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## Socioeconomic Manager's Inequalities and Under-Five Mortality in Nasarawa State

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By

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**N** **Abstract** *in the world. These mortality rates are unequally experienced both across the igeria is among the countries with the highest burden of under-five mortality states and among different socioeconomic households. However, despite*

*the large number of studies associating socioeconomic status and child mortality rate, socioeconomic pathways are not largely explored in Nigeria. This paper therefore, seeks to examine the causal relationship between parents' socioeconomic inequalities and child mortality in Nasarawa State. Primary data was collected from 480 women with children between the ages of five and zero. Multi-stage sampling technique was used to select respondents in six local government of Nasarawa State, two from each senatorial district. Pearson Chi-square was used for data description, while univariate and multivariate probit regressions were used for data analysis. Findings from this paper revealed that increased level of education and been in paid employment reduces the risk of under-five mortality among mothers in Nasarawa State. Estimation of causal pathway through which socioeconomic factors affect child mortality shows that education influence child mortality in Nasarawa State through use of modern toilet facility and practice of exclusive breastfeeding. The study also indicate that fathers' socioeconomic inequalities is not a determinant of child mortality in Nasarawa State. The study recommends empowerment that will enhance girl child education enrolment and awareness campaigns to increase knowledge about child health care prevention.*

**Key Words:** Socioeconomic Status, Child mortality, Child health, Intermediary determinants, individual characteristics

## 1.0 Introduction

Under-five mortality is a common indicator of child health worldwide. It is a topic of interest across most developing countries due to the high rate of under-five death. Although, the world under-five mortality rate substantial decreased to 60% between 2000 and 2017, the rates remained unacceptably high and are distributed unequally across the globe (UNICEF-WHO-World Bank Group-UNIGME, 2018). For instance, 2.5 million under-five children died from common child diseases in 2017 alone, accounting for 85% of the total children and young adolescents' death (UNICEFWHO-World Bank Group-UNIGME, 2018). The report also added that globally, SubSahara Africa has the highest number of under-five mortality rate recording an average of 76 deaths per 1,000 live birth which is 20 times that of Australia and New Zealand. The figures across countries also shows that Nigeria alongside India has the highest number of under-five mortality with 56.0-116.4 deaths per 1,000 live births (Chao, You, Perderson, Hug and Alkema, 2018). While, within country distribution shows that Nasarawa State is among the nine northern states that accounted for the highest burden of under-five mortality rate in Nigeria (National Bureau of Statistics (NBS) and United Nations Children's Fund, 2018).

The derive to reduce under-mortality has attracted programs to include Sustainable

Development Goal (SDG) aimed to reduce under-five mortality rate to 25 deaths per 1,000 live births by 2030 (United Nations, 2015). Also, Saving One Million Lives Program for Result (SOML PforR) aimed at reducing the estimated annual 900,000 maternal and child death resulting from common and preventable diseases in Nigeria (SOML PFORR, 2017). The persistence rate of under-five mortality in Nasarawa State and Nigeria indicates that essential services and program intervention clearly are not reaching most of the targeted population who needed it most.

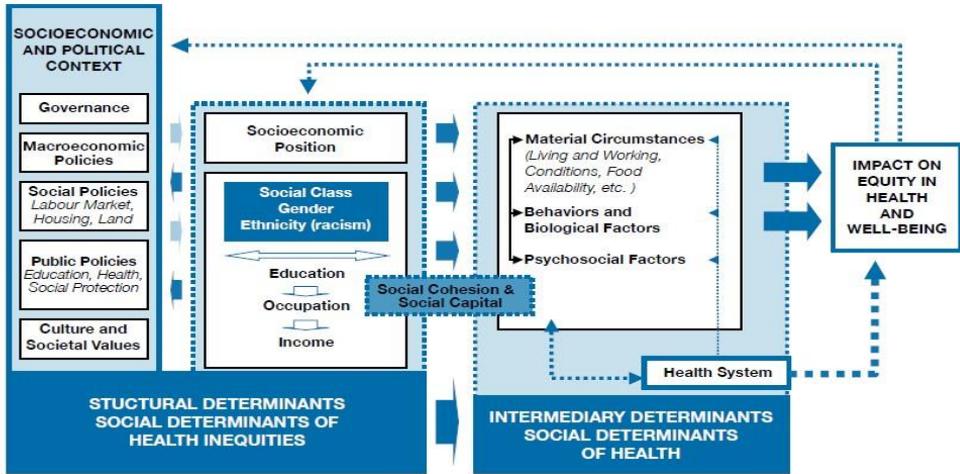
Link and Phelan (1995) reported that the important non clinical factor that explained ill health and mortality rate is socioeconomic status (money, knowledge and power) which either increases or reduces the consequence of ill health. Ibalaoro (2012) clearly stated that children socioeconomic status depends on their parents' level of education, family income and place of residence. These socioeconomic inequalities among parents tend to explained the unequal rate of child mortality among households. As reported by Anyamele, Akanegbu and Ukawuilulu (2015), that children from richer and educated parents tend to enjoy better health and low risk of death. The intuition is that educated parent have more knowledge about child health care prevention and richer parents can afford quality health care for their children. The challenge therefore, is to understand the role of socioeconomic factors in explaining inequalities in under-five mortality. This study seeks to differ from most researches that study socioeconomic factors as having a direct (structural) effect on under-five mortality rate without specifying the pathway mechanisms. This paper will study socioeconomic factors as structural factors that affect under-five mortality through some mechanisms known as underlying factors. This is understandable because been poor or illiterate alone does not kill a child but may lead to inability to afford quality health care, living in poor sanitized environment and having poor knowledge about child prevention which places a child at risk of death. This will provide clear policy direction to reduce child mortality. It is against this backdrop that this paper seeks to examine the relationship between socioeconomic variables and inequalities in under-five mortality rate in Nasarawa State.

