

IMPACT OF SOCIO ECONOMIC INEQUALITY ON UNDER FIVE MORTALITY

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ABSTRACT

Socioeconomic inequality in health and mortality remains a disturbing reality across nations including Nigeria. Inequality drew renewed attention globally. Nigeria though made impressive progress in health, it makes an interesting case for learning. This paper examined the trends and changing pattern of socioeconomic inequalities in under-five mortality in rural Nigeria. It also examined whether mother's education had any effect in reducing socioeconomic inequalities. The logit model and concentration index were utilized to achieve the set objectives of the research work. Data on under five mortality, household wealth and other socio economic variables were sourced from the Nigeria demographic health survey NDHS 2018. Findings from the estimated models reveal the following: Socio economic variables like household wealth, Mothers level of education, Employment status of mother, household size, place of residence have significant impact on under five mortality in Nigeria. There exist a significant inequality in under five and infant mortality in Nigeria with significant Negative bias towards the poor. The paper recommends that efforts to tackle under five mortality should be holistically addressed and must include increasing literacy rate among women, women empowerment programmes that improve women financial capacity, agency and freedom of choice.

Keywords: Impact, Socio-economic inequality, Under five mortality, Rural Nigeria.

1.1 Introduction

Socioeconomic disparity in health and mortality has been a disturbing reality for our societies irrespective of level of development (World Bank 2017) and Nigeria has not been any exception (World Bank 2017). Though health services including child health care by the public sector are free-of-cost in many settings poor access them in lower proportion compared to better offs for they are also less educated and are known to have cultural and social barriers to access health services. In recent times the inequality in health issues drew renewed attention globally with its explicit mention as development goals in global agenda, such as Millennium Development goals (MDGs) and Sustainable Development Goals (SDGs) (NDHS 2018). Developing nations, like Nigeria, while made significant progress in improving health and lowering level of mortality, inequalities in health and mortality persists (WHO, 2004). Though Nigeria has made progress towards reducing urbanrural and regional inequalities in under-five mortality but socioeconomic inequalities continue to persist (Akpan, 2012). Studies carried out in Matlab, Nigeria, with prospective health and demographic data, revealed that usual health intervention programmes do not reduce poor-rich gap (Eze 2021) but poverty alleviation programme does (UN 2013). Nigeria experience has been important where many poverty alleviation programmes, especially microfinance, targeted to the most disadvantaged

have been implemented with a view to improve socioeconomic condition of the disadvantaged and reduce socioeconomic inequalities. Impact of such development programmes in reducing socioeconomic inequalities has been examined and found to have health inequality reducing effects. Alongside the microfinance programmes, Nigeria also pursued free universal primary education programme with emphasis on girls backed by cash/material incentives for education resulting in sharp rise in female education. Also notable was the expansion of free immunization programme, family planning services, and primary healthcare by the public sector to take services to doorsteps of people, especially in rural areas resulting in near universal immunization coverage, and increased use of contraceptives (NDHS 2018).

1.2 Statement of the problem

Nigeria is a lower middle income country with a population of around 200 million and a per capita income of \$2.230 as of 2019 (WDI 2020). Like many developing countries, Nigeria's health outcome indicators are still unacceptably high, in spite of modest improvements. Communicable diseases still constitute a major public health problem amongst children and adult and Non communicable diseases (NCDs) burden are on the rise. Furthermore, a significant disparity in health status exists across States & geopolitical zones as well as across rural/urban divide, education & social status. (WHO 2017). Poverty is still widespread with an estimated 40% of the population still living below the poverty line of 1.9 dollar per day. Analyses of NDHS 2018/2019 show that, under five mortality declines as we move up the educational ladder (see Fig. 3 below). Higher level of mother's education is associated with lower levels of under-five. For instance, the data further reveals that whereas under five mortality rate is 40 for women without any education the value is 28 for women with more than secondary school education. This is equivalent to a 30% differential attributable to differences in level of education; this thereby supports the assertion that education is a major driver of income and health outcomes (UN 2013).

