DOES HEALTHCARE FACILITY DISTANCE HAVE INFLUENCE ON HUMAN CAPITAL DEVELOPMENT? EVIDENCE FROM NORTHWEST NIGERIA

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ABSTRACT
Over the years, the issue of healthcare facility distance has been hampering the growth of Nigeria's human capital, particularly in the country's north. This study looked at how human capital development in North West Nigeria was affected by maternal mortality as measured by the distance to healthcare facilities. Using cross-sectional data from a field survey that involved distributing a questionnaire to a sample of 1383 respondents in three states in North West Nigeria, the study used the binary logistic model with a focus on women of reproductive age. The logistic model's findings showed that while transportation has a positive and considerable impact on human capital development, healthcare facilities that are far from homes and the distance that prevents access to them have a positive but negligible impact. The study recommended the need for provision of feeder roads and means of transport to healthcare facilities in order to enable health seekers get to the healthcare centres promptly. Also, there is need to educate and financially empower women so that they can go to the healthcare center when the need arises

Keywords: Cross Sectional, Human Capital Development, Logistic Model, Healthcare Facility Distance
JEL Codes: C21, J24, C45, I15.

1. INTRODUCTION
In Northern Nigeria, there are several barriers to human capital development, including poverty, a lack of adequate healthcare and educational resources, poor maternal health, and consequently, unfavourable maternal health outcomes. The incidences of maternal deaths in Northern Nigeria are significantly higher than the southern part of the country as confirmed by Meh, Thind, Ryan and Terry (2019) in a study to compare the two zones. Some of the reasons for this difference are that; women especially in northern rural areas are less probable to have their babies at health facilities, many reside distant from health centers and then the already few centers are facing challenge of insufficient health workers and this is not the case when put side by side with the South of Nigeria. (Meh *et al*, 2019).

The study conducted by Sharma, Brown, Kainuwa, Leight and Nyqvist (2017) showed that maternal mortality ratio across Jigawa state is 1,012 maternal deaths per 100,000 live births while Kebbi has an estimated record of maternal mortality ratio of 890 deaths/100,000 live births as at 2006 as revealed by Gulumbe, Alabi, Omisakin and Omoleke (2018). These figures are significantly greater than the average rate of 512 given by the NDHS (2018). The above stated issues therefore make it necessary to identify the likely effects maternal mortality could have on the human capital development of states with such profile and these states fall in the northern region of Nigeria. According to Weil (2014), healthier people learn more in school, are more productive and live longer to accumulate human capital and Becker (1995) is of the opinion that parents are able to care more for their children when they have few of them by spending as much as they can on their education and health.

Indeed, various studies have shown that healthcare facility distance has impact on human capital development across the sub-Sahara Africa of which Nigeria is a member. According to the World Health Organization WHO, 2023, the greater the distance between residence and healthcare facility, the less the likelihood of utilizing healthcare services and this subsequently affects health outcomes especially in low-income settings. It is also pertinent to note that when there is hindered access to both pre-natal and early childcare services as a result of distance, it affects child's physical and cognitive development which has a direct impact on human capital (Adejo et.al, 2024).

Maternal death clearly has a significant impact on the economy since it reduces the number of workers in society (and thus, the number of hours worked) and also diminishes the role that women play in raising and caring for children. Stated differently, it affects a country's human resources. This is evident in a study by Okwan 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 boosts investments in education and health as greater rates of returns are recorded when more hours are put to work. Studies by Habib, et.al, (2024), Momo et.al, (2024), Ibrahim and Ditep (2022), Toyosi (2020), Corden et.al. (2021), Osoba and Tella (2017), Anyanwu, Adam, Obi and Yelwa (2015), Adelakun (2011), revealed that economic growth is positively impacted by the 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.

Given its size, population, and rate of growth, Nigeria is regarded as Africa's behemoth. However, without consistent growth, a nation cannot become developed, and economic progress is contingent upon the performance of all sectors, of which the health and education sectors are unquestionably crucial. Maternal and child health is one of the main indicators of the effectiveness of the health sector, which is why it was one of the main MDGs and was included in the SDG under the heading of "good health and wellbeing." According to estimates from the World Health Organisation (WHO), over 295,000 women died during and after childbirth in 2017, and 69% of all maternal fatalities worldwide occurred in the African region in 2020 which is too high as death while trying to give lives goes beyond health issues, it portrays the standard and level of development of an economy. This study therefore is aimed at investigating the impact healthcare facility distance has on human capital development with focus on the North West Nigeria as the study by Meh, Thind, Ryan and Terry (2019) to compare the two zones showed that health outcomes in the southern part of Nigeria are better than the north as many reside distant from health centers and then the already few centres are faced with the challenge of insufficient health workers. It therefore pertinent to ask if healthcare facilities distance impact on human capital development in North West Nigeria? Following the introductory section, section 2 treats the review of literature. Section 3 presents the methodology of the study. Section 4 presents the data and interpret is, while section 5 presents the conclusion.