## **2.0 Literature Review and Theoretical Framework**

### **2.1 Conceptual Review**

The Commission on Social Determination of Health (CSDH) was set up by World Health Organization (WHO) to uncover evidences on how the structure of societies through myriad social and economic interventions, institutions and norms affect population health (Solar and Irwin, 2010). This work led to the development of a conceptual framework to help understand the determinants and pathways through which social and economic factors explain health inequalities.

Figure 1 contain two major factors (structural and intermediary determinants) that explain child health inequalities. The conceptual framework highlights how socioeconomic and political context lead to composition of socioeconomic position that classify people according to their education, occupation, income and ethnicity. Figure 1



Source: Adopted from Solar and Irwin, 2010

The intermediary determinants through which socioeconomic factors affect health includes biological factors which include nutrition and other harmful consumption habit; psychosocial circumstance include stressful living condition and relationships. While, health system constitutes the issue of access to child health quality care in invent of illness which is consequential to child survival and adult health. The explanatory variable for this study will be constructed based on the structural and intermediary determinants.

## 2.2 Theoretical Review

The theory of family as producer of health is an extended Grossman model by Jacobson (2000). Jacobson (2000) commented that Grossman theory of health capital form the basis of explaining the relationship between socioeconomic status and health. Grossman (1972) explained that individual level of health is determine by the amount of investment in medical services and consumption habit which are also product of socioeconomic factors.

Jacobson (2000) reported that though Grossman theory provide valuable

contributions to explain individuals' health related behaviours and differences in health level, it can only be used to analyze adult health not child health. Jacobson (2000) therefore extended Grossman model to include family as producer of health, implying that parents not only produce their own health but the health of other family members using health levels as output and available family resources as input. This available household resources needed for child health production include family wealth, amount of market goods consumed by household and total family income. In a simplified form, the family as producer of health is represented by the model below:

$$H_c = f(y^t, z^t)$$

Where,  $H_c$  represent child health level which is a function of household gross investment in child health ( $y^t$ ) and other socioeconomic factors that affect child health ( $z^t$ ). The variables of this model will be modified using the concept of CSDH framework to suite data analysis for this research work.

### 2.3 Empirical Review

Literature will be reviewed base on the structural and intermediary factors that influence child mortality rate. The structural factors (socioeconomic factors) include education, occupation, income and place of residence. While, the intermediary determinants include biological/ nutritional factors (breastfeeding habit of mothers); psychosocial factors (housing/living condition) and health system (access to child healthcare).

#### 2.3.1 Structural Determinants

In the quest to establish the relationship between child mortality and socioeconomic status, several studies have reported conflicting result including direction of association. Some of these studies are reviewed below:

Biradar, Patel and Prasad (2019) studied effect of birth interval and wealth on under 5 child mortality in Nigeria, using Bi-variate and Cox Regression to analyze Nigerian Demographic and Health Survey (NDHS) 2013. The study reported that the prevalence of under-5 mortality was higher among illiterate and poor mothers and mothers' working as professionals and Agriculturalists. Similar result was reported by Malderen, Oyen and Speybroeck (2013) who studied the contributing determinants of overall and wealth related inequality in under-5 mortality in 13

African countries. The study used NDHS 2008 and analyzed by multivariate logistic regression. The reason behind this findings is that increased wealth provide opportunity to access quality care, increased level of education provides child health care knowledge while, high paying occupations are product of education and provides more wealth.