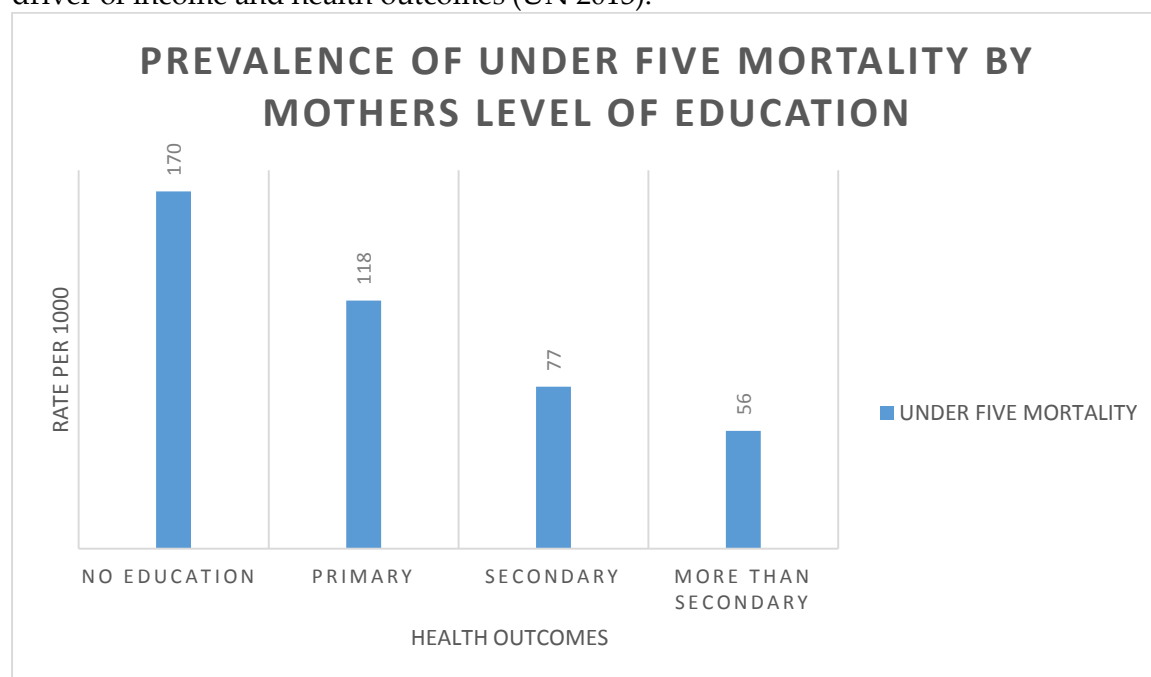


Figure 3: Prevalence of under-five by Mothers level of Education in Nigeria. Author's computation using data from the NDHS 2018/2019

2.0 Conceptual literature

2.1 Child Health outcomes

According to UNICEF, Child health Outcomes are influenced by the many factors that influence health, from the quality of medical care received to the availability of good jobs, Household wealth, Level of education, household size, access to clean water, and affordable housing. These health factors are influenced by programs and policies in place at the local, state, and federal levels. By looking at data related to Health Outcomes, we can get a glimpse at whether health improvement programs in a country are working. Consequently, development experts have continued to dig into the data to understand where and why health outcomes differ across a county, how a variety of health factors combine to influence these outcomes, and how our policies and programs are supporting—or restricting—opportunities for health for all. Health outcomes can be measured from two perspectives length of life and quality of life.

Protecting and improving the health of children is of fundamental importance. According to WHO Over the past several decades, there has been dramatic progress in improving the health and reducing the mortality rate of young children in many parts of the world. However, vast disparities exist around the world in a child's chances of survival, with low- and middle-income countries disproportionately affected. Sub-Saharan Africa has the highest child mortality rate in the world, in some places 15 times higher than in high-income countries. Survival is just one of many issues relevant to children's health. Child health, growth and development are inseparable. In 2016, at least 250 million children were not able to reach their full physical or psychological development. This represents the staggering figure of 43%. Violence against children is also rampant. In 2019, abuse or neglect affected as many as 1 billion children.

2.2 Under-five mortality

Under-five mortality rate refers to the probability of a child dying between birth and exactly 5 years of age, expressed per 1,000 live births. Data from the world development indicator (WDI) 2021 shows that in 2020, 5.0 million children under 5 years of age died. This translates to 13,800 children under the age of 5 dying every day in 2020. Globally, infectious diseases, including pneumonia, diarrhea and malaria, remain a leading cause of under-five deaths, along with preterm birth and intrapartum-related complications.

