

# Regional Differences in Postnatal Care Service Utilisation and Child Morbidity in Nigeria: Evidence from 2018 Nigeria Demographic and Health Survey (NDHS)

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## Research article

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# Abstract

## Introduction:

Modern Postnatal Care Services (PNC) in Nigeria is vital tool for providing quality health for mothers and newborns. Nonetheless, many regions in Nigeria are still struggling to achieve optimum utilisation of modern PNC services due to variation in associated socioeconomic factors of mothers based on their regions. This study aims at assessing regional socioeconomic factors associated with PNC services utilisation and its relationship with child morbidity in Nigeria.

## Methods

Data for this study was extracted from the Nigeria Demographic and Health Survey (NDHS) 2018 birth recoded file dataset, with a sample size of 30713 women (aged 15–49). Data were analysed using descriptive statistics, Chi-Square Test and logistic regression. The main predictor variable was the region, while others included the type of PNC service utilised and various demographic variables of the respondents – age, education, type of residence, religion, ethnicity among others.

## Results

The average age of the respondents was  $29.5 \pm 6.8$ . The use of modern PNC services ranged from South-West (20.3%), South-South (10.9%), South-East (23.0%), North-Central (22.0%), North-East (13.0%) to North-West (10.9%). The prevalence of child morbidity ranged from South-West (8.5%), South-South (9.8%), South-East (11.4%), North-Central (15.3%), North-East (26.3%) to North-West (28.7%). Child morbidity is significantly higher in the South-South (OR = 1.46), South-East (OR = 1.50), North-Central (OR = 1.13), North-East (OR = 2.31) and North-West (OR = 1.35) compared to the South-West.

## Conclusion

Majority of women in Nigeria are not using modern PNC services. Regional variations in the use of PNC services and socio-demographic characteristics of mothers influence child morbidity in Nigeria. There is need for regional-specific context sensitisation for mothers in the use of modern PNC services.

## Introduction

Due to the changes that are bound to occur during the period of postnatal care (0–6 months after birth) in the lives of mothers and their new-born babies, the World Health Organisation (WHO) has reiterated that the period is a critical phase in the lives of the mothers and the new-born babies [1]. Following the critical nature of this period, the Nigeria Demographic and Health Survey (NDHS 2018) report has also shown that the continuous provisions of health care services during pregnancy and childbirth including after delivery are important for the survival and well-being of both the mothers and their infants. As the report succinctly puts

it: “Ensuring access to a continuum of care for women during the antenatal, intrapartum, and postpartum periods is critical for maternal and newborn survival and is a priority of the Federal Ministry of Health” [2].

Despite the importance of providing quality health care services by skilled health care professionals during and immediately after childbirth to mothers and infants, the postnatal periods are usually neglected by most mothers due to sociocultural factors associated with new-borns [3–5]. Meanwhile, studies have shown that mothers who attend health facilities during postnatal periods where skilled health professionals can identify, observe and manage any health challenge that may arise in the lives of the mothers and their new-born babies [6–7] stand a chance of preventing the occurrences of body and mental damages [8], as well as child morbidity and mortality than those who did not [9].

Although there has been incredible progress in the global under-five mortality rate which had reduced from 93 deaths (in 1990) and 76 deaths (in 2000) to 39 deaths per 1,000 live births in 2018 [10], the reduction in this rate is uneven across regions and the Low and Middle-Income Countries (LMICs) of the world. For example, while the death of children under-five has declined from 182 to 78 deaths per 1000 live births in sub-Saharan Africa between 1990 and 2018, Europe and Northern America recorded a decline from 14 to 6 deaths during the same period [10]. This implies that the current mortality rate in sub-Saharan Africa is 13 times more than those in Europe and Northern America.

In Nigeria, it was reported that between 1990 and 2018, the under-5 mortality rate has declined from 193 deaths to 132 deaths per 1,000 live births [2]. It then means that the under-5 mortality rate as of 2018 is 3 times higher than that of the global one and 2 times higher than that of sub-Saharan Africa. While the trend in the deaths of children under-five seems to decline at the national level in Nigeria, the rates are not evenly distributed across all regions or geopolitical zones in the country. For example, the rates across the geopolitical zones as at 2018 ranged from 95 deaths per 1000 (North-Central), 134 deaths per 1000 (North-East), 184 deaths per 1000 (North-West), 25 deaths per 1000 (South-East), 73 deaths per 1000 (South-South) to 62 deaths per 1000 (South-West) [2]. Given that the rates of decline in under-five mortality are not evenly distributed across continents and regions, it is indicative that there are disparities in the rates of socioeconomic development as well as people’s attitudes towards prevention of child morbidity and mortality in the country.

