For the number of biological children, the mean is 4.47 which implies that a good number of respondents captured for this research are people who have experience of child delivery and have one way or the other given birth to a child at one point or the other. On the whole, it is plausible to say that those who respond to the questionnaire are well-experienced in child delivery. For the average income of respondents, the mean is 3.4529, approximately N35000 (a little above minimum wage) which implies that people do not have many resources to cater for themselves. This may be traced to a lack of means of livelihood that deters most pregnant women from securing proper health care during child delivery.

Table 4.2 Descriptive Statistics

Variable	Obs	Mean	Std. Dev	Min	Max
Los	1250	0.6375785	0.3281262	1	1
Hcd	1250	0.5285621	0.3982413	0	1
Hcfd	1250	0.2345328	3732812	0	1
Hcp	1250	5.193245	2.423221	1	4
hcfp	1250	0.4132146	0.6321372	0	1

	1250	3.46418	2.53942	1	4

Source: Author's Computation (2023)

As seen in Table 4.2, the total number of retrieved and analyzed responses is 1250 in each question category. The average number of respondents, who agree or strongly agree that they have at one time or the other lost a sister/ relation while she was pregnant is about 0.64 or 64% of the total respondents. This value indicates that more healthcare facilities and workers are required for the increasing number of pregnant women in the North West of Nigeria. This to a large extent has deterred safe child delivery. Similarly, the average of human capital development (proxied by educational level) in the North West is about 0.53 or 53%. This is above the threshold of 50% instructing that there are increasing rates of human capital development (proxied by educational level) as people tend to be more educated on the continuous usage of educational facilities. Likewise, the average number of respondents who agree or strongly agree that healthcare facilities are not far from their homes is about 0.24% of the total respondents. This implies that in the North West region covered by this research, it is clear that healthcare facilities are available but the distance in assessing some of these facilities has lent credence to some of them not being in use. This implies that healthcare facility distance is a major reason for the slow pace of human capital development in the selected northwestern region.

Table 4.3: Binary logistic Odds ratio result for maternal mortality and human capital development

Hcd	Odds ratio	Std. Dev	P>(z)
Lsr	-0.21130	0.0110124	0.028
Nbl	-1.30144	0.6113012	0.003
Mls	1.51901	0.0242115	0.001
Cons	0.203112	0.0410115	0.001

Source: Authors Computation, 2023

As seen in Table 4.3, all the parameter (coefficient) estimates are negative except for the relationship between maternal mortality and school attendance (mls). Also, they are all statistically significant. The result conforms with *a priori* expectations that maternal mortality has an inverse relationship with human capital development in the selected North West regions as the increase in the loss of sister while pregnant will cause a decrease in human capital development (hcd) proxied by educational level, this result is theoretically plausible as those sisters who were lost during pregnancy can no longer have a positive impact on human capital development in North West Nigeria. An inverse relationship exists between the level of education and mortality on the other side.

In further self-examination, the variables included for analysis are statistically significant as shown by their corresponding probability values. Each of the coefficients represents the odds ratio of the logit maternal mortality (proxied by loss of sister while pregnant (lsr), number of maternal losses (nbl) in the North Westregion and the relationship between maternal mortality and school attendance (mls) in the North Western region). Concerning lsr, nbl and mls the odds ratios for the logit of human capital development equals 1 in favour of human capital development and decreases by about 0.21, 1.3 and 1.5 respectively when maternal mortality increases.