2. LITERATURE REVIEW

2.1 Conceptual Literature

According to the World Health Organization (WHO, 2014), 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 stage and site of pregnancy from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes. Similarly, WHO (2019) redefined maternal mortality to wholly agree with the new structure of ICD-11 which replaced the word 'accidental' with 'unintentional' to match with international comparisons. According to this study, , maternal mortality is the death of a female before, during or after

delivery but within two months of end of pregnancy as a result of complications from the pregnancy. Healthcare facility distance on the other hand is how far patients travel to get healthcare. The access to healthcare facility is crucial to overall and maternal health outcomes as one of the factors that contribute to maternal death as given by Thaddeus and Maine (1994) and cited in Ope (2020) is the delay in arriving at the health care facility which is often as a result of distance from home to the facility or as a result of inadequate means of transportation. Distance is considered not only by how far but also travel time as some distances may not be very long but affected by the means of transportation.

Human capital development is the knowledge, skills and abilities of people as well as routine of work while maintaining valuable relationship (Stiles and Kulvisaechana 2003). An all-encompassing endeavour to enhance people's potential and establish an environment conducive to enhancing and utilizing that potential is known as human capital development. Becker (1995) opined that the twentieth century is the phase of human capital in the sense that the key determinant of a country's standard of living depends on its level of accomplishments in developing and utilizing the skills, knowledge, health, and habits of its population. Human capital development is a people-oriented strategy that requires creating platform for participation of people to get involved in the development process and this fundamentally comprise of education and health (Aluko and Aluko, 2012). As opined by Harbinson (1973) he stressed that human capital development is an intentional and continuous process of possessing knowledge. According to this study, the intentional endeavor to enhance a person's intellectual capacity through education and good health in order to gain information that boosts productivity, income, and ultimately welfare is known as human capital development, Joseph and Agada (2024).

2.2 Theoretical Literature

On the basis of theory, the Human Development Theory which became popular because of Amartya Sen's capability approach in 1997. The theory developed as the most influential substitute to standard economic framework for inequality, poverty and human development. In his opinion, resources, income, wealth and utilities are means towards an end for human development, not as ends in themselves. Sen (2000) states that wealth is useful because of the things we do with it. Human development is accomplished when individuals have greater independences or freedoms (capabilities). These substantive freedoms, according to Sen (2000), are viewed as capabilities of individuals to do things that have value to them. Human welfare in terms of life expectancy, education, and health has supplanted the long-standing emphasis on economic factors, goods, and living standards. The idea of functioning, which generally refers to engaging in an activity, is connected to capability. According to Sen (1999), functioning refer to a person's achievement in the effort to do something or to be somebody. Hence, functionings are mental or physical states (beings) and actions (doings) that enable people to engage in their society. These include basic physical states like being healthy, fed, clothed, and protected, avoiding avoidable morbidity and early death, and being literate, as well as the most complex social accomplishments like being happy, participating in community life, having self-respect or being able to appear in public without embarrassment, and engaging in social and political life.

The distance to healthcare facilities directly affects access to health services, which in turn influences health outcomes, especially in rural or underserved areas. Limited access due to long distances can lead to Delayed treatment, higher disease burden, Increased maternal and child mortality, reduced labor productivity. These health impacts depress human capital quality, which weakens the engine of endogenous growth. In view of this, Greater distances to healthcare facilities impair human capital formation (through poor health), which in turn undermines the endogenous mechanisms of long-term economic growth.