While several studies on postnatal care have focused on the use, non-use and barriers to the use of modern health care services during this period [4, 5], there is limited or little attention paid to the relationship between regional differences in postnatal care services and child morbidity which is a critical factor in under-five mortality. Take, for example, Olajubu *et al.* [5] examined the predictors of postnatal care utilisation among women in a facility-based study in Nigeria, it was found that age and education were strong predictors of postnatal care services utilisation.

Ugboanusi *et al.* [4] on the other hand, studied factors affecting the utilisation of postnatal care services in Primary Health Care (PHC) facilities in urban and rural settlements in Kaduna (Nigeria), postnatal care service utilisation was lower in the rural areas than the urban centres and there were barriers of transportation, large babies and poor wealth quintiles to the use of PHC facilities. Rao *et al.* [11] in their study in India pointed out that mothers of new-borns have to bathe water with ashes within seven days after

delivery. These practices may be good for the mothers and their new-borns from their cultural viewpoints, but the health implications could be more deleterious than its merits in modern health perspectives.

Meanwhile, Defar *et al.* [12] have argued that maternal and child health (MCH) care utilisation often varies with geographic location. As such, there is a need for an empirical study examining analysing regional differences in the use of postnatal care services and child morbidity using the recent data from the 2018 NDHS in Nigeria. This is urgently needed to explore the incidences of child morbidity in the country for necessary health programmes and interventions as well as to achieve target 3.2 of the Sustainable Development Goals, which seeks to end preventable deaths of new-borns and children under 5 years ... to at least as low as 12 and 25 per 1000 live births. [13]

## **Material And Methods**

### ***Data source***

Data utilised for this study were sourced from the ninth round of the Nigeria Demographic and Health Survey, NDHS, 2018. The NDHS was conducted between August and December 2018 by the National Population Commission (NPC) with technical support and assistance from the United States Agency for International Development (USAID) with ICF International. The 2018 NDHS was a nationwide survey conducted on women aged 15-49 years, where information about birth history and children under-five were ascertained and gathered. The 2018 NDHS utilized four (4) questionnaires: the Household Questionnaire, the Woman's Questionnaire, the Man's Questionnaire, and the Biomarker Questionnaire. The questionnaires, based on the DHS Program's standard Demographic and Health Survey (DHS-7) questionnaires, were adapted to reflect the population and health issues relevant to Nigeria. In specific terms, the birth recode dataset which focussed on mothers whose children were between the ages 0- 59 months to ascertain the predictive influence of the postnatal care service utilised by mothers during postnatal periods and child morbidity experience in the last five years that preceded the survey was used.

In this study, however, the birth recode dataset were extracted where individual women questionnaire was used. The women's questionnaire was used to collect information from all eligible women age 15-49. These women were asked questions on the following topics: background characteristics [including age, education, and media exposure]; birth history and child mortality; knowledge, use, and source of family planning methods; antenatal, delivery, and postnatal care; vaccinations and childhood illnesses [child morbidity]; breastfeeding and infant feeding practices; women's minimum dietary diversity; women's work and husbands' background characteristics, etc. However, for this study, only the socio-demographic characteristics of women, birth history, postnatal care information and child illness [child morbidity] that were extracted for the analysis in this study.

### ***Sample and sampling techniques***

The total number of women captured in the dataset was 127,545 of the NDHS. Of this number, a total number of 30,713 mothers whose children were under the age of five were selected as the sample size for this study. The sample for the 2018 NDHS was a stratified sample selected in two stages. In the first stage,

1,400 EAs were selected with probability proportional to EA size. In the second stage's selection, a fixed number of 30 households were selected in every cluster through equal probability systematic sampling, resulting in a total sample size of approximately 42,000 households. The household listing was carried out using tablets, and random selection of households was carried out through computer programming. Details of the sampling techniques can be found in the final report of 2018 NDHS.

### ***Variable Used in the Analysis***

#### *The Outcome Variables*

The outcome variables of interest in this study were: (i) postnatal care services utilisation, and (ii) child morbidity experienced by mothers. The postnatal care services utilised by the respondents was measured by the place of delivery of their babies. This was captured by the facility where a respondent was delivered of a baby in the last five years that preceded the survey. These facilities were ranged from home, respondent's home, other homes, other; public sector, government hospitals, government health centre, government post, other public sectors, private sector, private hospitals/clinics to other private sectors. These facilities were further re-categorised into traditional {0} or modern {1}. It is traditional if a respondent indicated that she was delivered of a baby either at home, respondent's home, other homes or any other place rather than a modern facility. And modern, if a respondent signified that she was delivered of a baby either in the public sector, government health centre, government health post, other public sectors, private sector, private hospitals/clinics, or any other private sector.