Table 4.4 Binary Logistic Regression Coefficient for maternal mortality and human capital development

Dependent Variable = hcd

Hcd	Coefficients	Std. Dev	P>(z)
lsr	0.1961004	0.8011245	0.041
nbl	-4.021	0.4110301	0.003
mls	-0.35022	0.451063	0.009
cons	-1.217021	0.2041620	0.000

Source: Authors Computation, 2023

Concerning the impact (marginal effect) of nbl on human capital development as shown in table 4.4, holding everything else constant, a 1 percentage increase in maternal mortality in north west Nigeria will cause human capital development (proxied by educational level) to decrease by about 4.0; with the odds ratio in favour of hcd proxied by educational level. This conforms to a priori expectation as the increase in the loss of sisters during pregnancy will invariably affect human capital development. This is quite circumspect as indicated in theoretical exposition implying that the magnitude of loss of sisters during pregnancy has a telling consequence on human capital development. The findings of this regression output suggest that the loss of sister while pregnant has a significant impact on human capital development in North West Nigeria. The result conforms to the empirical studies of Monika (2018); Meh et al. (2019); Frank and Kovacs (2020).

4.5 Heteroscedasticity Tests

Hcd	Coeff	Std. Err	P>(z)
Lsr	0.2512278	0.0218934	0.290
Nbl	0.2318911	0.3427822	0.118

Mls	0.1398021	0.1367111	0.090
Cons	-0.7231551	0.2041620	0.011

Likelihood-ratio test of lnsigma2=0: chi2(3) = 6.73 Prob > chi2 = 0.0041
Source: Authors computations, 2023

From the result in Table 4.5, the 'hetprob' command was used to test for the presence of heteroscedasticity, the results showed a p-value of 0.0041, which is significant, we, therefore, reject the null hypothesis and concluded that there is heteroscedasticity in the model, it needs to be emphasized that the test does not affect Binary Logistic regression as the model does not have error terms that come from the data sets as the distributions of errors are mainly built into the assumptions of the models itself. (Williams, 2009).

Table 4.6 Goodness of Fit Test

Hosmer-Lemeshow chi-squared result

Logistic model for hcd, goodness-of-fit test

No of obs	Hosmer-Lemeshow	Prob > chi 2
1250	11.21	0.05429

Source: Author's computation 14 (2023)

The Hosmer-Lemeshow chi-squared ('estat' function) shows a chi-square value of 11.21 and the probability value is 0.05429, higher than the 0.05 significant value, the probability value is therefore non-significant as seen in the table above and this implies that the data for the model is fit, the null hypothesis which states that there is the goodness of fit is therefore accepted.

5. Implication of Findings

This result lends support to the evidence of the study by Frank and Kovacs (2020) who found that there exists a reverse relationship between maternal mortality and human development indices. The findings suggest that when there is an increase in the loss of sister, it leads to a decrease in human capital development in Northwest Nigeria. Also, the significant p-value of the number of losses shows that it is a fact that it is high.

6. Conclusion and Recommendations

In line with the investigation of the impact of maternal mortality on human capital development in Northwest Nigeria, along with the findings, the study concludes that numerous maternal mortality factors interact with human capital development in Northwest Nigeria. It was empirically found out that loss of sister (lsr) when she was

pregnant had a significant adverse relationship with educational level in North West Nigeria. As maternal mortality increases, human capital development decreases. Furthermore, the number of loss (nbl) of lives of women who were pregnant was found to have an undesirable and very substantial impact on human capital development in North West Nigeria. This shows that it has a significant relationship with human capital development. The conclusion here is that maternal mortality has an overwhelming effect on human capital development in the North West of the country. This study therefore lends empirical support to the current situation and serves as the basis for intervention by all stakeholders (government and citizens alike). Hence, this critical policy issue requires urgent attention to reverse the situation given the dire consequences it has on society as well as on the economy. The empirical evidence that there is loss of lives of pregnant women stresses the need for policy mechanisms that are aimed towards reducing the causes of these deaths as most of the causes are preventable. This can be done by focusing on both medical and socioeconomic factors that cause maternal mortality. Also, women should be educated and empowered financially so that they can have the means to go to the healthcare centre when they have to. This recommendation is because reducing the loss of lives while pregnant will go a long way in not just preserving the life of the women of reproductive age but also enabling them to improve human capital development for themselves and their children.

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