2.3 Empirical Review

On the empirical front, Douthard, Martin, McGruder, Langer and Chang (2021) conducted a study within a Global Context of U.S. Maternal Mortality with focus on historical trends, present state, and directions for future based on a longitudinal perspective survey and found out that maternal mortality is high in the US compared to other high-income countries. Recommendations include need for investments to expand the maternity care workforce pipeline, expand healthcare coverage and quality and improvement in research. Similarly, Yaya, Anjorin, and Adedini (2021) studied disparities in maternal deaths across 54 African countries using descriptive analysis and the results revealed significantly low maternal mortality ratio (MMR) but within the vicinity of countries with significantly high MMR. They recommend the need for the continent to refocus its approaches on reducing the high prevalence of MMR with more core attention on causes of social inequalities. Again, Frank (2020) conducted a dynamic panel analysis study on maternal health outcome and economic growth in sub-Saharan Africa using the dynamic ARDL model and the cointegration test showed the existence of a long-run relationship between the variables, also, the long-run result of the pooled mean group estimates confirmed the hypothesis of an inverse relationship between maternal health outcome proxy by maternal mortality ratio and economic growth. The study recommends that improving economic growth by investing in the health care systems will help reduce maternal mortality in the sub-region. Oduaran and Fasina (2020) conducted a multivariate analysis of maternal mortality with implications for community participatory action learning using binary logistic regression and the likelihood ratio statistical test of significance and obtained results that showed that women who confirmed not being able to visit healthcare facility due to lack of transportation coupled with the fact that health facility costs much are less likely to seek the assistance of healthcare professionals for the delivery of their babies. It recommends that there should be implementation of policies and programs aimed at mobilizing communities to identify danger signs and activate emergency transport systems and the introduction of innovative digital health tools. Also, a study on socio economic determinants of maternal mortality in rural communities of Abia State, Southern Nigeria was conducted by Nwadinobi, Chima and Ojobah (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. The study recommended that illiteracy, inaccessible healthcare facility, income of women and delay in getting obstetric care in order to lessen maternal mortality rate in the studied areas, Abia state and the country in general should be addressed. The Retrospective study by Das (2014) on maternal mortality at a teaching hospital of rural India identified that the leading indirect cause of mortality in women were cases not previously booked at the healthcare facility. The study suggests that early referral, quick and well-equipped transport facilities in order to reduce maternal deaths.

For Nigeria, only a handy studies has been dedicated to this area, Akpabio, Angioha, Eguonwu, Awusa and Ndiyo (2020) carried out a study on the risk factors of maternal mortality using descriptive statistics and regression analyses. The results obtained revealed that uncivilized cultural practices as well as poor medical care caused high maternal mortality in Calabar, Southern Nigeria. The study recommends the need for government to establish more primary healthcare centres empower the health centers to effectively collect patient data for solving problems. 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. The study recommended that illiteracy, inaccessible healthcare facility, income of women and delay in getting obstetric care in order to lessen maternal mortality rate in the studied areas, Abia state and the country in general should be addressed. Meh *et al* (2019) examined the determinants and levels of maternal mortality in 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, in general, maternal mortality was highly correlated with age and community affluence. The report suggests implementing innovative tactics to enhance access to health information and services in the South and education for girls in the North.

From the empirical literature reviewed, several issues emanated, these issues formed the basis of the exigent lacuna in the literature. The majority of the evaluated studies on maternal mortality and human capital development have focused on cross-national comparisons. Given that Nigeria is one of the nations with the highest rates of maternal mortality, no research has examined the potential impact of maternal mortality on the development of Nigeria's human capital to yet. Nigeria; in particular, the NDHS's total national maternal mortality ratio shows that maternal death is higher in the northern region than in the southern one. There are no research that concentrate on the economic elements of maternal mortality in Nigeria or the potential impacts that it may have on economic variables; the majority of the studies that have been evaluated thus far are based only on trend analysis.

METHODOLOGY

3.1. Theoretical framework

The distance to healthcare facilities directly affects access to health services, which in turn influences health outcomes, especially in rural or underserved areas. Limited access due to long distances can lead to Delayed treatment, higher disease burden, Increased maternal and child mortality, reduced labor productivity. These health impacts depress human capital quality, which weakens the engine of endogenous growth. In view of this, Greater distances to healthcare facilities impair human capital formation (through poor health), which in turn undermines the endogenous mechanisms of long-term economic growth.

