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AN EMPIRICAL ASSESSMENT OF SOCIO-ECONOMIC DETERMINANTS OF MATERNAL MORTALITY: EVIDENCE FROM NORTH-EAST NIGERIA

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Abstract

This study examines the socio-economic determinants of maternal mortality in the North-Eastern region of Nigeria. A survey research design with the aid of structured interview was adopted and the target population are women of reproductive age bracket, and the sample of 384 respondents were drawn from the target population through multistage sampling technique. The data collected was analyzed using both descriptive and inferential statistics in the form of binary logistic regression analysis. The result of the study reveals that education, Age, Traditional, mass media and cost of antenatal care services are statistically significant predictors of maternal mortality in North East sub region of Nigeria. The study recommends that Governments at all levels should allocate more resources to girl child education.

Introduction

Maternal mortality is also known as maternal death, it continues to be the major cause of death among women of reproductive age in many countries and remains a serious public health issue especially in developing countries (World Health Organization, WHO, 2017). The rate includes death during pregnancy, childbirth, or within 42 days of terminal of pregnancy from any cause related or aggravated by the pregnancy or its management, but not from accidental causes. The World Health Organization (WHO,2015) in its article ''make every mother and child count'' defines Maternal mortality as the annual number of female deaths per 100, 000 live births from

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any cause related to or aggravated by pregnancy or its management (excluding accidental or incidental causes). The rate includes death during pregnancy, childbirth, or within 42 days of terminal of pregnancy, irrespective of the duration and site of the pregnancy for specified year. Maternal mortality is used as proxy as indices of development and an indicator to access a country's maternal and productive health status.

Maternal mortality is unacceptably high globally. According to WHO Factsheet (2020), about 287,000 women die globally during pregnancy, childbirth or shortly after given birth. Sadly, almost 95% of the world maternal deaths occur in developing countries and most could have been prevented. Sub-Saharan Africa and Asia accounted for 87% of the global maternal deaths and Sub-Saharan Africa alone accounted for 70% of the world maternal maternity (Sustainable Development Goals, 2020). It was revealed by the findings of Donga and Hamza (2021) that only 1% of maternal mortality case is normally reported for developed countries as against more than 90% of their developing counterpart. Thus, represents the largest discrepancy between developed and developing countries in all the health-related statistics.

Furthermore, the poor maternal mortality indices in Nigeria have remained a serious health problem (National Demographic Health Survey, NDHS, 2018). As evidenced by the literature, Nigerian maternal deaths are among the top six (6) countries in the world that contributed to more than 50% of the world maternal mortality (WHO & United Nations International Children's Emergency Fund, UNICEF, 2023). Nigerian maternal mortality rate (MMR) stands at 512 deaths per 100, 000 live births (National Population Commission, 2020), an estimate which indicate that the problem is responsible for about one third of all the deaths among women of reproductive age. Nigeria is ranked second to India, contributing about 14% of the global maternal mortality. As asserted by Fagbeminiyi and Oduaran (2019), more than 250,000 die yearly during childbirth in Nigeria; which translate to approximately 690 death every day.

In particular, the situation is much worst in Northern part of Nigeria where the MMR is estimated to be 1000 death per 100, 000 live births (NDHS, 2020). This indicates that the Northern part of Nigeria bears the greatest burden of the maternal mortality in the country. Specifically, the regional distribution of the maternal mortality in Nigeria reveals that the North East region had the highest rate of maternal mortality in Nigeria (NDHS, 2020). This is in consistent with the findings of Adedini et al (2019) which also discovered that North Eastern region having the highest burden of maternal deaths in Nigeria. The MMR in the region is estimated as 1000 per 100,000 live births (NDHS, 2018). According to (UNICEF 2018) the average of 1549 women die yearly in North East due high maternal mortality compared to only 165 in the South West region. On top of this, there are urban and rural variations with MMR of 351/100,000 live births in urban areas compared to 828/100,000 in the rural areas. Thus, the region is one of the worst places for women to deliver babies in the world. The tragedy is that these women die not from diseases but

during normal life enhancing process of procreation and most of these deaths are avoidable if preventive measures were taken and adequate care was available.