Child morbidity, on the other hand, was measured by the experience of any under-five disease diagnosed. These were captured by series of questions which ranged from whether children under the age of five had been diagnosed of diarrhoea recently; have had a fever in the last two weeks; have had a cough in the last two weeks; had short rapid breaths; had a problem in the chest or blocked or running nose and severe; or had mild or moderate anaemia level. The responses were all in either yes (1) or no (0). It is "yes" a respondent had experienced the disease diagnosed during the period indicated and "no" if the respondent did not have the experience of such disease of under-five in the period. Respondents' responses were further re-grouped as no child morbidity {0} if there was no disease diagnosed with under-five children, and child morbidity {1} if a respondent had ever had the experience of any disease.

#### *The Independent/Explanatory Variables*

The selection of the explanatory variables in this study was guided by Anderson-Newman's [14] Model of healthcare utilisation which proposed that the utilisation of any healthcare facility by an individual is determined by three factors, namely: the predisposing factors, enabling factors, and the need factor. However, only the variables related to the predisposing factors and the enabling factors were included in the analysis of this study. The *predisposing factors* are the socio-economic *cum* cultural traits of individuals that precede their health conditions and statuses such as region, age, educational level, and location. This study factored into the analysis the region of the respondent [South-West, South-East, South-South, North-West, North-East, North-Central], age, educational level [nor formal education, primary, secondary, tertiary], residence [rural/urban]. This study also factored in the ethnicity [Yoruba, Igbo, Hausa, The Minority] of the

respondent, the number of children-born [0-3, 4-6, 7+] as the *enabling factors* for PNC services utilization and child morbidity; while the *need factor is the* most immediate cause of health care service utilisation. Table 1 presents the summary of the measurements and definition of both the dependent and independent variables as used in the study.

**Table 1: Measurement, definition, variables and codes**

Variables	Definitions	Measurement	Code
<b>Dependent variable:</b>			
a) Postnatal care service utilised	<i>Measured by the place of delivery of babies -</i>	<b>Traditional</b> {home, respondent home, other homes, other}  <b>Modern</b> {public sector, government hospitals, government health centre, government health post, other public sectors, private sector, private hospitals/clinics, other private sectors}	0= <b>Traditional</b>  1= <b>Modern</b>
b) Child morbidity	Children under-five ever-diagnosed of any disease?	<b>Not diagnosed of any disease</b>  <b>Diagnosed of any disease</b> {had diarrhoea recently, had a fever in the last two weeks, had a cough in last two weeks, short rapid breaths, a problem in the chest or blocked or running nose and severe, mild or moderate anaemia level}	0 = No child morbidity  1 = Child morbidity
<b>Main Independent variables:</b>			
Region	The six geo-political zones in Nigeria represent the regions	South West, South-South, South East, North Central, North East and North West	1 = South West 2 = South South 3 = South East 4 = North Central 5 = North East 6 = North West
PNC service utilization	Place of delivery of respondents' babies	<b>Traditional</b> {home, respondent's home, other homes, other}  <b>Modern</b> {public sector, government hospital, government health centre, government health post, other public sectors, private sector, private hospital/clinic, other private sectors}	0 = <b>Traditional</b>  1 = <b>Modern</b>
<b>Socio-demographics variables:</b>			
Age in the 5-year group	Age in years	15 - 19; 20 - 24; 25 - 29; 30 - 34; 35 - 39; 40 - 44; 45 - 49	1 = 15 - 19; 2 = 20 - 24 3 = 25 - 29; 4 = 30 - 34 5 = 35 - 39; 6 = 40 - 44 7 = 45 - 49
Residence	Place of residence	Urban, rural	1 = Urban; 2 = Rural
Educational level	Highest educational attainment	No formal education, Primary, Secondary, Tertiary {any school attended other than primary and secondary}	1 = No formal education 2 = Primary; 3 = Secondary 4 = Tertiary
Religion	Membership of any religious groups	Catholic, Other Christians, Islam, Traditionalist	1 = Catholic 2 = Other Christians 3 = Islam 4 = Traditionalist
Ethnicity	Membership of the major and minority ethnic group	Yoruba, Igbo, Hausa, The Minority (Ijaw, Kanuri, Tiv, Igala, Kalabari, etc.)	1 = Yoruba; 2 = Igbo

			3 = Hausa; 4 = The Minority
Number of children	Number of children ever-born by the respondents	Measured at continuous but regroup as 0 - 3 children; 4 - 6 children; 7+ children	1 = 0 - 3; 2 = 4 - 6; 3 = 7+

### ***Data Management and Analysis***

After the extraction of relevant variables suitable for the analysis of this study as described in Table 1, the data were further cleaned and recoded for appropriate statistical analysis. However, both univariate, bivariate and multivariate statistical tools were used. With the aid of the Statistical Package for Social Sciences (SPSS version 21), descriptive and chi-square test were used to analyse the socio-demographic profiles of the respondents as well as the PNC services utilisation. To predict the likelihood of child morbidity, logistic regression was used to analyse and predict the likelihood of the regions and PNC service utilisation [traditional or modern health care facilities] on child morbidity experienced by women immediately after delivery as well as determining the predictive influence of mothers' socio-demographic variables on child morbidity (whether a child under the age of five developed any health condition or not).

