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Determinants of under–five mortality in south–eastern Nigeria

Abstract

Background: Under–five mortality is a major public health indicator hence its inclusion among the Sustainable Development Goals (SDGs). Identifying the determinants of under–five mortality is a major step in tackling under–five mortality. While it is important to determine factors that affect under–five mortality at the national level, is it also very important to disaggregate data to determine the peculiarities and differences at the geopolitical zones. This zoomed into the South–eastern geo–political zone of Nigeria.

Methods: This was a population based cross–sectional study. Secondary data of the 2013 Nigeria Demographic and Health Survey (NDHS) was analyzed. Though the NDHS was a nationally representative study, only data from the South–east geo–political zone was included in analysis. The aim of the study was to identify determinants of under–five mortality. Univariate and multivariate logistic regression were carried out.

Results: This study revealed several determinants of under–five mortality in the South–east geo–political zone of Nigeria. Children who reside in Anambra state had lower odds of under–five mortality compared with the children who reside in the four states. The following factors reduced the odds of under–five mortality: female gender, maternal education, maternal age less than 35years, maternal use of modern family planning, family belonging to the middle and rich wealth index.

Conclusions: this study has identified important risk factors that should be considered in the formulation of policies that combat under–five mortality in the South–east geo–political zone of Nigeria.

Keywords: under–five mortality, south–east Nigeria, world health organization, congenital anomalies, hypertension

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Introduction

Under–five mortality rate is the probability for a child born in a specified year to die before reaching the age of five, if subjected to current age–specific mortality rates. It is usually expressed as number of deaths per1,000 live births.[1] For the layman, under–five mortality simply means the death of a child before his/her 5th birthday. It is a major indicator for assessing the quality of a country's healthcare system. The world has recognized that under–five mortality is a major challenge to humanity that should be addressed, hence the inclusion in the Sustainable Development Goals (SDGs). Health target number 2 under goal 3 of SDGs aims to reduce under–five mortality to 25 per 1,000 live births by 2030.[2] Over the years studies have shown that the under–five mortality rates of developing countries lag far behind that of the developed countries. The World Health Organization (WHO) in her publication "Children: reducing mortality", said that children in developing countries are 10 times more likely to die before their fifth birthday compared with children in the developed countries.[3] The 2013 Nigeria Demographic and Health Survey (NDHS) reported that the under–five mortality rate was 128 per 1,000 live births.[4] This is a far cry from the situation in most developed countries. In Sweden the under–five mortality is 2.5 per 1,000 live births.[5] In Canada it is 5.22 per 1,000 live births.[5] This huge disparity between the developed and developing countries calls for serious concerns.

Identifying the factors that increase the probability of under–five mortality is very important in the efforts to reduce the menace. A study done in Burkina Faso identified the following factors that predispose to under–five mortality: interval between births, maternal age and birth order.[6] The study reported that short birth interval, low maternal age (<20years) and being the first child increase the likelihood of under–five mortality. Some studies also demonstrated that children of educated mothers survive better than children of uneducated mothers.[7,8] These studies highlight the effect of maternal education on under–five mortality. Similarly, large family size has been demonstrated to increase under–five mortality.[9] This is as a result of heightened competition for food and other resources within the family because of the number of mouths to feed. It is important to note that most of the studies did not consider possible confounding factors. Also there are very few studies that have been done in Nigeria and none has actually looked specifically at the South–east geopolitical zone of Nigeria. It is always informative to disaggregate data so that peculiarities of some sub–groups will be identified. This informs the decision of the authors to zoom into the South–east geopolitical zone of Nigeria while also taking into consideration possible confounders.

Methodology

Setting

Nigeria lies on the west coast of Africa between latitudes 4º16' and 13º53' north and longitudes 2º40' and 14º41' east.[4] It occupies approximately 923,768 square kilometers of land stretching from the Gulf of Guinea on the Atlantic coast in the south to the fringes of the Sahara Desert in the north. The territorial boundaries are defined by the republics of Niger and Chad in the north, the Republic of Cameroon on the east, and the Republic of Benin on the west. Nigeria is the most populous country in Africa and the 14th largest in land mass. Nigeria's 2006 Population and Housing Census placed the country's population at 140,431,790.[4] Though Nigeria is yet to conduct a national census after the 2006 Census, 2019 estimate by the World Population Review placed the country's population at 199,566.817.[10] Presently, Nigeria is made up of 36 states and a Federal Capital Territory, grouped into six geopolitical zones: North Central, North East, North West, South East, South South, and South West.