Despite the volumes of research on maternal mortality in the extant literature, there were few attempt to empirically explore the non-clinical determinants of maternal mortality especially in the north-east sub region, for instance (Hamza and Donga 2021, Kolo et al., 2017), these few studies were able to focus only on one state in addition to neglecting health insurance and mass media exposure as an important determinants of maternal mortality which this current study intends to look at.

Hence the present study fills such a huge research gap exploring empirically socio-economic determinants of maternal mortality in the north east sub region with the help of a primary data that will be collected through interview with the aid of a well-structured Questionnaire which will be analyze by deploying logistic regression. Accordingly, the paper is structured as follows: following this introduction, section two provides literature review, section three dwells on methodology, section four contain results and discussion and finally section five dwells on conclusion and recommendation.

Literature Review

Various attempts have been made in the extant literature to investigate the determinants of maternal mortality and the effects of such determinants on the phenomena of maternal deaths. For instance, Mlambo, Mvuyana and Ntshangase (2023) Investigates the Macro determinants of maternal mortality in southern African Development Community (SADC) states using a panel data from 2005-2019. The study employed the panel estimation technique, Generalized Method of Moment (GMM). The result reveals that GDP, per capita and HIV has positive and significant impact on maternal mortality. Abubakar et al. (2022) examined the socio-economic physical and health related determinants of causes of death among women in the Kitampo District of Ghana from 2005-2014. The data were sourced from Kintampo health and demographic surveillance system (HDSS) using three hierarchical multinomial Logistic regression models. The result in all the three models shows that ever married (RRR, WRA) were significantly less likely to die from infections or NCD than maternal causes, compared to those who were never married. The marital status is a key determinant of causes of death among women. Similarly, Kehinde (2022) provides a robust evidence on socio-economic determinants of maternal mortality in Sub-Saharan African countries using a panel data from 43 selected countries from 1995 to 2015 using a model of generalize method of moment (GMM) in the analysis of data, the result showed strong evidence in support of the impact of per capita health expenditure, fertility rate, female labour force participation rate, female employment, prevalence of HIC/AIDS, life time risk of maternal mortality and education on maternal mortality in Sub-Saharan African Countries. In addition, Adegoke, Mbonigaba and George (2022) investigate the macroeconomic determinants maternal and infant SDG targets in Nigeria using the annual time series data covering the periods from 1995 to

2020. The study employed Auto Regressive Distributive Lag (ARDL) econometric technique for the analysis of data; the result shows a negative significant relationship between the health outcomes and the Macro-economic determinants

Asogwa et-al. (2022) examined the women perception of the causes of maternal mortality in Nsukka South eastern Nigeria. The study adopted qualitative research design using both focus group discussion and in-depth interviews. Two health facilities were used and the participants were married and single mothers aged 18 to 40 years. The result showed that lack of education and exposure and sole reliance on the advice of relatives and other rural women within the immediate environment indirectly contributed to maternal mortality in the area.

Dawson et-al. (2022) examine the social determinants and in equitable maternal and parental outcomes in Aotearoa New Zealand for the periods from 2003 to 2018, using New Zealand Integrated Data Infrastructure. The study employed a Logistic regression to examine the relationship. The result reveals that Asian Women had poorer maternal or Parental outcome compared to New Zealand European/European women. High use of emergency department, Disability and lack of engagement with maternity care had the strongest relationship with poor outcomes. In another study, Donga and Hamza (2021) examines the socio-economic determinants of maternal mortality in Gombe North. The study adopts descriptive cross-sectional survey design with Taro Yamani's statistical formula in selecting the sample size of 400 respondents. The data obtained from questionnaire were analyzed using descriptive and inferential statistics in the form of Binary logistic regression. The study shows that mother's level of education, age of mother, party, traditional belief system, distance to healthcare facility, poverty, poor roads transport system and lack of access to maternal health care services are significant social and economic determinants of maternal mortality in Gombe North. Similarly, Vincent Verr and Iliya (2021) investigate the effect of selected Socio-economic Determinants of health on maternal/child health in Nigeria. The study employed a narrative analysis design to a qualitative documentary study. The study recognized the selected socio-economic health determinants that adversely affect maternal/child health. While good footwear, good dependency on social networks, education in maternal/child health, gender equity and involvement of men in reproductive health activities have been found to be common strategies for addressing maternal health services in Nigeria

Habonimana and Batura (2021) empirically analyzed the socio-economic determinants of maternal health services utilization in Burundi using the data from Burundi Demographic and health survey (DHS) for the periods between 2016 to 2017. The study employed the multivariate regression to analyzed the data. The result reveals that women's health, occupation and marital status have a positive effect on likelihood of utilizing ANC services from trained health professionals.