3.2 Model Specification

Based on the model specified by Lucas (1988), Romar (1990) which expresses that human capital development and investment on research and technology leads to growth, the model was adapted with modification. However, the models were specified along the hypotheses stated and in line with Oduaran and Fasina (2020):

$$\text{Log}\left[\frac{p}{1-p}\right] = L = \beta_0 + \beta_1 \text{ HFD} + \mu \text{- -(1)}$$

Where:

L= P=1, if Healthcare facility distance has significant impact on HCD in North-West Nigeria: (1-P), if otherwise. HFD = Healthcare facility distance (Healthcare facilities distance; proxied by health care facility distance from home (hfh), distance hinders the access to health care facility (dah) and means of transportation (mtf). However, the logit model is appropriate for this since all the variables were sourced through field survey. Following the model of 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 endogenous growth theory production function therefore is,

$$Y=F(A, K, L)\text{- - - - - - - --------(2)}$$

Where: Y = aggregate real output, K= stock of capital, L= stock of labour. And A = Technology The logit model is appropriate for problems when the predictor variable is binary or has multiple categorical levels, or even when there are multiple independent variables. It is a different form of multiple regression that has binary response rather than quantitative. Mckelvey and Zavoina (1975) proposed the ordered logit model for the analysis of categorical, ordered, nonquantitative choices, outcomes and responses. Gujarati (1995) demonstrated that the estimated probabilities lie in the 0–1 range and are usually nonlinearly related to the explanatory variables in a binary logit model. However, when the logarithm of the odds ratio is estimated, an initially highly nonlinear model eventually become linear in the parameters. Binary logit regression was used to determine the study's dependent variable, and the answers are coded. As a result, the model was suitable for evaluating and validating the study's hypotheses.

The logit regression was based on logistic model specified as:

$$Y = \alpha + \beta X + \mu \quad (3)$$

$$E\left(\frac{1}{x}\right) = \alpha + \beta X = Pi \quad (4)$$

$$P = \frac{1}{1+e^{-}}\alpha + \beta X + \mu \quad (5)$$

Equation (4 through 5) is the cumulative distribution function and the probability ranges between 0 and 1.

$$\text{Let } Z \text{ be } \alpha + \beta X + \mu \quad (6)$$

$$P = \frac{1}{1+e^{-}}Z \quad (7)$$

$$1 - P = 1 - \left[\frac{1}{1+e^{-}}Z\right] \quad (8)$$

$$P = \left[\frac{1}{1+e^{-}}Z\right] = \frac{ez}{ez+1} \quad (9)$$

$$\frac{pi}{1-pi} = e^{z} = \text{odd ratio} \quad (10)$$

$$\text{Therefore, } Log\left[\frac{pi}{1-pi}\right] = Log\ e^{z} \quad (11)$$

$$Log\left[\frac{pi}{1-pi}\right] = Z\ Log\ e \ \ but\ Log\ e = 1 \quad (12)$$

$$\text{Therefore, } Log\left[\frac{pi}{1-pi}\right] = Z \quad (13)$$

$$Log\left[\frac{pi}{1-pi}\right] = L = \alpha + \beta X + \mu \quad (14)$$

Equation (14) is the Logit model framework used in this study. This as well adopts the study of Oduaran and Fasina (2020) who used the model and it was sufficient to establish fact in their study.

3.3 Nature and Sources of Data

This study relies on primary data. The primary data were 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 (Jigawa, Katsina and Kano) healthcare facilities antenatal clinics and various households using random sampling procedure. The choice of this sample size is to reduce the chances of error which a small size may cause.

3.4 Sample Procedure

Given that the states have a lot of similarities in terms of culture, religion, and way of life, the questionnaire must be administered thoroughly and impartially to guarantee its complete dissemination. Three local governments were therefore selected from each of the three states making a total of nine local governments selected for this study. The Cochran sample size determination (Cochran, 1977) which is suitable when the population size is unknown was used. One of the main reason for the Cochran's formula is that it is one of the most widely recognized and statistically validated methods for determining sample size in survey research. It ensures the sample accurately represents the population with a known margin of error and confidence level.

This was determined by:

$$\boldsymbol{N_0 = \frac{z^2 \times p(1-p)}{e^2}} \text{ - - - - - - - - (15)}$$

Where: N_o = Estimated sample size, Z^2 = Selected level of confidence or critical value of 1.96 for 95% confidence interval, P= proportion (50%), e= margin of error (5%)

When estimated as thus:

$$\boldsymbol{n_0 = \frac{(1.96)^2 \times 0.5(1-0.5)}{(0.05)^2} = 384.16}$$

The minimum sample size is 384. An attrition rate of 20% was added and this increased the sample size to 461 for each state totaling 1383 questionnaires for all the three states. This was done to ensure that after the survey there is sufficient valid returned questionnaires considering the large population. 1250 valid questionnaires were returned and analyzed.