### **Ethical Considerations**

Ethical approval was sought from the DHS Program archivist, and the permission to download the dataset was granted on the 7<sup>th</sup> November 2019 via [https://www.dhsprogram.com/data/dataset\\_admin/login\\_main.cfm](https://www.dhsprogram.com/data/dataset_admin/login_main.cfm). All ethical standards prescribed by DHS in the use of the dataset were strictly applied in this study.

## **Results**

### *Socio-demographic characteristics of the respondents*

Table 2 presents the socio-demographic characteristics of the respondents, which ranged from the region (geo-political zones), age, residence, educational level, religion, ethnicity and the number of children ever-born by the respondents. However, it was revealed that North West region has the highest proportion of the respondents (29.1%), followed by those in North East (21.1%), and North Central (17.6%), while among those in the South East region has the highest proportion of respondents (11.5%) in the southern part of the country when compared to other categories of respondents.

Table 2  
Distribution of respondents by socio-demographic characteristics

<b>Demographic variables</b>	<b>Frequency (n = 30713)</b>	<b>Percentage (%)</b>
<b>Region</b>	5403	17.6
North-Central	6481	21.1
North-East	8934	29.1
North-West	3545	11.5
South-East	3021	9.8
South-South	3329	10.8
South-West		
<b>Age in the 5-year group (Mean = 29.54 ± 6.77)</b>	1286	4.2
15–19	5960	19.4
20–24	8660	28.2
25–29	6963	22.7
30–34	4915	16.0
35–39	2171	7.1
40–44	758	2.5
45–49		
<b>Residence</b>	10851	35.3
Urban	19862	64.7
Rural		
<b>Educational level</b>	13527	44.0
No education	4776	15.6
Primary	9913	32.3
Secondary	2497	8.1
Tertiary		
<b>Religion</b>	2744	8.9
Catholic	9594	31.2
Other Christian	18113	59.0
Islam	262	0.9
Traditionalist		

<b>Demographic variables</b>	<b>Frequency (n = 30713)</b>	<b>Percentage (%)</b>
<b>Ethnicity</b>	3037	9.9
Yoruba	4200	13.7
Igbo	12460	40.6
Hausa	11016	35.9
The Minorities		
<b>Number of children ever-born</b>	14434	47.0
0–3	10696	34.8
4–6	5583	18.2
7+		

*Regional differences in PNC services utilisation in Nigeria*

Table 3 simultaneously examines the distribution of respondents by PNC services utilised and their regions while also exploring the association between regions, socio-demographic characteristics and PNC services utilised (traditional or modern).

Table 3  
Association between Regions, socio-demographic characteristics and PNC services utilisation in Nigeria

Variables	PNC Services Utilisation ( <i>n</i> = 30,713)		Chi-square DF p-value
	Modern (%)	Traditional (%)	
<b>Region</b>	2528 (20.3)	801 (4.4)	$\chi^2 = 7411.046$
South West	1362 (10.9)	1659 (9.1)	DF = 5
South-South	2865 (23.0)	680 (3.7)	P = 0.000
South East	2746 (22.0)	2657 (14.6)	
North Central	1621 (13.0)	4860 (26.6)	
North East	13 54 (10.9)	7580 (41.6)	
North West			
<b>Age in 5-year groups</b>	391 (3.1)	895 (4.9)	$\chi^2 = 211.851$
15–19	2102 (16.8)	3858 (21.2)	DF = 6
20–24	3609 (28.9)	5051 (27.7)	P = 0.000
25–29	3102 (24.2)	3861 (21.2)	
30–34	2163 (17.3)	2752 (15.1)	
35–39	846 (6.8)	1325 (7.3)	
40–44	263 (2.1)	495 (2.7)	
45–49			
<b>Residence</b>	6638 (53.2)	4213 (23.1)	$\chi^2 = 2938.521$
Urban	5838 (46.8)	14024 (76.9)	DF = 1
Rural			P = 0.000

Significant at  $p < 0.05^*$

Variables	PNC Services Utilisation ( <i>n</i> = 30,713)		Chi-square DF p-value
	Modern (%)	Traditional (%)	
<b>Education</b>	1939 (15.5)	11588 (63.5)	$\chi^2 = 8427.927$
No education	1992 (16.0)	2784 (15.3)	DF = 3
Primary	6361 (51.0)	3552 (19.5)	P = 0.000
Secondary	2184 (17.5)	313 (1.7)	
Tertiary			
<b>Religion</b>	1968 (15.8)	776 (4.3)	$\chi^2 = 4486.880$
Catholic	5837 (46.8)	3757 (20.6)	DF = 3
Other Christians	4609 (36.9)	13504 (74.0)	P = 0.000
Islam	62 (0.5)	200 (1.1)	
Traditionalist			
<b>Ethnicity</b>	2314 (18.5)	723 (4.0)	$\chi^2 = 7265.647$
Yoruba	3402 (27.3)	798 (4.4)	DF = 3
Igbo	2147 (17.2)	10313 (56.5)	P = 0.000
Hausa	4613 (37.0)	6403 (35.1)	
The Minorities			
<b>Number of children</b>	7129 (57.1)	7305 (40.1)	$\chi^2 = 1293.965$
0–3 children	4127 (33.1)	6569 (36.0)	DF = 2
4–6 children	1220 (9.8)	4363 (23.9)	P = 0.000
7 + children			
Significant at $p < 0.05^*$			