Woko, Essi and Wegbom (2021) estimate the predictors of maternal mortality in a southern state Hospital management Board, Port Harcourt from January to December,

2019. The study employed the use of Chi-Square and multivariate logistic regression, the result shows that maternal age, educational level place of residence, marital status, delivery outcome, baby weight, ANC attendance and party as the risk factors of maternal mortality in Rivers State. In the same vein, Julian et-al. (2021) investigated the social determinants and ethnic factors associated with a new special distribution of maternal mortality for a city of Colombia from 2000 to 2019. The study employed special correlation including the analysis of univariate, bivariate and multivariate. The study shows that pregnant women belonging to the mixed ethnic backgrounds and spanic while ethnicity from low socio-economic income, Access to education, attendance at pre-natal care and access to health institutions identified as protective factors for maternal mortality.

However, Despite several attempts by scholars to explore the relationship between the selected variables and the rate of maternal mortality, to the best of our knowledge there was no such study that narrowed its focus in x-raying the roles of socio-economic determinants of maternal mortality in the north east sub-region of Nigeria using a survey methodology, therefore this study will fill this research gap by adding to existing literature and knowledge on the subject matter and provide a room for further researches in the area.

Methodology

Study Area and Sampling Procedure

The study was conducted in the North -East Geopolitical zone of Nigeria which comprises of six (6) States namely: Adamawa, Bauchi, Borno, Gombe, Yobe and Taraba. The zone covers close to one third (280.419km^2) of Nigeria's total land area (909,890Km^2). According to the 2022 projection by National Bureau of Statistics the zone has total population of 28,182,695 which represents 13% of Nigeria's population. The zone borders with three countries Republic of Cameroon to the East, Republic of Chad to the North-East as well as Niger republic to the North. The region has the highest rate of maternal and child date due to preventable pregnancy related challenges that had been neglected. The target population of the study are living and deceased women of reproductive age brackets (15-49). A multi-stage sampling procedure was employed for the collection of data and information by interviewing respondents with help of well-designed questionnaire. The first stage involved random sampling of three states (Gombe, Yobe and Taraba) out of the six states that formed the North – East sub region. In the second stage two Local Government Area (LGAs) from each of the selected states was made using simple random sampling technique thus giving a total of six LGAs in the sample. In the third and final stage a random selection of sixty-four (64) women of child bearing age between 15 and 49 years from each Local Government selected giving a total of 384 women respondents as a sample size for the study. Study adopted sisterhood method of Graham etal (1989) procedure of estimating maternal mortality in collecting the data about maternal death. This method relies on sibling history where respondent is asked

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about sisters of the same mother that reached adulthood both living and those that died from pregnancy related causes. This method is adopted in determining maternal mortality because siblings and respondents share similar characteristics (Graham et al, 1989).

Variables and Measurements

Dependent Variable

The study's independent variable is Maternal death measured as a binary outcome YES/NO coded as 0 and 1). Where 1 was assigned to a deceased woman if a respondent indicated "yes" to whether her female sibling died while pregnant, during child birth, or within 2 months of delivery while "No" was assigned when the respondent reported no pregnancy related death of female sibling. The dependent variable was coded as binary; cases of maternal mortality (deceased siblings) were coded as 1 and 0 was assigned to living women (respondents).

Independent Variables

Age. In order to collect data on age as a determinant of maternal mortality, respondents were asked to state their age in years**,** while in the case of deceased sibling respondents were asked about the age of sibling at death. Age in this study is therefore treated as continuous variable.

Education**.** Education as a major determinant of maternal mortality is categorized in this study in to four categories, where 0 = No education, 1 = primary school, 2 = Secondary School and 3 = Higher education. Education as a determinant is expected to reduce the rate of maternal death.