Fayehun, Majekodunmi and Ayinmoro (2019) examine maternal education and under-five mortality among urban poor in Nigeria. Nigeria Multiple Indicator Cluster Survey (MICS) 2016/2017 was analyzed using logistic regression as method of analysis. The result from this study is somehow different by emphasizing mothers' education as major determinants of under-five mortality rate in Nigeria. This study agrees with the findings of Samuel and Oni (2017) who studied the changing levels and patterns of under-five mortality using data from NDHS 2003-2013 and descriptive approach for analysis; and Kingsley, Charlie and Chidi (2017). Kingsley et al (2017) investigated the socioeconomic determinants of under-five children health outcome among child bearing mothers in Abia State using logistic regression on primary data collected from 609 women. This result is also different by reporting negative relationship between mothers' occupation and under-5 mortality. The intuition behind mothers' education was based on the fact that mothers are closer to their children and higher level of educations provide basic knowledge on child health care prevention.

In contrast, Antai (2011) investigated regional inequalities in under-5 mortality in Nigeria, using multilevel cox proportional hazards to analyzed NDHS 2003 data. Under-5 mortality was found to be higher in the south-south of the country and communities with lower access to child health care. Using combine data for NDHS 2003 and 2008 analyzed by logistic, Anyamele, Akanegbu, Assad and Ukawuilulus found higher prevalence of under-5 mortality in the northwest, north east zone and generally among rural areas of the country. Reason been that communities with regional disadvantage in terms quality care, prevalence of diseases, poor infrastructural facilities and poor environmental condition are at risk of child mortality.

### *2.3.2 Intermediary Determinants*

Bello and Joseph (2014) examine determinants of child mortality in Oyo State using logistic regression to analyzed data from randomly selected 150 respondents from Atibal Local Government. The result reported mode of breastfeeding and postnatal care to determine child mortality. Akinyemi, Bamgboye and Ayeni (2015) studied trends in neonatal mortality in Nigeria and effects of bio-demographic and maternal characteristics. Result analyzed from NDHS 2003-2013 using cox regression shows

that hospital delivery and birth interval are important determinants of child mortality. While, Samuel and Oni (2017) studied changing levels and patterns of under-5 mortality using descriptive approach to analyze NDHS data for 2003-2013 reported sources of drinking water and immunization as major determinants of under-5 mortality.

The reviewed literatures reported different structural and intermediary factors as separate determinants of under-five mortality using both country level and community level data. This study seeks to differ by analyzing socioeconomic factors as structural determinants of under-5 mortality and also to investigate the mechanisms through which these socioeconomic factors affect child health.

### 3.0 Methodology

This research paper employs cross-sectional design. This design is appropriate for the study because it is a survey design that seeks to measure the differences between variety of people at a particular point and sample size are selected based on existing differences in the population. 480 women with children between the ages of 0 and 5 were systematically selected through multi-stage sampling technique across the 3 senatorial districts of Nasarawa State. Information about child individual characteristics, parents' socioeconomic status, parents' demographic factors and incident of child mortality were gathered from the respondents. The multi-stage procedure for sample selection is stated below:

**Stage 1:** Two Local Government areas (LGAs) were randomly selected from each senatorial district of Nasarawa State, making a total of 6 LGAs selected.

**Stage 2:** The LGAs headquarters were purposively selected to form urban areas where, one community each was randomly selected outside the LGAs to represent rural communities based on ecological factors.

**Stage 3:** General hospitals were purposively selected from each LGA while, one private hospital was also selected randomly. This is to allow fair selection of both lower and higher socioeconomic mothers either seeking care for their children or immunization. The study discovers that each of the rural communities selected had Primary Health Centers and it was used as point of data collection.

**Stage 4:** Convenient sampling technique was used to locate mothers at health centers who are willing to avail themselves for data collection.

There was high response rate because questionnaires were administered through faceface interview. All respondents read through the research consent form and gave their informed consent. The respondents participated voluntarily and were assured of confidentiality for information given.

The sample size for this study was calculated using a standard formula since the actual number of under-5 children in Nasarawa State was not available to the researcher. Babalola (1998) stated that a minimum sample size can be calculated

$$n = \frac{z^2 pq}{d^2}$$

using where the population under study are 10,000 and above.