Study design

This is a secondary analysis of data from a nationwide population–based cross sectional study called Nigeria Demographic and Health Study (NDHS) 2013. The NDHS was done by the National Population Commission (NPC) of Nigeria while ICF International provided financial and technical assistance through the USAID–funded MEASURE DHS program. This particular paper focused on only the South–East geopolitical zone of Nigeria. This paper investigated the roles of some factors in Under–five mortality in South–eastern Nigeria.

Sampling technique

A detailed explanation of the sampling technique applied is in the full report of the 2013 NDHS.[4] The sample for the 2013 NDHS was nationally representative and covered the entire population residing in non–institutional dwelling units in the country. The survey used as a sampling frame the list of enumeration areas (EAs) prepared for the 2006 Population Census of the Federal Republic of Nigeria, provided by the National Population Commission. The sample was designed to provide population and health indicator estimates at the national, zonal, and state levels. The sample design allowed for specific indicators to be calculated for each of the six zones, 36 states, and the Federal Capital Territory, Abuja. Administratively, Nigeria is divided into states. Each state is subdivided into local government areas (LGAs), and each LGA is divided into localities. In addition to these administrative units, during the 2006 population census, each locality was subdivided into census enumeration areas (EAs). The primary sampling unit (PSU), referred to as a cluster in the 2013 NDHS, is defined on the basis of EAs from the 2006 EA census frame. The 2013 NDHS sample was selected using a stratified three–stage cluster design consisting of 904 clusters, 372 in urban areas and 532 in rural areas. A representative sample of 40,680 households was selected for the survey, with a minimum target of 943 completed interviews per state. A fixed sample take of 45households were selected per cluster. All women age 15–49 in the households were eligible to be interviewed. In a subsample of half of the households, all men age 15–49 eligible to be interviewed.

Data collection

Detailed information on the data collection and questionnaires has been published in the final report of 2013 NDHS.[4] Three questionnaires were used in the 2013 NDHS: the Household Questionnaire, the Woman's Questionnaire, and the Man's Questionnaire. The content of these questionnaires was based on model questionnaires developed by the MEASURE DHS program. The model questionnaires were modified according to the country's requirements, in consultation with a broad spectrum of government ministries and agencies, nongovernmental organizations, and international donors, to reflect relevant issues. Data collection started in February 2013 and ended in June 2013.

Ethical considerations

Ethical approval for this project was obtained from the ethical committee of ICF at Calverton, Maryland, USA and National Ethic Committee in the Federal Ministry of Health, Abuja, Nigeria.

Outcome variable

The outcome variable is death before fifth birthday (under–five mortality).

Explanatory variables

Selection of variables was based on previous studies.[7,8,11–14] The following factors were considered in the study: State of residence, gender of the children, maternal highest educational level, maternal number of births in the last 5years, maternal current marital status, maternal current age, maternal current use of family planning, child's birth order, family size, family's wealth index, family's type place of residence (urban/rural).

Statistical analysis

All the explanatory variables that were originally continuous numerical variables were recorded into categorical variables. Also some explanatory variables that were originally categorical were recorded to reduce their groups. Descriptive analysis of both the explanatory and outcome variables was done. Uni variable logistic regression was used to examine the association between the explanatory variables and the outcome variable. Only explanatory variables that were statistically significant were incorporated into multivariable logistic regression. P–value ≤ 0.05 was considered statistically significant. IBM–SPSS data analysis software (version 20.0) was used for the analysis.

Results

Sample characteristics

Out of all the 11,219children delivered by 11,219 mothers, 1,563(13.9%) died before their fifth birthday. This survey retrospectively covered from the year 2008 to 2013. A little above half (51.9%) of the children were males. Majority of the mothers (86.2%) had formal education. Only 8.5% of the mothers had at least 3 births in the last 5years. Almost all the women (98.4%) had been in a union either at the time of data collection or previously. The commonest age group among the mothers was those greater than 35years (63.5%). More than half (69.8%) of the mothers were not using any family planning method. Almost half (48.1%) of the under–five children occupied the 2nd to 4th birth order in their families. More than half (56.7%) of the families had at least 5 household members. Less than half (46.2%) of the families belong to the rich wealth index. Close to two–third (64.9%) of the families lived in the urban areas (Table1).