It was reported that about two-fifth of those in the North West utilised traditional PNC services (being the highest), while those in the southeast has the highest proportion of women using modern health care

facilities for PNC services. It was also found that there is a statistically significant relationship between region and PNC services utilisation ( $\chi^2 = 7411.046$ , DF = 5,  $p < 0.05$ ).

Further analysis of the relationship between socio-demographic characteristics and PNC services utilisation shows that there are statistically significant relationship between age in 5-year groups ( $\chi^2 = 211.851$ , DF = 6,  $p < 0.05$ ), residence ( $\chi^2 = 2938.521$ , DF = 1,  $p < 0.05$ ), education ( $\chi^2 = 8427.93$ , DF = 3,  $p < 0.05$ ), religion ( $\chi^2 = 4486.880$ , DF = 3,  $p < 0.05$ ), ethnicity ( $\chi^2 = 7265.647$ , DF = 3,  $p < 0.05$ ), number of children ( $\chi^2 = 1293.965$ , DF = 2,  $p < 0.05$ ) and PNC service utilisation. It also means that there are significant differences in the use of either modern or traditional PNC service utilisation across the categories of socio-demographic characteristics of the respondents.

#### *Association between regions, PNC service utilisation and child morbidity in Nigeria*

To determine the predictive influence of regions and PNC service utilized by women of reproductive age on child morbidity, Table 4 presents the results of the logistic regression at two models. While the first model was used to explore the predictive influence of regions and PNC utilized on child morbidity, model 2 included socio-demographic variables of the respondents as confounders to examine the net effects of the variables on child morbidity.

In the first model, however, there is a statistically significant association between the region and the type of PNC service utilized by women on child morbidity. The odds of those who were in the South-South (OR = 1.46), South East (OR = 1.50), North Central (OR = 1.13), North East (OR = 2.31) and North West (OR = 1.35) are far above those in the South West region. Those in the North East have the highest odds of child morbidity than other regions.

Table 4

Logistic regression analysis predicting child morbidity from regions, PNC facilities utilised and socio-demographic variables of the respondents in Nigeria

Variables	Child morbidity (column %)		Model 1	Model 2
	NO (%)	YES (%)	OR [95% CI for Exp (B)]	AOR [95% CI for Exp (B)]
<b>Region</b>	2033 (13.1)	1296 (8.5)	-	-
South West (RC)		1492 (9.8)	1.456** [1.316–1.611]	1.352** [1.178–1.552]
South-South	1529 (9.8)	1727 (11.4)	1.503** [1.365–1.654]	1.303* [1.093–1.552]
South East	1818 (11.7)	2316 (15.3)	1.130* [1.033–1.235]	.976 [.862–1.105]
North Central	3087 (19.8)	3983 (26.3)	2.305** [2.107–2.521]	1.835** [1.603–2.100]
North East		4344 (28.7)	1.345** [1.233–1.468]	1.013 [.880–1.165]
North West	2498 (16.1)			
	4590 (29.5)			
<b>PNC Service Utilized</b>	6816 (43.8)	5660 (37.3)	-	-
Modern (RC)		9498 (62.7)	1.177** [1.116–1.241]	1.079* [1.018–1.142]
Traditional	8739 (56.2)			
<b>Age in 5-year groups</b>	594 (3.8)	692 (4.6)		-
15–19 (RC)	2945 (18.9)	3015 (19.9)		.908 [.804–1.027]
20–24		4253 (28.1)		.875* [.773 – .990]
25–29	4407 (28.3)	3367 (22.2)		.832* [.729 – .948]
30–34	3596 (23.1)	2420 (16.0)		.823* [.715 – .948]
35–39		1038 (6.8)		.716** [.612 – .839]
40–44	2495 (16.0)	373 (2.5)		.738* [.605 – .899]
45–49	1133 (7.3)			
	385 (7.3)			
<b>Residence</b>	5965 (38.3)	4886 (32.2)		-
Urban (RC)		10272 (67.8)		1.140** [1.079–1.203]
Rural	9590 (61.7)			

Significant at  $p < 0.01^{**}$  or  $p < 0.05^{*}$ ; RC = Reference Category; PNC = Postnatal Care; OR = Odds Ratio; AOR = Adjusted Odds Ratio; Number of Observation = 30,713