Mass Media Exposure: Exposure to Mass Media was also consider in this study as a determinant of maternal mortality as adopted from (DHS,2018). This was measured by asking respondents questions on how frequent they listen to radio, watch Television and read newspaper. The responses are coded as 0 = Not at all, 1 = once in a week and 3 = almost every day. A media exposure composite index was constructed and range from 0 to 9where 0 was "not at all" on all three forms of media and a score of 9 being "almost every day" response on all 3 media forms. They were categorized as no exposure (0), low exposure (1-3), medium exposure (4-6), and high exposure (7-9).

Traditional belief system**.** Cultural practices of many communities especially rural areas have a strong influence on the rate of maternal mortality, because while pregnant and during delivery women are expected to practices certain cultural norms which prevent them from visiting hospitals for antenatal and postnatal and this increase the likelihood of maternal mortality (Hamza and Donga,2021). Respondents were asked whether they patronized traditional medicine while pregnant, during and after delivery and their responses were recorded as 0= No and Yes = 1.

Cost of Antenatal Care Services**.** The cost of antenatal as an economic factor is also consider as a determinant in this study, this variable is coded as a variable response where

0 = expensive, 1 = Affordable. High cost of antenatal care services is expected to increase maternal mortality rate

Health insurance. Having a health insurance cover can positively influence the use and quality of maternal and neonatal health services, which can in turn improve health outcome for both the mothers and newborn. Health insurance can help increase access to high quality health care, reduce out of pocket cost and improve financial protection. This can encourage the use of preventive and curative services which can reduce mortality (Comfort et al., 2013). In this study health insurance is recorded as a binary response variable 0 = No health insurance cover, 1 = health insurance cover.

Wealth Index**.** A woman's economic status is closely linked to her maternal health outcomes, with those who are less wealthy and marginalized having a higher risk of death. This is because wealth determines a women access to quality health care and influence her ability to make decisions about her health. Wealth index is assessed through individual asset ownership, where women with fewer assets are more likely to have poor health outcomes (United Nations Population Fund,2012). In this study, individuals whose wealth index was poor, or middle were coded as 0. Those who were rich were coded as 1.

Method of Data Analysis and Model Specification

In order to achieve the research objective of determining socio-economic factors that influence maternal mortality in the North-eastern Nigeria, this study adopted Binary Logistic Regression. This method is suitable for this study Since the dependent variable maternal mortality is a dichotomous (binary). The binary logistic regression therefore has the power of estimating the relationship between a dichotomous response variable and a set of explanatory variables /predictors.

The basic form of binary logistic regression model can thus be expressed as

$$P_i\left(Y=\frac{1}{X_i}\right)=f(Z_i)=\frac{e^{\beta_0+\beta_1 X}}{1+e^{\beta_0+\beta_1 X}}. \qquad (1)$$

Where P_i represents the probability of event occurring that ranges between 0 and 1, which in this case refers to the probability of maternal death in the face of exogenous variables (X) considered in this study. e is the base of natural logarithm (2.71828), X is a predictor while β_0 and β_1 are the constant term and slope parameter respectively. For simplicity the model is expressed in odds and log of odds. Odd ratio therefore is the likelihood of recording maternal death (P_i) to the likelihood of not recording maternal death due to pregnancy related causes (1-P_i) therefore

$$e^{Z_i}=\frac{P_i}{1-P_i}=\ln\left(\frac{P_i}{1-P_i}\right)=Z_i \qquad (2)$$

And $Z_i = \beta_0 + \sum_{i=0}^{n}\beta_i X_i + \varepsilon_i$ (3)

Introducing Dichotomous response variable $Y_i = \begin{cases} 1\ if\ Y>0 \\ 0\ otherwise \end{cases}$

Where 1 is recorded for respondent who report sibling's death from pregnancy related

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causes and 0 is recorded when respondent does not report female sibling's death from pregnancy related causes.