3.5 Estimation and Evaluation Techniques and Procedures

Logit Model techniques was employed in computing the numerical estimates of the constant and coefficient of the variables in the specified models. Binary logistic regression is suitable for investigating the relationship between dichotomous ("yes" or "no", "true" or "false", agree or disagree etc.) response variables (dependent) and categorical or continuous variables (Independent). All estimations and test statistics were carried out using STATA 14. Package. Percentages and Frequency statistics were adopted in analyzing the demographic data of respondents. Bruesh-Pagan (1980) test is a test of a null hypothesis (no heteroscedasticity) against presence of heteroscedasticity of unidentified, general form. By regressing the squared residuals on all potential (nonredundant) cross products of the regressors, an auxiliary regression calculates the test statistic. The choice of this test is because of its reliable and unbiased result, also, it is relatively easy to conduct. In binary logistic regression however, the presence or absence of heteroscedasticity has no effect on the outcome of regression because the model does not have an error term from the data since they are mainly built into the assumptions of the model itself (William 2009).

Goodness of Fit Tests is used to test determines if the observed values match the model. It shows whether the sample group truly represents the entire population. The chi-square test (Hosmer- Lemeshow test) is used in this study to determine whether the null hypothesis that states that there is no goodness of fit is to be accepted or rejected. In other words, the null hypothesis states that the observed and model predicted values have no difference between them. The sensitivity and specificity diagnostic test shows the proportion of correct prediction, as well as the proportion with incorrect prediction. In other words, the test result shows the

overall accuracy rate of responses that establish that respondents agree to the presence of a dependent variable.

3.6 Justification of the Method

The use of Krejci and Morgan, (1970) in determining the sample size is a generally acceptable technique in the selection of participants for the study. The method is accepted partly because of its minimal error acceptability of 0.05 and the confidence interval of 95%. Consideration of addition of 20% attrition rate was to ensure that there is sufficient representative for the population to ensure that results obtained are robust and accurate. This method was used to ascertain that the sample used in the study is a true and fair representative of the population of females of reproductive age in North West Nigeria.

The moderately accurate and succinct questions in the questionnaires used in the study were carefully constructed in order to lessen boredom and weariness on the targeted respondents to avoid getting exhausted and taking too much time and effort in answering the questions. This methodology produced the best responses in terms of originality, objectivity and promptness of response.

4. RESULTS AND DISCUSSION

4.1 Demographic Responses

Table 1: Age Group Distribution of Respondents

Age group	number of respondent	percentage
Less than 15	31	3.0
15-24	163	13.0
25-24	790	63.0
35-44	145	12.0
45-49	66	5.0
50 and above	55	4.0
Total	1250	100

Source: Authors' Computation (2025)

The age group distribution of respondents is analyzed in Table 1, 63% of the respondents are between the ages of 25 to 34 which represents majorly people in a very active age and are youths in North West region, 13.0% of respondents are between the ages of 15 – 24 years, also 12.0% respondents fall within the age group of 35 to 44 years while only 3.0 %, 4.0%, and 5.0% of the respondents are less than 15 years , 50 and above and 45- 49 years respectively. The age range of 25-34 has the highest respondent rate and this portrays the active and independent age range of the population who is majorly youths in their active age and perhaps are newly married. The age range of less than 15 has the lowest respondent rate; this may be justified to the fact that children within this age bracket are still within adolescent stage and hence still majorly indoor under the control of their parents not easily accessible and may not be available to give concrete response to the questionnaire.

Table 2: Marital Status of Respondents

Marital status	number of respondent	percentage
Single	102	8.2
Married	572	45.7
Divorced	390	31.2
Widowed	186	14.9
Total	1250	100

Source: Authors' Computation (2025)

The marital status respondent is presented in Table 2 confirm the status of respondents; this gives further insight on the spread of maternal mortality in the North West regions. However,

what is glaring from the result is that, 102 respondents who represent 8.2% of the total respondents are single; hence they are yet to be married. 572 respondents which represent 45.7% of the total respondents are married which send a more glaring signal to reliable responses from the North West region, this is because the response of these married people will give a better insight on the impact of maternal mortality in the region. 31.2% of the respondents represent the divorced people that is, people who are no longer married or entangled with their married status. This category of people will also give a better insight on what they have experienced during the period when they were still giving birth. Also, this will unmask the extent of maternal mortality in the North Western region as encapsulated in the objective of this research. Similarly, 186 of the respondents who represent the 14.9% of the total respondents indicated people who are widow, these categories of respondents are no longer married but have children. However, their experiences during maternal period and beyond gave an insight to the study.