Where n = minimum sample size; z = the standard statistics that defines confidence level desired = 1.96; p = the proportion of people in the study, accounted for by the target population = 57.58/100 = 0.58

Note: 57.58 is the percentage of under-five children in the reported total birth registered of 108,064 children in Nasarawa State (National Bureau of Statistics, 2017).

$$q = 1 - p = 1 - 0.58 = 0.42$$

$$d = \text{statistic degree of accuracy desired} = 0.05$$

$$n = \frac{1.96^2 \times 0.58 \times 0.42}{0.05^2} = \frac{3.8416 \times 0.2436}{0.0025} = \frac{0.93581376}{0.0025} = 374.3255$$

$$n = 374$$

10% of the calculated sample size is added to the sample size to take care of the likelihood of non-responses in data collection, making a sample size of 411. Due to the fact that sample selection criteria (research budget and researcher convenience) allows for flexibility as long as the minimum acceptable size is accepted (Babbie, 2005), 480 sample size was proposed for convenient distribution across the 3 senatorial districts of Nasarawa State.

The variables for this study are sub-divided into dependent and independent variables. The major dependent variable for this study is child mortality. This variable is numbered 1 if a mother ever lost under-5 child and 0 otherwise. The independent variables comprise structural and underlying factors. The important structural factors are defined below:

- Mothers education: mothers with no formal education are coded 0, those with primary certificate are coded 1, secondary 2, NCE 3 and degree and above were coded 4.

- Mothers income level: mothers without any form of earning are coded 0, those earning N25,000 and below are coded 1; N26,000-N51,000 earnings 2; N52,000-N75,000 earners are coded 3; while, women earning N76,000 and above are coded 3
- Mothers occupation is grouped into non workers, marketers, farmers, civil and private
- Some of the important underlying factors are explained below:
- Breastfeeding: the variable breastng is coded 1 if a mother practiced exclusive breastfeeding and 0 if she does not.
- Immunization: This variable is coded 1 if a child is immunized and 0 otherwise
- Source of water: this variable is coded 1 if child drink water from borehole and 0 if child drinks water from well or stream
- Toilet facility: the variable is coded 1 if a household uses water system toilet and 0 if a household uses pit toilet or bush.

Chi-square analysis will be used for data descriptive statistics, probit method of analysis will be used to examine the causal relationship between parents' socioeconomic status and under-5 mortality rate in Nasarawa State. Probit regression is relevant for this study because the dependent variables are binary in nature. Three Probit models are specific for analysis: the first model estimates the relationship between socioeconomic factors and child mortality; the second model is used to establish the relationship between structural (socioeconomic) factors and underlying factors. This is to establish the pathways through which socioeconomic factors affect child mortality and the third model include both the structural and underlying factors to estimate causal link between socioeconomic factors and child mortality in Nasarawa State. These models are specified below:

$$CHM = \beta_0 + \beta_1ME + \beta_2FE + \beta_3MI + \beta_4MO + \beta_4PI + \beta_5FI \dots\dots\dots (1)$$

$$ud = y_0 + y_1ME + \beta_2FE + \beta_3MI + \beta_4MO + \beta_4PI + \beta_5FI \dots\dots\dots (2)$$

$$CHM = \beta_0 + \beta_1ME + \beta_2FE + \beta_3MI + \beta_4MO + \beta_4PI + \beta_5FI + \beta_5ud + Chc + Mc \dots\dots\dots (3)$$

Where:

*CHM* represent child mortality; *ME* is mother's level of education; *FE* (father's level of education); *MI* (mother's income); *MO* (mother's occupation); *FI* (father's income); *PI* (place of residence); *Chc* represent child individual characteristics (child age and gender) and *ud* represent underlying factors (immunization, mode of breast feeding, source of water and toilet facility).

## 4.0 Results and Discussion

### 4.1 Descriptive Statistics

Table 1 below shows the raw distribution in terms of frequency and percentages of important socioeconomic and underlying variables that determine child mortality in Nasarawa State. Mothers' without formal education and those with primary certificates as their highest qualification had the highest percentages (89.58 and 89.66 respectively) of under-five mortality compared to mothers' with degree and other higher qualifications with only 3.57 percent of under-five mortality. The rate of under-five mortality is also higher among poor mothers: 63 percent of poor mothers lost their under-five children while, only 12 percent of rich mothers ever lost their under-five children. The prevalence of under-five mortality was found to be slightly higher among rural communities (57 percent) compared to urban communities where only 47 percent of mothers ever lost an under-five child.

The underlying determinants of child mortality show that among households who used modern toilet facilities (water system toilet) only 34 percent ever lost an under-five child compared to households that used pit toilet/bush with an 80 percent rate. Among households that use borehole as a source of drinking water only 42 percent ever lost an under-five child while, 74 percent of households that use well/stream as a source of drinking water lost an under-five child. Similarly, 48 percent of mothers that practice exclusive breastfeeding lost an under-five child which is lower compared to 67 percent of child mortality recorded among mothers that did not practice exclusive breastfeeding.