Variables	Child morbidity (column %)		Model 1	Model 2
	NO (%)	YES (%)	OR [95% CI for Exp (B)]	AOR [95% CI for Exp (B)]
<b>Education</b>	6445 (41.4)	7082 (46.7)		-
No education (RC)	2290 (14.7)	2486 (16.4)		1.144** [1.063–1.231]
	5282 (34.0)			
	1538 (9.9)			
Primary		4631 (30.6)		1.007 [.937–1.083]
Secondary		959 (6.3)		.807** [.725 – .899]
Tertiary				
<b>Religion</b>	1498 (9.6)	1246 (8.2)		-
Catholic (RC)	5095 (32.8)	4499 (29.7)		1.088 [.993–1.192]
Other Christians	8795 (56.5)	9318 (61.5)		1.115* [1.000–1.243]
Islam	167 (1.1)	95 (0.6)		.635* [.485 – .832]
Traditionalist				
<b>Ethnicity</b>	1882 (12.1)	1155 (7.6)		-
Yoruba (RC)	2185 (14.0)	2015 (13.3)		1.200* [1.007–1.429]
Igbo	5937 (38.2)	6523 (43.0)		1.243* [1.080–1.430]
Hausa	5551 (35.7)	5465 (36.1)		1.093 [.962 -1.241]
The Minorities				

Significant at  $p < 0.01^{**}$  or  $p < 0.05^{*}$ ; RC = Reference Category; PNC = Postnatal Care; OR = Odds Ratio; AOR = Adjusted Odds Ratio; Number of Observation = 30,713

Variables	Child morbidity (column %)		Model 1	Model 2
	NO (%)	YES (%)	OR [95% CI for Exp (B)]	AOR [95% CI for Exp (B)]
<b>Number of children</b>	7558 (48.6)	6876 (45.4)		-
0–3 children (RC)		5382 (34.8)		1.066* [1.003–1.133]
4–6 children	5414 (34.8)	3000 (19.8)		1.260** [1.151–1.379]
7 + children	2583 (16.6)			
<i>Chi-Square</i>			659.172	169.363
<i>Degree of freedom</i>			6	18
<i>-2Log likelihood</i>			41912.955	41743.592
<i>Cox &amp; Snell R Square</i>			.021	.027
<i>Nagelkerke R Square</i>			.028	.035
Significant at $p < 0.01^{**}$ or $p < 0.05^*$ ; RC = Reference Category; PNC = Postnatal Care; OR = Odds Ratio; AOR = Adjusted Odds Ratio; Number of Observation = 30,713				

This shows that there are variations in the prevalence of child morbidity across the regions in Nigeria with the North East having the highest odds. In the same vein, those who resided in the rural areas at the time of the survey are observed to be 1.2 times more likely to experience child morbidity than those in the urban centre. This suggests that the place of residence of the respondents can have a significant influence on child morbidity.

In the second model when the socio-demographic variables of the respondents were factored into the analysis, the statistical significance influence of the region on child morbidity persisted though with a drop in the propensity especially with those in North Central and North West which had no statistically significant influence on child morbidity. On the rural-urban dichotomy, although statistically significantly associated with child morbidity, there is a drop compared to the first model when socio-demographic characteristics of the respondents were not included in the model.

Further analysis revealed that the age of the respondents is statistically associated with child morbidity. Those who are in the age categories of 25 and above are found to be less likely to experience child morbidity than those between 15–19 years. This may be largely due to the fact that as the mother advance in age, the management of under-five children relative to morbidity increases with age which those in the lower categories of age may not have the capacity.

Relative to the influence of residence on child morbidity, there is a statistically significant association between residence and child morbidity. Those who resided in the rural areas of Nigeria are 1.14 times more likely to experience child morbidity than those in the urban centre. The education of the respondents is indeed fundamental to child morbidity. While those who had attained primary educational level are 1.14 times more likely to experience child morbidity than those who did not attend any formal education, those with tertiary educational level are 19.3% less likely to experience child morbidity than those without any formal education.

Religious adherent is also found to be critical among the study population on child morbidity. Those who adherents of Islam are 1.11 times more likely to experience child morbidity than those who were followers of Catholic, while the traditionalists were 36.5% less likely to experience child morbidity when compared to those in the reference category. It then means that the risk of child morbidity is higher among the followers of Islamic religion than those in other categories of religion.

Ethnicity and child morbidity are also statistically significantly related. Those who are Igbo and Hausa, in particular, are 20% and 24.3% more likely to experience child morbidity than those in Yoruba. Although there is no statistically significant association between those in the minorities and child morbidity in Nigeria, yet variations existed in the experience of child morbidity in the country.