Table 3: Number of Biological Children

Number of children	number of respondent	percentage
0-1	197	15.76
2-4	895	71.6
5-7	158	12.57
Total	1250	100

Source: Authors' Computation (2025)

As indicated in Table 3, the number of biological children was included in the questionnaire to give an insight into the appropriateness of the number of child delivery, however, it was discovered from the response of the respondent that a total of eight hundred and ninety five respondent have nothing less than two children and not more than four which represent the 72% of the total respondent while a total of one hundred and ninety seven have at least one child which represent 16% of the total respondent and finally one hundred and fifty eighth represent 13% of the total respondent have nothing less than five children and not more than seven. The reason for the higher participation rate of female that have at least number of two to four children could be trace traced to the number of respondent and the age of the respondents. This further gives clue that the respondents are experienced in child delivery and so can give appropriate responses. The number of biological children distribution is presented in appendix 4 using bar chart.

Table 4: Binary Logistic Regression Output

Dependent Variable = hcd

Hcd	odd ratio	std. err	p>(z)
hfh	0.3110481	0.1226669	0.526
dah	0.211621	0.21821	0.110
mtf	3.002100	0.0200311	0.017
cons	0.2103103	0.2171020	0.016

Source: Authors Computation, (2025)

Descriptive Statistics

Table 5: 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	0.3732812	0	1
hcp	1250	5.193245	2.423221	1	4
hcfp	1250	0.4132146	0.6321372	0	1
y	1250	3.46418	2.53942	1	4

Source: Authors' Computation (2025)

Test for Data Reliability

The Cronbach's Alpha reliability and consistency test was used to assess the dependability of the research tools (question items). A scale's internal consistency is measured by Cronbach's Alpha.

According to Ndiyo (2005), items of a scale are internally consistent with each other if their Cronbach's Alpha value is equal to or more than 0.70 and this assures that the constructs/items as evaluation instruments are reliable. There are six questions items (Q1-Q6 where Q1= Have you lost sister or relation while she was pregnant, Q2= Is the healthcare facility (hospital/clinic) far from your home, Q3= does age have a relationship with maternal mortality, Q4= Does income affect access to education facility, Q5= Do you attend health care facilities when pregnant, Q6 Are there enough health care workers in the health care facility you attend on the categorical scale *yes, no*; The results of the Cronbach's Alpha statistics for the question items are presented below:

Table 6: Cronbach Alpha

Test scale = mean (unstandardized items)

Average intem covariance	0.863271
Number of items in the scale	6
Scale reliability coefficient	0.76584

Source: Authors' Computation (2025)

As seen in Table 6, the value of Cronbach's Alpha exceed 0.70. Specifically, the value is 0.863 for all included instruments. This indicates the level of internal consistency among the scales used as instruments to measure each variable represented by Q1-Q6 is very strong. Also notice that removing any one of the question items may produce a low Cronbach's Alpha. Thus, all the items are indispensable and consistent.

Table 7: Binary Logistic Regression Coefficient Output

Dependent Variable = hcd

Hcd	coefficient	std. err	p>(z)
Hfh	-0.0911082	0.1226669	0.292
Dah	2.132261	0.064412	0.033
Mtf	0.2733401	0.0361291	0.016
Cons	-0.4013731	0.3218901	0.028

Source: Authors Computation, (2025)

Keeping the impact of mtf constant, a 1 percent increase in the rate at which distance hinders health care facilities will have a 2.1 percent impact on human capital development (as measured by educational level) in the chosen North West regions. This is in accordance with the effect (or marginal effect) of dah on human capital development as indicated in Table 7, with the odds ratio favouring the respondents in the "agree and strongly agree" category. This conforms to a priori expectation as the availability of closer health care facility will significantly improve the level of human capital development in the selected region. This result is systematically circumspect. Albeit a closer health care facility is expected to enhance educational level on a facial prima. This result is similar to the empirical studies (Oduaran and Fasina, 2020).
Similarly, the coefficient value of about 0.27 for mtf i.e (means of transportation to the facility is easy) implies that with a 1 percentage improvement means of transportation such that it is not cumbersome to assess health care facility in the selected North West states, residents agree and strongly agree response will increases the probability of human capital development (proxied by educational level) in the selected North West region by the same magnitude.