According to a report by UNICEF in 2021, Children continue to face widespread regional and income disparities in their chances of survival. Sub-Saharan Africa continues to be the region with the highest under-five mortality rate in the world—74 deaths per 1,000 live births. In 2020, 1 in 13 children in sub-Saharan Africa died before reaching their fifth birthday—15 times higher than the risk for children born in high-income countries and 19 years behind the world average, which achieved a 1 in 13 rate by 2001. Disparities in child survival abound at the country level as well, where the risk of dying before age five for a child born in the highest mortality country is about 65 times higher than in the lowest mortality country, and all five countries with mortality rates above 100 deaths per 1,000 live births are in sub-Saharan Africa. If the current trend of under-five mortality continues, Nigeria will not be able of meeting the SDG target of at most 25 deaths per 1000 under five children. This portends grave danger for child health and requires concerted efforts by all to ensure that under five mortality is reduced

to the barest minimum. This study will contribute to this debate by ascertaining the impact of socio economic variables on under five mortality in Nigeria.

3.0 Methods

3.1 Theoretical Framework

The Materialistic model of poverty argues that Poverty exposes people to health hazards. Disadvantaged people are more likely to live in areas where they are exposed to harm such as air-pollution and damp housing. Black (2008) found materialist explanations to be the most important in explaining social class differences in health. There is some specific evidence for materialist explanations. For example, many studies have associated higher rates of childhood respiratory disease with damp housing. The full impact of living standards, however, can only be understood over the course of the life term. While most experts in public health agree that materialist explanations play a role in explaining health inequalities, many find a simple materialist model to be insufficient. In the UK, relatively disadvantaged people receive various kinds of state help (rent, school meals etc) which, some argue, makes diet or poor housing unlikely to account for all inequalities health outcomes. Furthermore, internationally, inequalities in health tend to follow a steady gradient, rather than there being poor outcomes for the most disadvantaged and equally good outcomes for the rest of society

Mathematically, the theory states that:

$$HO = f(x) \quad (1)$$

Where

HO= Health outcomes which for the purpose of this study, we shall focus

X= measures of living standard which includes Level of education, wealth, employment status, place of residence.

3.2 Model specifications

Model for objective one: To capture the objective one, which is to evaluate the impact of socioeconomic variables on infant mortality, the study will estimate a logit model.

The Econometric specification of the Logit model is presented thus:

$$L_i = \ln\left(\frac{P_i}{1-P_i}\right) = \beta_1 + \beta_2\text{moth_hins_any} + \beta_3\text{educ_yrs} + \beta_4\text{wealth_index}_i + \beta_5\text{region}_i + \beta_6\text{rururban} + \beta_7\text{Mothersedu} + \beta_8\text{Sex_hhh} + \beta_9\text{Moth_empl} + \beta_{10}\text{moth_tobc_cig} + \beta_{11}\text{total_kids} + \beta_{11}\text{Electricity} + \mu_i$$

Model for objective two: Objective 2 involves estimating the impact of socio economic variables on under five mortality. Just like in the case of objective one, the study will employ a logistic regression model to capture the impact of socio economic variables on under five mortality in Nigeria.

The Econometric specification of the Logit model is presented thus:

$$L_i = \ln\left(\frac{P_i}{1-P_i}\right) = \beta_1 + \beta_2\text{moth_hins_any} + \beta_3\text{educ_yrs} + \beta_4\text{wealth_index}_i + \beta_5\text{region}_i + \beta_6\text{rururban} + \beta_7\text{Mothersedu} + \beta_8\text{Sex_hhh} + \beta_9\text{Moth_empl} + \beta_{10}\text{moth_tobc_cig} + \beta_{11}\text{total_kids} + \beta_{11}\text{Electricity} + \mu_i \quad (2)$$