On the account of the number of children a respondent has, there is a statistically significant association between those who had between four and six children, seven children and above and child morbidity in the country. For example, those who had between 4–6 children and 7 + children are 6.6% and 26% more likely to experience child morbidity than those who had between zero and three children. This suggests that as the number of children increases, the more likely a woman exposes to the risk of child morbidity in the country.

## **Discussion Of Findings**

The study found that North West region has the highest proportion of respondents, followed by those in North East, and North Central with those in the South-South having the least proportion in the country. This simply suggests that women who were within the reproductive age in the northern part of Nigeria are far higher than those in the southern regions. It was also revealed that the respondents' age was 30 years. This is by implication suggesting that majority of those who were captured in the survey were young women who were also reproductively active enough to have children and may require postnatal care services.

Finding also indicated that majority of the respondents resided in rural areas while only a few of the respondents were urban residents. This simply means that there are more rural areas in the country than the urban centres which may inform the nature of postnatal care facilities that will be available for the teeming population of mothers in the country. Findings on the educational attainment of the respondents showed that almost half of them did not have formal education, while the highest proportion of the respondents that had attended formal education was those who had secondary school certificate compared to just one in ten who had tertiary educational attainment. This further explains the fact that the majority of the women in the survey were not residing in the urban centres where there are diverse opportunities to attain higher educational level than the rural areas.

It further revealed that majority of the respondents were adherents of Islam. This is true of the fact that majority of the respondents were from northern Nigeria depicting the fact that majority of the adherents of Islam in the country are Hausa who are also domiciled in the northern part of the country when compared to the southern part of Nigeria where there are more adherents of Christianity.

Earlier studies have shown that there are variations in the use of PNC services by regions [12] based on sociocultural differences and some factors affecting PNC service utilization in some facilities [4, 11, 14]. This study also found that PNC services utilization varied significantly by regions and socio-demographic characteristics with those in the North East and North West using more of the traditional facilities more than the modern health care facilities for PNC services. The variations in the use of modern and traditional PNC services with the North East and North West having higher percentages of traditional PNC service utilization than the modern PNC facilities could be attributed to some forms of barriers identified by Ugboanusi and colleagues [4] that there are barriers of transportation and poor wealth quintiles to the use of PHC facilities. Takai *et al.* [15] found that there are factors affecting the under-utilisation of modern PNC services which Somefun and Ibisomi [14] succinctly mentioned that distance could be a barrier. Hence, mothers may not have an option other than the use of traditional facilities at their disposal.

Findings revealed that there is significant variation in the likelihood of child morbidity by regions in Nigeria. While the findings indicated that those in the South-South, South East, North Central and North West are 1.5, 1.5, 1.3 and 1.3 times more likely to experience child morbidity than those in the South West region respectively, mothers in the North East are two times more likely to experience child morbidity than those in the South West. This suggests that the type of PNC facilities a mother uses for both ANC and PNC services are strong predictors of child morbidity, which consequently accounted for the increase in child deaths per 1000 live births as demonstrated in the report of NPC and ICF International [2] in Nigeria.

It was also revealed that the socio-demographic characteristics of the respondents predicted child morbidity in Nigeria. This finding corroborates the work of Sotunsa *et al.*[7] who found that there is a significant relationship between postnatal care utilization and maternal and child mortality in a population. This means that this can affect child morbidity. It further explains the Anderson-Newman Model [13] that socio-demographic factors of the respondents are the predisposing factors of health condition that influence the use of PNC service utilization.

## Conclusion And Recommendations

Following the logic of this research, it can be deduced that the occurrence of any disease in Nigeria population among the children under the age of five varied significantly by regions as well as the nature of PNC service utilized. Although other variables such as the socio-demographic characteristics of the respondents influenced the variation to some extent, it is quite observable that the variations that existed in PNC service utilization by regions have greatly influenced the disparities in the prevalence of child morbidity across the regions in the country. As such, there should be region-specific programmes of action that will facilitate the use of modern PNC service utilization across all the regions.

Given the findings of the study, the following are recommended for the health policymakers to take action:

- There should region-specific sensitization of women on the need for the use of modern health care for both antenatal care and postnatal care services to reduce the high prevalence of child morbidity across the regions.
- The government and other stakeholders in the health sector should assist the provision of adequate modern health care facilities across the regions while laying more emphasis on maternal and child health care facilities.
- The provision of Primary Health Care (PHC) facilities should be encouraged in all communities as this remains the closest health care facilities for easy accessibility for mother and children to combat child morbidity that informed child deaths.

## Abbreviations

PNC: Postnatal care; NDHS: Nigeria Demographic Health Survey; WHO: World Health Organisation; LMICs: Low and Middle-Income Countries; PHC: Primary Health Care; MCH: Maternal and child health; NHIS: National Health Insurance Scheme; NPC: National Population Commission.

## Declarations

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### Authors' contributions

EU conceptualised and designed the study. EU and ADA contributed to reviewing the literature for the study. ADA analysed and interpreted the data. ADA and EU wrote the manuscript. EU had final responsibility to submit the manuscript for publication. All authors critically reviewed and approved the final draft of the study.