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Table 1 Statistical summary of variables

Variable	Frequency	Percentage
State of Residence		
Anambra	2,050	18.3
Enugu	2,296	20.5
Ebonyi	3,257	29.0
Abia	1,958	17.5
Imo	1658	14.8
Gender of the children		
Male	5,827	51.9
Female	5,392	48.1
Survival status		
Dead	1,563	13.9
Alive	9,656	86.1
Mothers' highest Educational Qualification		
No education	1,551	13.8
Primary	4,340	38.7
Secondary or higher	5,328	47.5
Maternal number of births in the last 5 years		
Less than 3 births	10,260	91.5
3 or more births	959	8.5
Maternal Current marital status		
Never in a union	181	1.6
Currently in union/living with a man	9,587	85.5
Formerly in union/living with a man	1,451	12.9
Maternal current age (years)		
≤20	135	1.2
21 – 25	623	5.6
26 – 30	1,571	14.0
31 – 35	1,765	15.7
>35	7,125	63.5
Maternal current use of family planning		
No method	7,831	69.8
Traditional/Folkloric method	2,019	18.0
Modern method	1,369	12.2
Birth order		
1	2,621	23.4
2 to 4	5,400	48.1
≥5	3,198	28.5
Family size		
1 to 5	6,359	56.7
>5	4,860	43.3
Wealth index		
Poor	2,748	24.5
Middle	3,288	29.3
Rich	5,183	46.2
Residence		
Urban	7,286	64.9
Rural	3,933	35.1

Uni variable analysis

The results of uni variable (unadjusted) analysis are shown in Table 2.

Table 2 Results of uni variable analysis logistic regression for under-5 mortality.

	OR	P-value	CI
State of residence			
Anambra	1.000		
Enugu	1.303	0.008	1.071 – 1.584
Ebonyi	2.436	<0.01	2.051 – 1.584
Abia	1.295	0.012	1.058 – 1.597
Imo	1.481	<0.01	1.206 – 1.820
Gender			
Male	1.000		
Female	0.808	<0.01	0.726 – 0.900
Maternal highest Education level			
No education	1.000		
Primary	0.754	<0.01	0.650 – 0.875
Secondary or higher	0.460	<0.01	0.395 – 0.535
Maternal number of births in the last 5 years			
Less than 3	1.000		
3 or more	1.032	0.741	0.854 – 1.248
Maternal Current marital status			
Never in a union	1.000		
Currently in union/living with a man	1.074	0.752	0.691 – 1.670
Formerly in union/living with a man	1.389	0.160	0.878 – 2.197
Maternal age (years)			
≤ 20	1.000		
21 to 25	1.547	0.238	0.749 – 3.196
26 to 30	1.699	0.135	0.848 – 3.403
31 to 35	1.891	0.071	0.947 – 3.775
>35	2.589	0.006	1.313 – 5.107
Family planning			
No method	1.000		
Traditional/Folkloric	0.695	<0.01	0.597 – 0.808
Modern method	0.534	<0.01	0.439 – 0.649
Birth order			
1	1.000		
2 to 4	0.981	0.789	0.854 – 1.128
≥5	1.345	<0.01	1.161 – 1.558
Family size			
1 to 5	1.000		
>5	0.768	<0.01	0.690 – 0.855
Wealth index			
Poor	1.000		
Middle	0.720	<0.01	0.629 – 0.825
Rich	0.513	<0.01	0.451 – 0.584
Residence			
Urban	1.000		
Rural	0.990	0.867	0.885 – 1.108

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Before adjusting for confounders, the under–fives in Ebonyi state were 143% more likely to die before their fifth birthday compared with those in Anambra state. Also, those in Enugu, Abia and Imo were more likely to die before their 5th birthday compared with those in Anambra State. The likelihood of under–5 mortality decreased by 20% in females compared with males. The odds of under–5 mortality reduced by 25% among under–fives whose mothers had primary education and by 54% among those whose mothers had secondary or tertiary education compared with those whose mothers did not have formal education. Before controlling for other factors, under–fives whose mothers were older than 35years were 158% more likely to experience under–five mortality compared with those whose mothers were 20years or less. The odds of under–five mortality among the under–fives whose mothers used traditional or folkloric family planning and modern family planning reduced by 31% and 47% respectively, compared with those whose mothers do not use any family planning method. The under–fives who were at least the 5th birth of their mothers had their under–five mortality increased by 34% compared with those who were the first birth of their mother. Having a family size of more than 5 reduced the under–five mortality by 24% compared with a family size of 1 to 5. Belonging to the middle wealth index reduced under–five mortality by 28% while rich wealth index reduced under–five mortality by 49% compared with the poor wealth index.

Multivariable analysis

The results of multivariable analysis where all factors were controlled for are shown in Table 3.

Table 3 Results of multi variable analysis logistic regression for under-5 mortality.