Model for objective three and four: To determine the level of inequality in infant and under five mortality across wealth quantile in Nigeria, we use the concentration index popularized by (Kakwani, et al 1997). Formally, the concentration index is defined as

$$C= 1-2\int_0^1 L_h(p)dp \quad (3)$$

The index is bounded between -1 and 1. The convention is that the index takes a negative value when the curve lies above the line of equality, indicating disproportionate concentration of the health variable among the poor, and a positive value when it lies below the line of equality (O' Donnell et al 2012). For computation, a more convenient formula for the concentration index defines it in terms of the covariance between the health variable and the fractional rank in the living standards distribution (Jenkins 1988; Kakwani 1980; Lerman and Yitzhaki 1989),

$$C= \frac{2}{\mu} cov (h, r) \quad (4)$$

Table 1: Description of variables

Li	Natural logarithm
Pi	Probability of Infant mortality (in model one)
Pi	Probability of Under 5 mortality (in model two)
rc_hins_any	A dummy variable that equals one if the respondent have any health insurance and zero otherwise
rc_media_tv	A dummy variable that takes the value 1 if the mother has access to television and zero otherwise
rc_tobc_cig	A dummy variable that takes the value 1 if the mother smokes cigerrate and zero otherwise
Age_hhh	Age of household head
wealth_index _i	Wealth of Respondent household ranked from poorest to richest
region _i	Geographical region of respondent
rural	Place of residence of respondent(rural/urban)
Moth_litr	A dummy variable that equals 1 if the mother is literate and zero otherwise
Total_kids	Total number of kids less than 15 years in the household
Electricity	A dummy variable that equals 1 if the household has electricity and zero otherwise
Sex_hhh	Sex of household head

3.3 Model Justification.

The logit model is a maximum likelihood estimation technique that is employed in estimating models that contains binary or dichotomous dependent variable. By using the cumulative distribution function (CDF), the Logit model ensures that the probability of success lies between 0 and 1 Gujarati (2004). On the other hand, the instrumental variable model was employed to control for endogeneity in the explanatory variable

On the other hand, the concentration index is an appropriate measure of socioeconomic-related health (care) inequality when health (care) is measured on a ratio scale with nonnegative values.. The Concentration Index is invariant to multiplication of the health sector variable of interest by any scalar (Kakwani 1980). Similarly, it does not matter whether health care is analyzed in terms of utilization per month or if monthly data are multiplied by 12 to give yearly figures. However, the concentration index is not invariant to any linear transformation of the variable of interest. Adding a constant to the variable will change the value of the concentration index. In many applications this does not matter because there is no reason to make an additive transformation of the variable of interest.

4.0 Results

4.1 Descriptive Statistics

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
un5 mort	89336	.093	.29	0	1
rctobc cig	10257	.002	.046	0	1
	2				
rchins any	10257	.026	.158	0	1
	2				
rcempl	10257	1.282	.939	0	2
	2				
rcmedi\ a tv	10257	.247	.431	0	1
	2				
rclitr	10257	.444	.497	0	1
	2				
age hhh	10257	44.467	12.018	14	78
	2				
sex hhh	10257	1.131	.337	0	1
	2				
electricity	10257	.578	.824	0	1
	2				
rururban	10257	1.625	.484	1	2
	2				
region	10257	3.345	1.619	1	6
	2				
total kids	10257	4.919	2.785	0	17
	2				
wealth	10257	2.875	1.383	1	5
	2				

The descriptive statistics shows the mean, standard deviation, Minimum and maximum value of the variables used in the study as can be seen from table 4.1 above. Apart from the variables wealth, region, age of household head (Age hhh) and total number of kids in the household,

all other variables used are binary variables that takes on values of either 0 or 1 where 0 represents No or negative and 1 represents yes or positive.

The table indicates that the minimum age for household head is 14 and the maximum is 78. The mean age of household heads in the sample is 44.5 with a standard deviation of 12.05. Again the household with the least kids have zero and the maximum number of kids in any given household is 17. The average number of kids in the household is 5 with a standard deviation of 2.3.

Wealth status is an ordinal variable and is broken into five quintiles (poorest, poorer, middle, rich, richest), with those in the poorest quintile taking on a value of 1 while those in the richest quintile takes the value of 5.

Region is a nominal variable used to capture the six geographical regions in the country. The variable ranges from 1 to 6 representing North central, North east, North west, South east, South South and South West regions respectively.