*Table 1: Percentages and Frequency Distribution of child mortality by structural and underlying factors*

Child Mortality Rate						
	Lost a Child			Never Lost a Child		
	Frequency (f)	Percentage (%)	Chi-Square (x <sup>2</sup> )	Frequency (f)	Percentage (%)	Chi-Square (x <sup>2</sup> )
<b>Mother's Educational Level</b>	43	89.58	176.3810**	5	10.42	176.3810**
Non Formal	104	47.28	*	12	52.72	*
Primary	87	20.55		97	79.45	
Secondary	15	3.57		58	96.43	
NCE	2			54		
Degree		63.12			36.88	
<b>Wealth</b>	89	63.13		52	36.87	
Poorest	137	28.21		80	71.79	
Second	22	0.00	68.765***	56	100	68.765***
Middle	0	11.54		15	88.46	
Fourth	3			23		
Richest		64.19			35.81	
<b>Mothers Occupation</b>	95	55.73		53	44.27	
Not working	33	30		19	70	
Farming	107	12.73		85	87.27	
Marketing	9		52.406***	21		52.406***
Private	7	57.36		48	42.64	
Civil Servant		46.70			53.30	
<b>Place of</b>	152			113		
<b>Place</b>	99			113		
			5.368			95.998***

<b>Residence</b>	132	41.51		186	58.49	
Rural	119	74.84	47.241***	40	25.16	11.85***
Urban						
<b>Source of Water</b>	97	34.15		187	65.85	
Borehole	154	79.79	95.998***	39	20.21	95.998***
Well						
<b>Toilet Facility</b>	175	48.21		188	51.79	
Water system	76	66.67	11.85***	38	33.33	39.282***
Pit/Bush	12	54.55		10	45.45	
<b>Breastfeeding</b>	57	42.86		76	57.15	
Exclusive	15	51.72	42.86	14	48.28	57.14
Non-exclusive	15	47.54		20	52.46	45.877***
	29	20.83		32	79.17	
	5	56.52		19	43.48	
<b>Region</b>	13	55		10	45	
Gunduma	22	62.50		18	37.50	
Lafia	30	85.19		18	14.81	
Keffi	23	83.33		4	16.67	
Akwanga	15	88.24		3	11.76	
Nasarawa	15			2		
Keana						
Wamba						
Laminga						
Agyaragu						
Gudi						
Iwagu						
Nakere						

*Source: Owners Computation*

#### 4.2 Probit Regression of Causal Relationship

Table2 and Table3 presents four models estimated by probit regression to analyze the causal relationship between parents’ socioeconomic status and under-five mortality in Nasarawa State. Model1 presents univariate probit regression to examine the relationship between parental socioeconomic status and under-five mortality. Model2 presents multivariate probit regression of the relationship between socioeconomic factors and under-five mortality controlling for individual and underlying factors. Model3 and Model4 examine the relationship between parents’ socioeconomic status and underlying factors to determine the pathway through which socioeconomic factors influence child mortality.

Result from the univariate probit regression (model1; table2) shows a significant relationship between under-five mortality and parents socioeconomic status with the

exception of fathers' income level and occupation. For instance, the result indicated that mothers' with degree and above, NCE and Secondary certificates are 0.68, 0.63 and 0.52 percentage points respectively less likely to experience under-five mortality compared to mothers with no formal education. These statistical values are significant at  $p < 0.001$  level. Mothers' occupation also shows similar pattern to mothers' educational level. Mothers' working as civil servants, private servants, marketers and farmers are 0.59, 0.55, 0.68 and 0.57 ( $p < 0.001$ ) percentage points respectively less likely to have under-five mortality compared to mothers that are not working. In contrast, the result shows that mothers increase level of income increases the likelihood of child mortality showing a positive coefficient of 0.44 percentage point at  $p < 0.001$  level.