The model for this present was adopted and modified from the work of Donga and Hamza (2021) and is specified as

$$\log\left(\frac{\Pr(MMT)}{1-\Pr(MMT)}\right) = \beta_0 + \sum_{i=0}^{n} \beta_i X_i + \mu_i \quad (4)$$

$$\Pr(MMT) = \beta_0 + \beta_1 AGE_i + \beta_2 EDU_i + \beta_3 MME_i + \beta_4 TBS_i + \beta_5 CAC_i + \beta_6 HIS_i + \beta_7 WIX_i + \mu_i \quad (5)$$

Where Pr (MMT) is the probability of maternal mortality occurring, 1-pr (MMT) is the probability of maternal mortality not occurring, while AGE, EDU, MME, TBS, CAC, HIS and WIX are Age of the respondent/Age of deceased female sibling at death, educational attainment of respondents, Mass Media Exposure, Traditional belief System, Cost of Antenatal care, Health Insurance as well as wealth index which are social and economic determinants of maternal mortality considered in this study.

Results and Discussion.

Descriptive Statistics

The table one below summarizes the social, demographic and economic characteristics of the respondents in the study

Table 1: Social, Demographic and Economic Characteristic of Respondents.

Variable	Frequency (384)	Percentage (%)
Age		
15-24	142	37
25-34	129	33.6
35-44	87	22.7
45 and Above	26	6.8
Education		
No education	254	66
Primary	41	10.7
Secondary	75	19.5
Higher	14	3.6
Traditional Belief		
Do not patronize traditional medicine while pregnant	301	78.2
patronize traditional medicine while pregnant	83	21.6
Mass Media Exposure		
No exposure	223	57.9
Low exposure	134	34.8

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Medium exposure	27	7.0
High exposure	0	0
Wealth index		
Poor	327	84.9
Rich	57	14.8
Health Insurance		
Not covered by health insurance	380	98.7
Covered by health insurance	4	1.0
Cost of Antenatal Care		
Expensive	144	37.4
Affordable	240	62.3

Source: Field Survey 2023.

The result from table 1 above indicates that the majority of the respondents are within the range of 15-24 years of age representing 37% of the 384 sampled women, and the least in terms of age among the respondents are those in the age bracket of 45 years and above which are 26 representing only 6.8% of the respondents for this study. Educationally, greater percentage of the respondents are those with no formal education, based on the result 254 out of 384 representing 66% of the respondents are those without formal education, the least of educational attainment are those with higher education who are only 14 out of 384 representing 3.6%. The rest are those with primary and secondary certificates representing 10.7% and 19.5% respectively. On the practice of traditional and customary practices the result shows that majority of the respondents 301 out of 384 which represent 78.2 reported not patronizing traditional medicine during labour and pregnancy, only 83 respondents constituting 21.6% of all the women sampled.

On exposure to mass media majority of the women sampled were not exposed to any of the media (Radio, Newspaper and Television) considered in this study, they represent 78.2% of the total respondents, and this is followed by those with a low and medium exposure which account for 38.4% and 7.0% respectively. While none of the respondents were found to have high exposure to mass media. The result also shows that on the basis of wealth index, out of 384 respondents 327 representing 84.9% were found to be poor and only 57 constituting 14.8% of the sampled women are Rich. On health insurance 98.7% of the respondents are not covered by health insurance and only 1% reported being covered by health insurance. 144 out of the 384 sampled respondents representing 37.4% reported that the cost of Antenatal care is expensive while majority of them (240/62.3%) stated that the cost is affordable

Goodness of fit tests

One of the Goodness of fit test usually applied to logistic regression is Omnibus test. This is which is a likelihood ratio Chi-square test that is applied to investigate the difference

between the current model and the null model/ intercept only model. Under this test the significance value of (P< 0.05) indicates that the current model is better than the null model and it means there is improvement in the model when the independent variables/ predictors are included in the model. The result of the Omnibus test is presented in the table 2 below

Table 2: Omnibus Test

	Chi-Square	df	P-Value
Step	4.174	7	0.000
Step 1 Block	4.174	7	0.000
Model	4.174	7	0 .000

Source: Field Survey, 2023

The result of the Omnibus test in the table 2 above indicates that the P-values of the Chi-square are all less than 0.05 suggesting that in the fitted model, the Odd Ratio of at least one of the predictors/independent variables is statistically significant which means that the model adequately fits the data and it is therefore a significant improvement in fits.
The second Goodness of fits that is considered of paramount importance in logistic regression analysis is Hosmer and Lemeshow test. This is also Chi-square statistics for goodness of fit which help to determine whether the current model adequately describe the data or not. However, contrary to the Omnibus test for the good fit to be achieved under this test, the P-value must be > 0.05, in other words it must be statistically insignificant. The table 3 below presents the result of the test

Table 3: Hosmer and Lemeshow test

Step	Chi-Square	df	P-Value
1	8.114	8	0.422

Source: Field Survey, 2023

The result of the Hosmer and Lemeshow test indicates that the P-value of 0.422 is quite greater than the 0.05 threshold which means that the current model adequately fits the data and therefore has a good fit, by implication there is no significant difference between the model and its observational data.