4.2 Model Estimation and interpretation

Table 3: Variation of Socio economic variables with mortality

	Socio economic variables and under five mortality	
	(1) Logit Model Un5mort	(2) Odd Ratio Un5mort
rc_tobc_cig	-0.403 (0.416)	0.668 (0.278)
rc_hins_any	0.141 (0.102)	1.151 (0.117)
rc_empl	-0.050*** (0.016)	0.951*** (0.016)
rc_media_tv	-0.082* (0.044)	0.921* (0.040)
rc_litr	0.005 (0.036)	1.005 (0.036)
educ_years	0.013*** (0.004)	1.013*** (0.004)
total_kids	0.059*** (0.007)	1.061*** (0.007)
sex_hhh	0.242*** (0.059)	1.274*** (0.076)
age_hhh	-0.016*** (0.002)	0.984*** (0.002)
Poorer	0.029 (0.043)	1.030 (0.044)
Middle	-0.003 (0.051)	0.997 (0.051)

Richer	-0.222*** (0.064)	0.801*** (0.051)
Richest	-0.359*** (0.081)	0.698*** (0.056)
North East	0.145*** (0.053)	1.156*** (0.061)
North west	0.212*** (0.051)	1.236*** (0.063)
South East	-0.072 (0.070)	0.931 (0.065)
South South	-0.269*** (0.076)	0.764*** (0.058)
South West	-0.155** (0.073)	0.856** (0.063)
rururban	-0.147*** (0.042)	0.864*** (0.036)
electricity	-0.005 (0.024)	0.995 (0.024)
Constant	-2.739*** (0.098)	0.065*** (0.006)
Observations	89,336	89,336

Authors' computation using stata 16. Data from NDHS 2018 . Asterisk means *** p<0.01, ** p<0.05, * p<0.1.

4.4 Socio economic variables and under five mortality

Estimated Logit models indicates that the wealth status of a household is a major determinant of under-five mortality in Nigeria as described in table 4.2. Children born into the richest household have a lower chance of dying before their fifth birthday compared to those born in the poorest household. from figure 4.2, the Logit model describe that children born in the richest home tend to have mortality. Specifically the log odd in favor of under-five mortality for children born into households in the top two wealth quintile is -0.222 and -0.356 lower compared to children born in the poorest households. The impact is also statistically significant indicating that household wealth is a major determinant of under-five mortality in Nigeria. One possible reason for this finding is that wealthy households are able to afford adequate nutrition and healthcare to children born into their households at any given time. This in turn, improves child's chances of survival. This finding is line with the findings of Hosseinpoor et al (2006) who concluded that, socio economic factors like wealth has significant impact on child mortality rates.

From the plot, ot can be observed that living in the urban area reduces the log odds in favor of under-five mortality compared to living in the rural area. The impact is also statistically significant at the five percent level. The odds in favor of under-five mortality decreases by a factor of 0.864 compare to children born in the rural area. Again, the odds in favor of under-five mortality is lower for children born to mothers who are employed compared to children born to women who are not in the labor force , the odds in favor of under-five mortality is

lower by about 0.951 for children born to gainfully employed women. Reasons for this is that employed women tend to be more educated, have financial freedom and more income compared to those who are employed. With more income, they have access to quality health services for their children which in turn reduces infant mortality.

In terms of regional differentials in under five mortality in Nigeria, the plot from the study established that there is a statistically significant difference in under five mortality in the South Eastern and South Southern regions compared to the North central region. The odd in favor of under-five mortality is about 0.856, 0.76 and 0.93 lower in the South West, and South South. And South East respectively compared to the benchmark region which is the North central region. For the North West the odds in favor of under-five mortality is higher by a factor of 1.236 compared to the benchmark category. The difference is also statistically significant indicating that there are regional disparities in under five mortality in Nigeria.