The findings of this regression output suggest that the impact of healthcare facility not far from home and distance hindering access to healthcare (dah) are not significant. Only means of transportation to the facility is easy (mtf) is significant in ensuring improvement in human capital development (education level) in the selected North West region. With this outcome, we accept the null hypothesis that health care facilities distance has no significant impact on human capital development in North West Nigeria.

Table 8: Heteroscedasticity test result

Hcd	coefficients	std.e error	p>(z)
Hfh	-0.0289111	0. 0941235	0.371
Dah	0.3715411	0.3427181	0.372
Mtf	0.0452171	0. 0381351	0.421
Cons	-0.5317512	0.2741321	0.418

Likelihood-ratio test of lnsigma2=0: chi2 (3) = 9.37 Prob > chi2 = 0.062
Source: Authors computations (2025)

The above result shows that the 'hetprob' command was used to test for the presence of heteroscedasticity, the results showed a p-value of 0.062, which is not significant even at 5% level as shown in Table 5.3, therefore the null hypotheses is accepted and conclusion is made that there is no heteroscedasticity in the model, the test however does not have effect on binary logistic regression as the model does not have error terms that comes from the data sets as the

distributions of errors are mainly built in to the assumptions of the models itself. (Williams, 2009).

Table 9: Goodness of Fit Test

Hosmer-Lemeshow chi-squared result

Logistic model for hcd, goodness-of-fit test
(Table collapsed on quantiles of estimated probabilities)

Number of observatiobs	1250
Number of groups	22
Hosman-lemeshow chi2 (8)	13.89
Prob> chi2	0.0612

Source: Authors' Computation (2025)

The goodness of fit test was conducted using the Hosmer-Lemeshow chi-squared (or "estat") function. Table 9 displays a chi square value of 13.89 and a p-value of 0.0612, both of which are greater than the 0.05 significant value. As can be seen in Table 7.2, the p value is therefore non-significant, indicating that the data has a good fit.

Table 10: Classification Table with Sensitivity/Specificity Results

Logistic model for hcd

Agree respondents	684
Correct predicted	371
Accuracy (%)	59.32
Disagree respondents	566
Correctly predicted	325
Accuracy rate (%)	63.41
Overall accuracy (%)	69.23

Source: Authors' Computation (2025)

Table 10 shows that respondents were able to establish that the impact of heath care facilities distance has a telling consequence on human capital development in the selected North Western of the northern Nigeria of which 371 out of 684 respondents that agree was correctly predicted by the model with 59.32% accuracy rate and 566 respondents did not agree with the fact that health care facility distance has an impact on human capital development as the case may be in the selected North Western Nigeria with 325 predicted correctly by the model with accuracy rate of 63.41%. The overall accuracy rate is however 69.23% in establishing the significance of health care facility distance on human capital development in North West Nigeria.

As seen in Table 4, the parameter (coefficient) estimates are statistically insignificant except mtf which is statistically significant. This means that hfh (health care facility not far from home) and dah (distance hinders the access to health care facility) are not capable of influencing human capital development (proxied by educational level) during the time of this investigation. Instructively, this result does not conform to a priori expectations as the increase in the rate at which health care facility is not far from home is expected to generate increase in high rate of educational level as the case may be, this does not support the human capital theory that greater health increases working hours, it is instructive to know that other variables used to capture health care facility distance are statistically insignificant except mtf (means of transportation)

in the model as indicated by their corresponding p-values. Each of the coefficients represents the odds ratio of the logit for health care facility distance in the selected North West region (The healthcare facility in my area is not far from my home, does distance hinder your access to healthcare and is means of transportation to the facility is easy) being predicted by hfh, dah and mtf with respect to the respondents who agree and strongly agree to that proposition against those who disagree, strongly disagree and neutral with that. With respect to hfh and dah, the odds ratios of the logit of health care facility distance in the selected North West region is less than 1 against those who agree and strongly agree (i.e. healthcare facility in my area is not far from my home, distance does not hinder access to healthcare). Means of transportation to the facility is easy is in favour of those who agree and strongly agree. Selected North West region and is correctly predicted.