Model Summary

In order to explore the degree of variation in dependent variable that is explained by the independent variables/predictors in the logistic regression model, the results of the Cox

& Snell and Nagelkerke R-square are considered as equivalent of the coefficient of determination in linear regression model. However, because with categorical outcome Cox & Snell has a theoretical maximum value of less than 1 then Nagelkerke R-square is adopted as adjusted version of Cox & Snell because of its capacity to adjust the scale to cover the full range from 0 to 1.

The result of the model summary containing Cox & Snell and Nagelkerke R-square which captures the variance in dependent variable (Maternal Mortality) that is explained by the independent variables considered in this study.

Table 4: Model Summary

Step	-2log likelihood	Cox & Snell R-square	Nagelkerke R-square
1	335.453	0.098	0.160

Source: Field work ,2023

The result of the Spuedo R-Square in the in the table above shows that Nagelkerke R-square is 0.16. this means that the independent variables/predictors are able to explain the variability of the dependent variable (Maternal Mortality) by 16% while the rest is explained by other variables not included in the current model.

Logistic Regression Coefficient result

The result of the binary logistic regression which captures the effects predictors/ independent variables on the outcome variable (Maternal Mortality) is presented in the 5 below

Table 5: Logistic Regression Coefficients (outcome variable: Maternal Mortality)

Variables	β	S.E.	Wald	D.F.	P-Value	Exp(β)	95% C.I for Exp(β)	
							Lower	Upper
EDU	-0.641	0.214	8.949	1	0.003	0.527	0.346	0.802
AGE	0.042	0.015	8.123	1	0.004	1.043	1.013	1.074
TBS	1.041	0.304	11.699	1	0.001	2.831	1.559	5.139
MED	-0.308	0.117	6.965	1	0.008	1.361	1.082	1.710
HIS	-19.625	23.470	0.000	1	0.999	0.000	0.000	0.000
WIX	0.056	0.433	0.017.	1	0.897	1.058	0.452	2.427
CAC	0.577	0.298	4.009	1	0.045	1.816	1.013	3.256
CNST	-3.4300	0.557	37.928	1	0.000	0.032	0.000	0.000

Source: Field work, 2023

The table 5 above presents the result of logistic regression showing estimates of the effects of predictors of maternal mortality considered in this study. Based on the result

Education, Age, Traditional Belief, Media exposure as well as cost of Antenatal care services were found to be significant predictors of maternal mortality, only Health insurance and wealth index exhibit insignificant effect on the outcome variable (maternal mortality).

The level of education of responds is negative and statistically significant at 1% level in predicting the level of maternal mortality in the North Eastern Nigeria, this implies that as the level of education increases the likelihood of maternal mortality decline, this is in conformity with the findings of Donga and Hamza (2021) and Ibrahim (2016) , this is because educated women are more likely to seek for quality health care services and this improves overall health outcome in general and maternal mortality in particular .In contrast, the age of respondents exhibit a positive and statistically significant impact on the maternal mortality rate at 1% level and this by implication means that the increase in the level of age result in to a higher likelihood of maternal mortality, this result agrees with the findings of Macdorman et al.,(2018) . Traditional belief as a predictor shows a positive and significant influence on the rate of maternal mortality in the studied area, where patronage in traditional medicine while pregnant as well as practicing certain customary and traditional activities related to pregnancy and labour increases the likelihood of maternal death. This is in Line with the results found by Donga & Hamza (2021) and Shamaki and Amriah (2017).