*Table 2: Probit Regression for child mortality by Socioeconomic Status*  
*Model1 (child mortality)      Model2 (child mortality)*

<b>Indicators</b>				
<i>Mothers Education</i>				
<b>Degree</b>	<b>-0.687***</b>	<b>(0.102)</b>	<b>-0.684***</b>	<b>(0.113)</b>
<b>NCEE</b>	<b>-0.632***</b>	<b>(0.093)</b>	<b>-0.603***</b>	<b>(0.104)</b>
<b>Secondary</b>	<b>-0.521***</b>	<b>(0.100)</b>	<b>-0.454***</b>	<b>(0.114)</b>
<b>Primary</b>	<b>-0.040</b>	<b>(0.136)</b>	<b>0.0008*</b>	<b>(0.145)</b>
<b>Mothers Occupation</b>				
<b>Civil Serv</b>	<b>-0.590***</b>	<b>(0.125)</b>	<b>-0.666***</b>	<b>(0.121)</b>
<b>Private</b>	<b>-0.552***</b>	<b>(0.125)</b>	<b>-0.608***</b>	<b>(0.124)</b>
<b>Marketing</b>	<b>-0.688***</b>	<b>(0.166)</b>	<b>-0.798***</b>	<b>(0.140)</b>
<b>Farming</b>	<b>-0.572***</b>	<b>(0.138)</b>	<b>-0.637***</b>	<b>(0.132)</b>
<b>Mothers Income</b>				
<b>Rich</b>	<b>0.444***</b>	<b>(0.125)</b>	<b>0.468***</b>	<b>(0.132)</b>
<b>Middle</b>	<b>0.451**</b>	<b>(0.155)</b>	<b>0.544***</b>	<b>(0.145)</b>
<b>Poor</b>	<b>0.627**</b>	<b>(0.185)</b>	<b>0.747***</b>	<b>(0.165)</b>
<b>Husband Education</b>				
<b>Degree</b>	<b>-0.254*</b>	<b>(0.135)</b>	<b>-0.029</b>	<b>(0.157)</b>
<b>NCE</b>	<b>-0.177</b>	<b>(0.130)</b>	<b>0.002</b>	<b>(0.145)</b>
<b>Secondary</b>	<b>-0.194</b>	<b>(0.120)</b>	<b>-0.039</b>	<b>(0.135)</b>
<b>Primary</b>	<b>-0.051</b>	<b>(0.155)</b>	<b>0.029</b>	<b>(0.164)</b>

<b>Fathers Income</b>				
<b>Richest</b>	<b>0.748</b>	<b>(6.682)</b>	<b>0.682</b>	<b>(8.406)</b>
<b>Rich</b>	<b>0.654</b>	<b>(5.326)</b>	<b>0.608</b>	<b>(6.316)</b>
<b>Middle</b>	<b>0.979</b>	<b>(2.728)</b>	<b>0.949</b>	<b>(6.582)</b>
<b>Poor</b>	<b>0.911</b>	<b>(5.891)</b>	<b>0.875</b>	<b>(8.656)</b>
<b>Husband Occupation</b>				
<b>Civil Serv.</b>	<b>-0.966</b>	<b>(2.657)</b>	<b>-0.942</b>	<b>(4.753)</b>
<b>Private</b>	<b>-0.780</b>	<b>(3.937)</b>	<b>-0.573</b>	<b>(4.684)</b>
<b>Marketing</b>	<b>-0.943</b>	<b>(3.539)</b>	<b>-0.917</b>	<b>(5.482)</b>
<b>Farming</b>	<b>-0.786</b>	<b>(3.705)</b>	<b>-0.776</b>	<b>(4.327)</b>
<b>Manual</b>	<b>-0.941</b>	<b>(3.537)</b>	<b>-0.917</b>	<b>(5.295)</b>
<b>Place of Resid.</b>				
<b>Lafia</b>	<b>0.261*</b>	<b>(0.121)</b>	<b>0.419**</b>	<b>(0.125)</b>
<b>Keffi</b>	<b>0.075</b>	<b>(0.154)</b>	<b>0.066</b>	<b>(0.167)</b>
<b>Akwanga</b>	<b>0.249</b>	<b>(0.127)</b>	<b>0.330**</b>	<b>(0.119)</b>
<b>Nasarawa</b>	<b>0.030</b>	<b>(0.145)</b>	<b>0.054</b>	<b>(0.166)</b>
<b>Keana</b>	<b>-0.130</b>	<b>(0.185)</b>	<b>-0.175</b>	<b>(0.222)</b>
<b>Wamba</b>	<b>0.009</b>	<b>(0.167)</b>	<b>-0.055</b>	<b>(0.189)</b>
<b>Laminga</b>	<b>-0.013</b>	<b>(0.157)</b>	<b>0.062</b>	<b>(0.177)</b>
<b>Agyaragu</b>	<b>0.096</b>	<b>(0.144)</b>	<b>0.252*</b>	<b>(0.137)</b>
<b>Gudi</b>	<b>0.357**</b>	<b>(0.496)</b>	<b>0.318*</b>	<b>(0.135)</b>
<b>Iwagu</b>	<b>0.240</b>	<b>(0.161)</b>	<b>0.242</b>	<b>(0.181)</b>
<b>Nakere</b>	<b>0.150</b>	<b>(0.189)</b>	<b>0.060</b>	<b>(0.012)</b>
<b>ethnicity</b>			<b>-0.0055</b>	<b>(0.032)</b>
<b>married</b>			<b>-0.324**</b>	<b>(0.122)</b>
<b>Religion</b>			<b>0.023</b>	<b>(0.081)</b>
<b>Under5</b>			<b>-0.036</b>	<b>(0.055)</b>
<b>Child age</b>			<b>0.035</b>	<b>(0.027)</b>
<b>gender</b>			<b>-0.021</b>	<b>(0.065)</b>
<b>children</b>			<b>0.037</b>	<b>(0.051)</b>
<b>birth space</b>			<b>-0.033</b>	<b>(0.030)</b>
<b>T. Child</b>			<b>0.036</b>	<b>(0.027)</b>
<b>Awareness</b>			<b>-0.010</b>	<b>(0.033)</b>
<b>Breastfeed</b>			<b>-0.136*</b>	<b>(0.076)</b>
<b>Immuniz</b>			<b>0.082</b>	<b>(0.159)</b>