On Table 5, for every question category, a total of 1250 responses were obtained and examined. About 0.64 percent of respondents, or 64% of the total, agree or strongly agree that they have lost a sister or other relative while she was pregnant at some point. Given the rising number of pregnant women in North West Nigeria, this figure suggests that more medical facilities and personnel are needed. This has mostly discouraged safe childbirth. Similarly, the North West's average human capital development, as measured by educational attainment, is roughly 0.53, or 53%. This is above the threshold of 50% instructing that there is 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 numbers of respondents who agree or strongly agree that health care facilities distance is not far from their homes is about 0.24% of the total respondents. It is implied that while it is obvious that there are healthcare facilities in the North Western area that this study covers, the distance involved in evaluating some of these facilities has given rise to the possibility that some of them are not being used. This suggests that one of the main causes of the sluggish rate of human capital development in the chosen North Western region is the distance between medical facilities.

For the mean values of the independent variables, the results further indicated that the average number of health care personnel available in each facility in the selected North Western region covered during this research is about 5 in each for the period under investigation. Similarly, the average of attending health care facilities while pregnant is about 0.41 or 41% of the respondents. This suggests that though the percentage is below average of 50%, but a good number of women that are pregnant have access to health care facilities while pregnant and the health care facilities are put in to use possibly even though the health care personnel are limited in numbers at every health care unit in the North Western region. Lastly, the result further showed that the average income earned across the study sample per month is about thirty-five thousand naira. (N35, 000) on the average. Incidentally, this is in conformity with earlier result of the summary of the demographic statistics.

Keeping the impact of mtf constant, a 1 percent increase in the rate at which distance hinders health care facilities will have a 2.1 percent impact on human capital development (as measured by educational level) in the chosen North West regions. This is in accordance with the effect (or marginal effect) of dah on human capital development as indicated in Table 7, with the odds ratio favouring the respondents in the "agree and strongly agree" category. This conforms to a priori expectation as the availability of closer health care facility will significantly improve the level of human capital development in the selected region. This result is systematically circumspect. Albeit a closer health care facility is expected to enhance educational level on a facial prima. This result is similar to the empirical studies (Oduaran and Fasina, 2020). Similarly, the coefficient value of about 0.27 for mtf i.e (means of transportation to the facility is easy) implies that with a 1 percentage improvement means of transportation such that it is

not cumbersome to assess health care facility in the selected North West states, residents agree and strongly agree response will increases the probability of human capital development (proxied by educational level) in the selected North West region by the same magnitude.
The findings of this regression output suggest that the impact of healthcare facility not far from home and distance hindering access to healthcare (dah) are not significant. The only convenient way to get to the facility (mtf) is important for improving the development of human capital (level of education) in the chosen North West area. Given this result, we adopt the null hypothesis, according to which the distance between medical facilities has no discernible effect on the development of human capital in North West Nigeria.

5. Conclusion

This research work has examined the impact of maternal mortality on human capital development in North West Nigeria. Empirical findings of the study revealed that there exist a positive but insignificant relationship between two out of the three proxies for healthcare facility distance (healthcare facility not far from home and distance affect access to healthcare facility) and human capital development. Only the third proxy for healthcare facility distance (means of transportation had positive and significant relationship. The weak/insignificant response of healthcare facility distance indicates that distance is not a strong factor that affects educational level; as long as means of transportation is easy, healthcare facilities are accessible. The responses on the effect of age on human capital development is positive and significant as age of getting married and age of woman/sister lost as at the time she died gave positive and significant results, only responses on cause of death had an insignificant value. There is also positive and significant impact of income on human capital development measured by my income has disrupted my ability to access health care facilities and the level of income has effect on access to education facilities in North West Nigeria. Only the average income I earn per month is above 30,000 showed a positive but insignificant impact on human capital development proxied by educational level. Based on the qualitative investigation along with the findings, the study concludes that there are numerous maternal mortality factors that interact with human capital development in North West Nigeria. Although healthcare facility distance empirically showed an insignificant relationship with human capital development, the result obviously disclosed that means of transportation is significant, this therefore calls for the need to recommend that state governments should provide efficient and affordable means of transportation (ambulances, mini buses and tricycles) from various easily accessible points to healthcare facilities. The works departments of local governments should provide accessible feeder roads to make movement easy at least in the short run. While the state government comes up with better roads in the long run.

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