The result also shows that exposure to mass media has a negative and statistically significant effect on the rate of maternal mortality at 1% level of significance, by implication a higher exposure to media reduces the likelihood of maternal mortality in North- East sub region. According to Lee & Mcleod (2020) through their coverage of maternal health issues, mass media such as (Television, Radio and Newspaper) increase knowledge and awareness about risk of maternal mortality, and promote safe motherhood practice such as antenatal care attendance and this result in a decline in the level of maternal mortality. Cost of Antenatal care services is found to have positive and statistically significant effect on maternal mortality at 5% level of significance where a higher cost of antenatal care services increases the likelihood of maternal mortality, this is because a higher cost of such services discourage the poor segment of the society from assessing antenatal care services and this aggravates the level of maternal mortality. This result is corroborated by the findings of the studies conducted by Donga and Hamza (2021). However, Wealth index and Health insurance as predictors of maternal mortality were both found to be statistically significant in predicting maternal mortality in North East sub region of Nigeria.

Conclusion and Recommendation.

On the basis of findings of this current study, it is concluded that respondent's level of education, Age of respondents, traditional belief system, Mass Media exposure and cost of antenatal care services are critical social and economic predictors of maternal mortality

in the North East Sub region of Nigeria. Based on this finding the study recommends that Federal Government of Nigeria as well as states Governments of the North Eastern states on one hand should invest more on especially girl child education and parents on the other hand should endeavor to enroll their children especially girl child to school. Secondly, pregnant women should discourage from practicing traditional and customary activities related to pregnancy and labour and should instead be made to focus more on antenatal and postnatal attendance. The mass media especially radio stations should come up with programmes that educate women especially in the rural areas on the risk of maternal mortality. Finally, states Governments of the North Eastern states of Nigeria should make more budgetary allocations to primary health care and make antenatal care services affordable to women, this is in addition to the need for international development partners to focus more on funding health sector in order to improve maternal health and reduce the level of maternal mortality.

Further Study

This research still has limitation, so there is need to carry out more studies on the socio-economic determinants of maternal mortality, focusing more on rural areas and applying both primary and secondary data, adopting mixed research design in order to improve this research and increase reader's insight.

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Reference.

Abubakari, S. W., Alhassan, N., Adda, R., Asante, P., Bawah, A. A., Watara, S., Alhassan, N., & Adda, R. (2022). determinants of causes of death among women in the Kintampo districts of Ghana public health determinants of causes of death among women in the Kintampo districts of Ghana. Cogent Public Health, 9(1), 1–19. https://doi.org/10.1080/27707571.2022.2109300

Adenine, S., Odimegwu, C., Imasiku, E., Ononokpono, D. &Ibisomi, L. (2015). Regional variations in infant, child and mortanal mortality in Nigeria: A multiple analysis. Journal of Biosocial Sciences, 2(1).

Adegoke, Y. O., Mbonigaba, J., & George, G. (2022). maternal and infant SDG targets in Nigeria : Correlation and predictive modeling. Journal Frontiers in Public Health, 12. https://doi.org/DOI 10.3389/fpubh.2022.999514

Babajide, O.O., Akinyemi, J.O. &Ayeni, O. (2021). Subnational estimates of maternal mortality in Nigeria: Analysis of female sibling's survivorship histories. Journal of Medical Statistics, 6 (4), 200-225

Comfort, A. B., Peterson, L. A., & Hatt, L. E. (2013). Effect of health insurance on the use and provision of maternal health services and maternal and neonatal health outcomes: A systematic review. *Journal of Health, Population and Nutrition*, *31*(4 SUPPL.2).

Dawson, P., Auvray, B., Jaye, C., Gauld, R., & Hay-smith, J. (2022). Social determinants and inequitable maternal and perinatal outcomes in Aotearoa New Zealand. Women's Health, 18, 1–14. https://doi.org/10.1177/17455065221075913

Donga,M. Hamza,Y. (2021). Assessment of Socio-economic Determinants of Maternal Mortality in Nigeria: A Case Study of Gombe North Senatorial District, Gombe State. *International Journal of Economics and Development Policy Policy.*, *4*(1), 119–132.

Fegbeniyi, E. &Oduaran, A. (2019). socio-demographic modelling of maternal mortality with implications for community learning and actions. African Renaissance.201916 (1), 253-272.