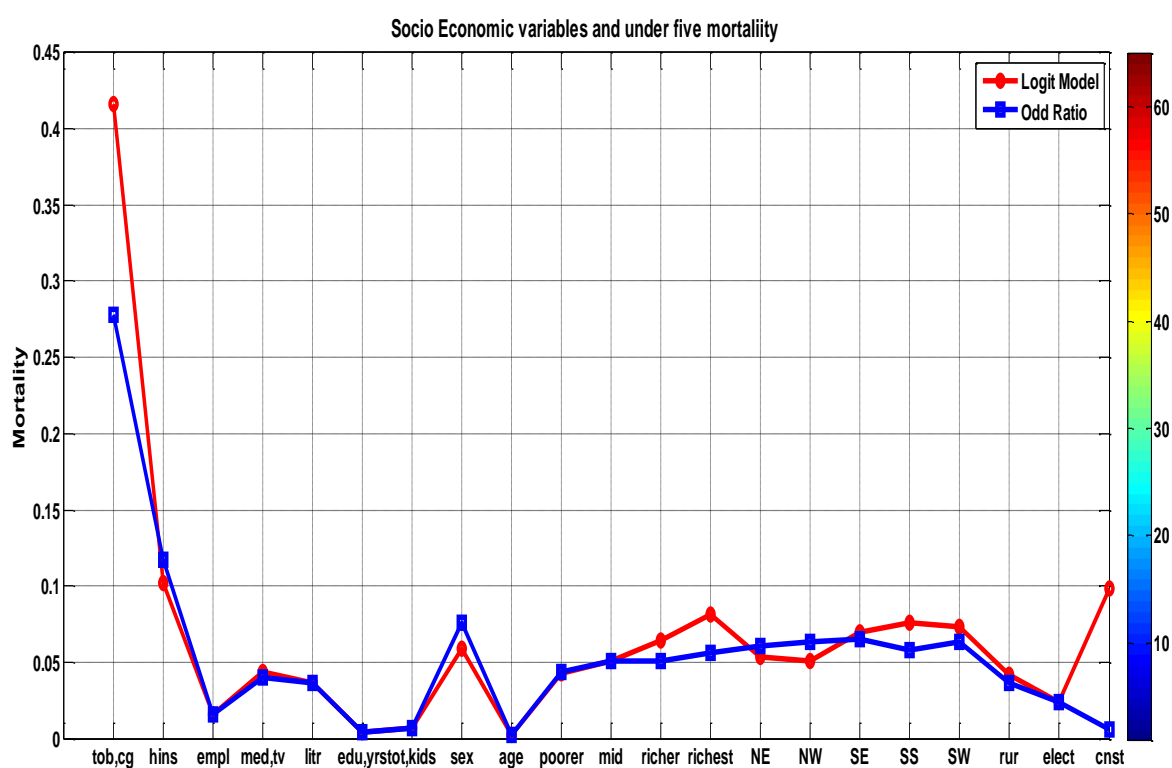


Figure 4.2: plot showing the impact of economic variable on under 5 mortality

On the sex aspect, the study also found that number of children and sex of household head increases the chances of under-five mortality as can be seen from the plot. For instance the estimated Logit model indicate that increasing the number of children by 1 increases the log odds of infant mortality by 0.043 with an odd ratio of 1.044. This finding is also in line with a priori economic expectations. As the total number of kids increases, the overall resources available for every kid in the household decreases leading to insufficient resources for medical care and nutrition. This may worsen child health outcomes and worsen household health.