	OR	P-value	CI
State of residence			
Anambra	1.000		
Enugu	1.159	0.150	0.948 – 1.418
Ebonyi	1.190	<0.01	1.576 – 2.314
Abia	1.273	0.021	1.037 – 1.564
Imo	1.509	<0.01	1.224 – 1.859
Gender			
Male	1.000		
Female	0.802	<0.01	0.719 – 0.895
Maternal highest Education level			
No education	1.000		
Primary	0.939	0.427	0.803 – 1.097
Secondary or higher	0.755	0.005	0.621 – 0.918
Maternal age (years)			
≤ 20	1.000		
21 to 25	1.697	0.156	0.817 – 3.524
26 to 30	1.990	0.055	0.986 – 4.015
31 to 35	2.189	0.029	1.086 – 4.412
>35	2.568	0.007	1.287 – 5.124
Family planning			
No method	1.000		
Traditional/Folkloric	0.943	0.471	0.803 – 1.107
Modern method	0.693	<0.01	0.565 – 0.848
Birth order			
1	1.000		
2 to 4	0.911	0.201	0.789 – 1.051
≥5	1.089	0.293	0.929 - 1.276
Family size			
1 to 5	1.000		
>5	0.742	<0.01	0.664 – 0.831
Wealth index			
Poor	1.000		
Middle	0.874	0.066	0.756 – 1.009
Rich	0.808	0.011	0.685 – 0.953

State of residence remained statistically significant. The under–fives from Ebonyi state were 19% more likely to experience under–five mortality compared with the Anambra resident. Similarly, those in Abia and Imo had 27% and 50% increased odds of under–five mortality compared with the Anambra under–fives. Females were 20% less likely to experience under–five mortality compared with the males. After adjusting for possible confounders, maternal education of secondary/tertiary level reduced chance of under–five mortality by 25%. Older maternal age (>35years) also increased the odds of under–five mortality by 156%. On the contrary, using modern family planning methods reduced the odds of under–five mortality by 31%. Surprisingly, family size of greater than five reduced the odds of under–five by 26%. Finally, Table 3 also showed that belonging to the rich wealth index reduced the odds of under–five by 20%.

Discussion

The findings of this study revealed important factors that increase the likelihood of under–five mortality. After adjusting for possible confounders, the state of residence of the children had an effect on their odds of under–five mortality. Children in Imo state have 50% increased odds of under–five mortality compared with the children in Anambra state. Enugu, Ebonyi and Abia state children also had increased odds (15%, 19%, 27%, respectively) of under–five mortality compared with Anambra state children. This may be as a result of the differences in the availability and accessibility of health care in the different states and the poverty levels in the different states. In this study being a female was protective of under–five mortality by 20%. Similarly, in Ethiopia being female reduced the odds of under–five mortality by 15%.[13] In our study, having a mother that had minimum of secondary education reduced the odds of under–five mortality by 26%. This is consistent with a nationally representative study in Nigeria[15] and a study in Bangladesh.[16] This may be because an educated mother is more likely to seek health care attention from pregnancy period to post delivery. Also an educated mother is more likely to understand the importance of immunizations and ensure her child is vaccinated appropriately. Maternal age also had an effect on under–five mortality. Children of mothers that were 31 to 35years had higher odds of under–five mortality and those whose mothers were older than 35years had even higher odds of under–five mortality compared with the younger mothers. This is consistent with a previous study in Burkina Faso.[6] It has been reported that congenital anomalies, hypertension, surgical deliveries occur more among older mothers.[17] These may account for the increased odds of under–five mortality among the children of older aged mothers.

Furthermore, our study demonstrated that the use of family planning was protective against under–five mortality even after controlling for confounders. The use of modern family planning methods reduced under–five mortality by 30% compared with those who do not use any family planning method. This agrees with the reports of previous studies.[14,18] This may be explained by the fact that contraception prevents unwanted pregnancies and makes it possible to space pregnancies. This ensures that one gets to have only the children she/he plans for and consequently improves chances of survival. Children from the middle and the rich wealth index families were more likely to survive (13% and 20% respectively) compared with those from the poor wealth index families. This may be explained by the greater ability of the middle and rich wealth index families to purchase both preventive and curative healthcare.

It is important to highlight some strengths and weaknesses of this type of study. This was a population based cross–sectional study. The sample size was also relatively large. Based on the fore–going, the findings from this study can be generalized to the general population. On the other hand, the weakness is that this type of study can't be used to establish causal effect. In addition, the data is a point prevalence data. One may not be able to say whether the data is time dependent thereby making length bias a source of concern.

Based on our findings we recommend as follows: The governments of the South–east states in collaboration with Non–governmental organizations (NGOs) should develop a peer review system to aid the states in the South–east geo–political zone to monitor and evaluate their health policies. This will reduce the disparities between the states. There must be something the states with lower odds of under–five mortality are doing which the others are not doing. The South–eastern states and the NGOs should design interventions that that will encourage female education and the use of modern family planning methods. Furthermore, it is important that states recognize that poverty is not just an economic issue but an important determinant of health; hence the fight against poverty should be given the needed attention.

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Conflicts of interest

The author declares there are no conflicts of interest.

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