Freire, J. A. P., Hernández, M., Castillo, L. A., Ruiz, J. A. H., & Murgueitio, J. A. H. (2021). Social Determinants and Ethnic Factors Associated with a New Spatial Distribution of Maternal Mortality for a City of Colombia (2000-2019). European Journal of Medical and Health Sciences Www.Ejmed.Org, 3(4), 1–5. https://doi.org/DOI: 10.24018/ejmed.2021.3.4.916 Julian

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Graham W, Brass W, Snow RW. Estimating maternal mortality: the sisterhood method. Stud Fam Plan. Population Council. 1989; 20:125

Habonimana, D., & Batura, N. (2021). Empirical analysis of socio-economic determinants of maternal health services utilisation in Burundi. BMC Pregnancy and Childbirth, 21(684), 1–11. https://doi.org/10.1186/s12884-021-04162-0

Ibrahim D., (2016). Socio Economic Determinants of Maternal Mortality I Rural Communities of Oyo State, Nigeria. Journal of Scientific Research Publication, 6(9), 280-285

Kehinde, P.O. & Shaibu, I. (2020). Traditional Pooled data estimates of the socioeconomic determinants of maternal mortality in Suh-Saharan Africa: A case study of SDGs Era. KIU Journal of Social Sciences, 6(3), 55-75

Kolo, M. A., Adamu, Y. M., Chutiyami, M., Mairiga, A. G., & Mshelia, B. S. (2017). *Determinants of Maternal Mortality in North Eastern Nigeria : A Population Based Study*. *24*(10), 1–11. https://doi.org/10.9734/JAMMR/2017/38070

Lee, B., & McLeod, D. M. (2020). Reconceptualizing cognitive media effects theory and research under the judged usability model. *Review of Communication Research*, 8, 17–50. https://doi.org/10.12840/2255-4165.022

Mlambo, C., Mvuyana, B., & Ntshangase, B. (2023). Determinants of Maternal Mortality in Southern Africa : A Macro-Level Analysis. Women, 3, 132–151. https://doi.org/doi.org/10.3390/women3010011

Macdorman, M. F., Declercq, E., Thoma, M. E., Population, M., & Dean, A. (2018). *Trends in Maternal Mortality by Socio-Demographic Characteristics and Cause of Death in 27 States and the District of Columbia*. *129*(5), 811–818. https://doi.org/10.1097/AOG.0000000000001968.Trends

Nsukka, F., Asogwa, U. S., Jemisenia, O. J., & Asogwa, N. U. (2022). Women ' s Perceptions of the Causes of Maternal Mortality : Qualitative Evidence. Journals.Sagepub.Com/Home/Sgo. https://doi.org/10.1177/21582440221079817

National Population Commission and National Demographic Health Survey (2018). Available from: https:/www.dhsprogram.com/pubs/pdf/FR359.pdf

Osemwengie, P. K. (2022). Socio-economic Determinants of Maternal Mortality in Sub-Saharan Africa : Evidence from Generalized Method of Moments (GMM) Approach to Panel Data Analysis. Amity Journal of Management Research, 5(1), 433–448.

Studies, S. (2021). Estimating The Predictors Of Maternal Mortality. African Journal Of Mathematics And Statistics Studies, 4(3), 79–88. Https://Doi.Org/10.52589/Ajmss-Mykbnrb

Shamaki, M., Amriah, B. (2017). Socio Cultural Practices in Maternal Mortality Among Women in Less Developed Economy: An Overview of Sokoto State, Nigeria. *Malaysian Journal of Society and Space, 10*(6), 1-44

Vincent, A. A., Verr, J. B., & Iliya, M. (2021). The Effect of Selected Socio-Economic Determinants of Health on Maternal / Child Health in Nigeria. International Journal Of Multidisciplinary Research And Analysis, 04(01), 1–10. https://doi.org/10.47191/ijmra/v4-i1-01

United Nations International Children's Fund; Training and Sensitization on the high rate of maternal mortality in the North East Region, Nigerian Tribune, February 8, 2018.

World Health Organization Factsheet, Maternal Mortality, Department of making pregnancy safer, 2015

World Health Organization Factsheet (2023). Detail on Maternal Mortality: Worldwide Overview