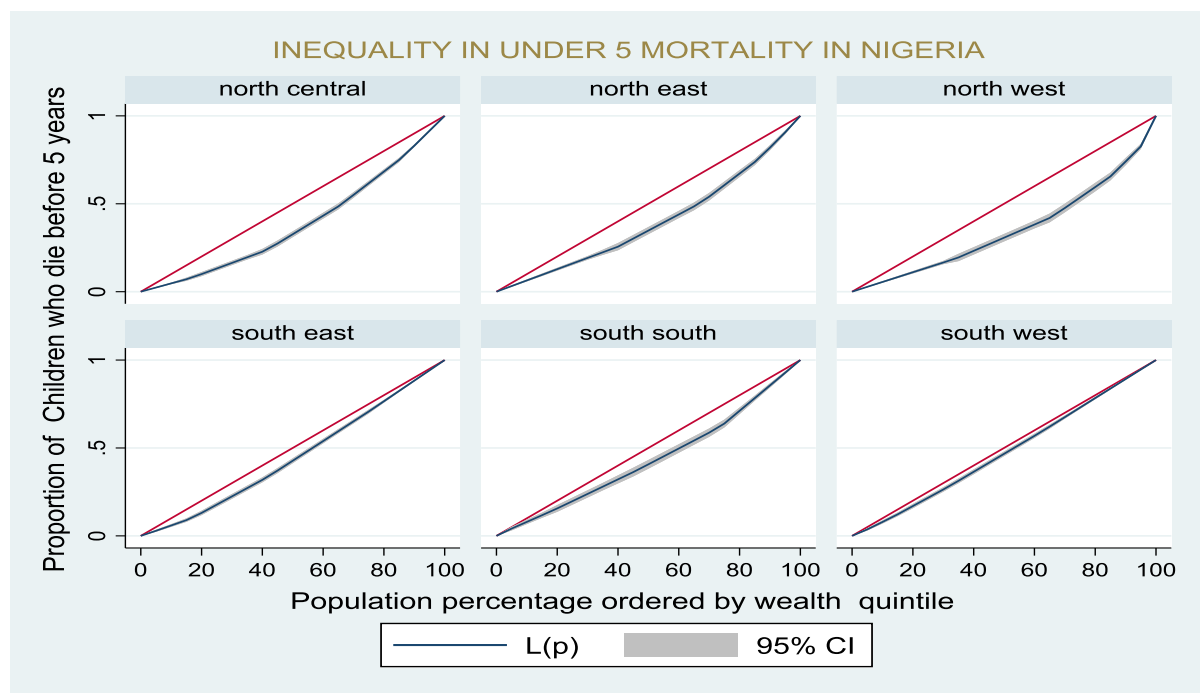
Furthermore, having electricity or access to media and television reduces the log odds of under-five mortality although both are not statistically insignificant at the 5% level indicating that they are not a major determinant of under-five mortality in Nigeria.

4.3.2 Inequality in under-five mortality

The study also sought to ascertain the extent of the inequality in under-five mortality across wealth quintiles in Nigeria. Using specific stata codes (see O'Donnell et al (2008) designed for this estimation, the study established that the concentration index for the inequality is -0.1773 (see appendix). Similar to the case of infant mortality, the negative value of the concentration index indicate that the health outcome is more prevalent among the poor households compared to the richer one in Nigeria. The impact is also statistically significant indicating that the incidence of under-five mortality is skewed against poorer households.

One possible reason for this inequality is that, deprivations in health is highly correlated with the ability of people to meet basic needs like healthcare and adequate nutrition that ensures health growth and development. On the other hand, most poor people are uneducated, reside in rural areas with little or no resources to cater for the health needs of children, this in turn leads to poor health outcome for children in the household.

Studies like Aluko (2017) corroborated this finding indicating the prevalence of inequality in under five mortality in Nigeria. A geographical aggregation by regions;



The closer the curve is to the straight line, the lesser the inequality while the wider the curve is to the straight line, the more the inequality.

4.5 Evaluation of research hypothesis

Ho: There is no statistically significant impact of socio economic variables on under five mortality in Nigeria

H1: Comparatively, from the estimated binary logistic regression model also in table 4.3, the study found that socioeconomic variables (mother’s employment, literacy level, age, total

number of kids, wealth, sex of household head and region of residence) has significant impact on under five mortality. All the variables have P values less than 0.05.

Ho: There is no statistically significant inequality in under five mortality in Nigeria

H1; Evidence from the concentration index indicate that there is a statistically significant inequality in under five mortality in Nigeria

5.0 Conclusion

The study examined the relationship between socio economic variables and child health outcomes in Nigeria as well the extent of inequality in child health outcomes in Nigeria. Using a maximum likelihood estimator and the concentration index the study analyzed the relationship between selected socio economic variables and selected child health outcomes in Nigeria. Data for the analysis was sourced from the Nigerian Demographic and health survey data NDHS 2018.

The study also established that household wealth, geographical region of household, employment status of mother, mother's literacy level, sex of household head, and age of household and availability of health insurance significantly reduces the log odds of under-five mortality in Nigeria

Furthermore, the study established that number of children in the household, poverty and living in the northern part of the country increases the odd in favor of under-five mortality. The study also found evidence of significant inequality in under five mortality, also the study established the presence of significant inequality in under five mortality in Nigeria. Findings from our estimation indicate that under five mortality is skewed towards the poor.

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