<b>Child rm</b>			<b>-0.018</b>	<b>(0.043)</b>
<b>Water</b>			<b>-0.124</b>	<b>(0.082)</b>
<b>Toilet</b>			<b>-0.273***</b>	<b>(0.202)</b>
<b>constant</b>	<b>2.185***</b>	<b>(0.576)</b>	<b>2.800**</b>	<b>(0.075)</b>

<b>N</b>	<b>462</b>		<b>460</b>	
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*adj. R-sq*

Standard errors in parentheses

\* p<0.05, \*\* p<0.01, \*\*\* p<0.001

**Source: Owner’s Computation**

*Table3: Probit Regression Result for underlying factors by structural determinants*

<b>Indicators Mothers Education</b>	<b>Model(1) Toilet</b>		<b>Model2 Breastfed</b>	
Degree	0.581***	(0.042)	0.235***	(0.035)
NCE	0.417***	(0.405)	0.091	(0.066)
Secondary	0.139***	(0.261)	0.146*	(0.059)
Primary	0.411	(0.276)	0.085	(0.085)
<b>Mothers Income</b>				
Richest	-0.009	(0.370)	0.083	(0.160)
Rich	-0.022	(0.330)	0.087	(0.151)
Middle	0.295*	(0.162)	0.023	(0.163)
Poor	0.045	(0.212)	0.127	(0.158)
<b>Occupation</b>				
Civil Serv.	-0.166	(0.249)	-0.0066	(0.183)
Private Org.	-0.011	(0.253)	-0.083	(0.216)
Marketing	0.059	(0.208)	-0.124	(0.173)
Farming	0.081	(0.209)	-0.163	(0.217)
<b>P. Residence</b>				
Lafia	0.467***	(0.073)	0.121	(0.076)
Keffi	0.165	(0.131)	-0.016	(0.111)
Akwanga	0.011	(0.156)	0.085	(0.083)
Nasarawa	0.200*	(0.116)	-0.144	(0.117)
Keana	0.303**	(0.440)	0.045	(0.104)
Wamba	0.250*	(0.114)	-0.0091	(0.114)
Laminga	0.149	(0.130)	0.157**	(0.055)
Agyaragu	0.153	(0.124)	0.126*	(0.066)
Gudi	-0.326*	(0.159)	-0.026	(0.114)
Iwagu	0.206	(0.135)	0.125*	(0.074)
Nakere	-0.265	(0.623)	-0.099	(0.147)
Constant	-1.644***	(0.391)	0.0844	(0.355)

N	421	477
adj. R-sq		

Standard errors in parentheses

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

*Source: Owner's Computation*

The multivariate probit regression (model2; table1) control for necessary covariate. The result present similar outcome to model1 with slight reduction of some variables coefficient. For instance, the coefficient on mothers' with NCE reduced from -0.63 to -

0.60 percentage point and that of mothers' with secondary certificate reduced from -0.52 to -0.45 percentage point. This indicate that other factors such as been married -0.32 ( $p < 0.01$ ), exclusive breastfeeding -0.13 ( $p < 0.05$ ) and using water system toilet -0.13 ( $p < 0.001$ ) reducing the chance of under-five mortality.