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### Availability of data and materials

Data for this study were sourced from the Nigeria Demographic Health Survey and are available at [https://www.dhsprogram.com/data/dataset\\_admin/login\\_main.cfm](https://www.dhsprogram.com/data/dataset_admin/login_main.cfm).

### Ethics approval and consent to participate

For NDHS data, the process of seeking ethical approval has been described by ICF International institutional review board, who are responsible for providing the dataset for any DHS program. Thus, all ethical process was followed in seeking permission to use the dataset provided by the DHS program. The description of the

consent process is available at:

<https://www.dhsprogram.com/What-We-Do/Protecting-the-Privacy-of-DHSSurvey-Respondents.cfm>.

## Consent for publication

Not applicable.

## Competing interests

The authors declare that they have no competing interests.

## Author Details

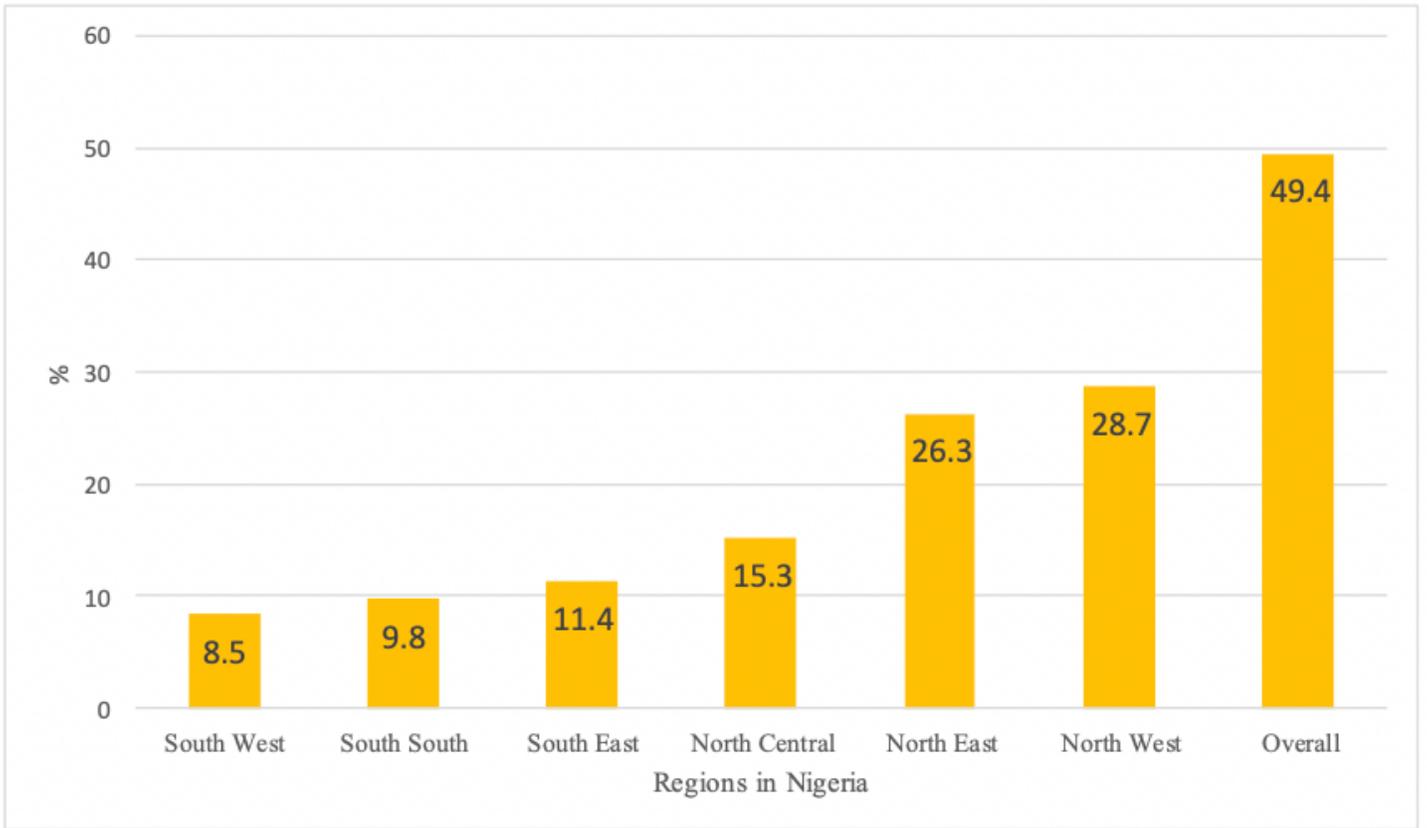
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## Figures



**Figure 1**

Percentage distribution of child morbidity by regions in Nigeria