Model3 result shows that increase mothers education from secondary, NCE to degree level increases the likelihood of using modern toilet facility by 0.13, 0.41 and 0.58 percentage point respectively all at  $p < 0.001$ . Also, residing in Lafia, Nasarawa, Keana and wamba increases the use of modern toilet facility. In contrast, model4 shows that only mothers with degree certificate are more likely to use exclusive mode of breastfeeding on their children at  $p < 0.001$  level of significance.

### 4.3 Discussion of Findings

This paper focuses on the causal relationship between parents' socioeconomic status and under-five mortality in Nasarawa State. The intuition behind this objective is the understanding that parents' socioeconomic status determines the resources to provide quality care to children and education that provide basic knowledge about child health care prevention. Also, the study from WHO through CSDH that uncovered evidences that led to the development of conceptual framework explain how socioeconomic status affect child health through underlying factors.

The results from the descriptive statistics and univariate and multivariate probit regression indicates that mothers' socioeconomic status and some underlying factors determine the rate of inequality of under-five mortality experienced in Nasarawa State. The combined results of this study shows a significant negative relationship between mothers' level of education and child mortality in Nasarawa State even after adjusting for important covariates. This result supports the findings of Fayehun et al (2019) and Adetoro and Amoo (2014) and confirms the belief that children are closer to mothers compared to their fathers. Therefore, mothers influence impact greatly on their children. studies have also shown that mothers educational level relate

significantly to child ill health prevention and environmental variables that affect child survival (Fayehu & Omololu, 2011).

The result from this study also revealed lower risk of child mortality among working mothers' relative to non-working mothers which is similar to the study of Oyefara (2013). This is expected because occupation is a product of education, meaning most paid working class women are educated. Therefore, they have the basic knowledge about child health care and also have the finances to afford quality diet and health care for their children, hence increasing their survival rate. Though, Kingsley, Charlie and Chidi (2016) found positive relationship between mothers' occupation and child mortality, this could be community level factors since the study was conducted on a community in Imo State.

In contrast to the previous finding on mothers' education and occupation, results from this study indicate a significant positive relationship between mothers' income level and child mortality which is closely related to the study of Edeme, Ifelunini and Obinna (2014). This is possible because income is a function of many variables aside education. A woman that is into farming or marketing and uneducated might earn more income than her counterpart who is a teacher in a secondary, primary school or work with government or private organization. Income therefore might not be a good determinant of child mortality. Studies that reported negative relationship such as Adeboye, Ige and Yusuf (2013) might be due to characteristics of the population where most income earners are working class. Also, place of residence depicts similar characteristics where most mortality rate are prevalence in the urban areas of Nasarawa State.

Other control variables that reduces the risk of under-five mortality in Nasarawa State include been married as supported by Adeboye, Zhao and Lamichhane (2016); practice of exclusive breastfeeding as found in Bello and Joseph (2014) and the use of modern toilet facility which agrees to the finding of Edeme et al (2014). This is understandable because married women have support from their husbands in taking care of their children.

Model3 and Model4 aim to established the underlying factors through which socioeconomic factors affect child mortality as explained in the conceptual framework by CSDH. This is the point where this study differs from other findings that study socioeconomic factors as having direct causal effect on child mortality. The result revealed that mothers' education influence child mortality through mode of breastfeeding and the type of toilet facility used by household. Mothers with higher level of education were significantly more likely to use modern toilet facility which provide better sanitation and practice exclusive breastfeeding that is found to

protect infants from infection which increases child survival

## 5.0 Conclusion and Recommendations

The high rate of under-five mortality in Nigeria is unequally spread across the 36 states in Nigeria including the Federal Capital Territory (FCT). This inequality in under-five mortality is a function of community and individual level factors such as poverty, poor health care facilities, poor environmental sanitation, poor education enrolment among women and geographical factors. It is against this backdrop that this study seeks to examine the socioeconomic determinants of under-five mortality in Nasarawa State. This paper uses CSDH conceptual framework and empirical review to select important socioeconomic variables that determine child mortality and the causal pathways. Jacobson theory of family as producer of health was used to establish the link between the dependent and independent variables which was analyzed using univariate and multivariate probit regression.

The findings of this paper suggest that mothers' socioeconomic factors in terms of education and occupation explain the rate of inequality in under-five mortality among households in Nasarawa State. Among these mothers' socioeconomic factors, only mothers' educational level was found to establish a causal pathway to child mortality through types of toilet facility and mode of breastfeeding.

An important strategy to reduce under-five mortality rate in Nasarawa State should involve investment in education. Investment that will enhance girl child enrolment through free quality education and scholarship for tertiary education. Health awareness campaigns about child health care prevention should be prioritized through primary health centers to sensitize low educated mothers.

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