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Research Article

Prevalence, Trend Analysis and Factor Associated With Diarrheal Diseases among under 5 Children in Nigeria: Evidence From 2008 to 2018 Demographic Health Surveys

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ABSTRACT

Background: Diarrhea is the second most common propagator of childhood mortality in most developing countries, including Nigeria. Diarrheal infection is majorly transmitted through fecal-contaminated food and water and can also be transmitted from one person to another due to poor hygienic practices, This study aimed to estimate the prevalence, trend analysis, and factors associated with diarrhoeal diseases among under-five children in Nigeria over the last ten years.

Method: Data from 2008, 2013 and 2018 Nigeria Demographic and Health Survey (NDHS) were pooled for the analysis used in this study. Data were obtained from a total weighted sample of 94,121 children under-5 years through a stratified two-stage cluster sampling approach. A multivariable logistic regression model was used to assess the predictors of diarrheal disease at 95% confidence interval (CIs) with computed adjusted odds ratios (aORs).

Results: The weighted prevalence of diarrheal diseases among under-5 children in Nigeria were 10% for 2008 and 2013 increased to 13% in 2018. Associated factors with under-5 children's diarrheal diseases includes children aged 12-23 months [aOR=1.79, 95% CI= 1.66-1.94], 24-35 months [aOR=1.19, 95% CI= 1.09-1.31], 36-47 months [aOR=0.67, 95% CI= 0.60-0.75] and 48-59 months [aOR=0.51, 95% CI= 0.45-0.57] of having diarrhea disease compared to children 0-11 months. Furthermore, children under five who had not received measles vaccination [aOR=1.62, 95% CI= 1.51-1.75] and those who had not received DPT3 vaccination [aOR=0.82, 95% CI= 0.76-0.88] were found to be associated with diarrheal diseases among under-5 children. Other associated factors includes mothers age, mothers' education level, fathers' educational level, types of house's floor used, household size, number of under-5 children, region and household wealth index after controlling for confounders.

Conclusion: The prevalence of diarrheal diseases among under-5 years in Nigeria was low and had increased in 2018 by 3%. There is a need to design and promote household and community-level water, sanitation and hygiene programs, especially in the country's northern region. Government should design robust, community-based social and behavioural change communication strategies and programs with solid elements of awareness rising at household and community levels.

Keywords: Diarrheal diseases, Under 5 children, Prevalence, Factors, Nigeria

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INTRODUCTION

Diarrhea, also known as 'loose motions', is a symptom of an infected intestinal tract, usually caused by various harmful pathogens, including viruses, bacteria, and parasites [1]. Diarrheal infection is majorly transmitted through fecal-contaminated food and water and can also be transmitted from one person to another due to poor hygienic practices [2]. Diarrhea is characterized by a sudden onset of watery stool ejection, about 3 times a day [2], resulting from decreased water absorption or increased water secretion in the bowels, a typical diarrhea case can span up to 2 weeks [3]. Claiming about 1.8 million lives of children under the age of 5 annually, with most of them being affiliated with Africa and South Asia [4,5,6,7], diarrhea has been identified to be the second most common propagator of childhood mortality in most developing countries, inclusive of Nigeria [2]. A statistical report from WHO and UNICEF in 2009 also revealed that diarrhea accounted for a higher mortality rate globally than Acquired Immune Deficiency Syndrome (AIDS), Measles, and Malaria did altogether [8]. In Nigeria, the disease has been identified to be responsible for about 16% of deaths of children annually, amounting to a figure of over 151,700 child deaths [9]. Furthermore, national studies reveal that 10% of the total population of children in Nigeria less than 5 years of age is battling this disease [10]. Also, the disparities in the prevalence of this disease vary regionally, as the northern parts of Nigeria record the greatest prevalence rate of the disease (37.1%), and the southern region records the closest figures to that (21.1%) [7].

Many risk factors have been attributed to Nigeria's abnormally high percentage of diarrhea prevalence. These risk factors range from poor living and housing conditions, crowded environments, and poverty, to unhygienic water storage procedures, unsanitary water sources (like rivers or streams in less refined areas), improper sewage treatment and disposal methods, and improper disposal of refuse [11]. Furthermore, a lack of access to clean water and a sanitary environment increases the chances of diarrhea contraction [12]. Statistically, about 780 million people worldwide lack access to clean and hygienic water, while about 2.5 billion persons live under unsanitary conditions [13]. Based on these facts, it is safe to conclude that diarrheal diseases have become a malady that requires appropriate and immediate interventions, as it hampers the efficacy of the United Nations Sustainable Development Goals (SDGs) in Nigeria [5].

Additionally, acts of negligence by pregnant and nursing mothers have also contributed to risk factors of diarrhea, further heightening the spread of this disease [14]. Practices such as improper hand hygiene, partial breastfeeding of children, inadequate supervision and maternal care of infants, malnutrition, and immunodeficiency of children can lead to a myriad of health complications, including diarrhea [15]. Most often than not, diarrhea cases among children are not severe, as long as the lost fluid is replaced at the very onset of the disease. However, if fluids are not replaced, it might lead to severe outcomes such as malnutrition, dehydration, and death in worse cases [2].

Therefore, this work used the available DHS dataset to estimate the prevalence, trend analysis, and factors associated with diarrhoeal diseases among under-five children in Nigeria over the last ten years.

METHODS

Data Source

Data from the 2008, 2013 and 2018 Nigeria Demographic and Health Survey (NDHS), a nationally representative, cross-sectional descriptive survey that covered the entire population residing in the six geo-political zones in the country, were used for the analysis. The study used a stratified multi-stage cluster sampling approach to create a population-based sample. In accordance with the probability proportional to the size of the Enumerated Areas (EAs), 888 (2008), 904 (2013), 1,400 (2018) clusters/EAs were selected respectively in the first stage of both surveys. The second stage involved a methodical selection of 41, 45, 30 households from each cluster/EA of the survey.

Interviews with women aged 15 to 49 years old were used to collect information about their children under five years for the study. With over 95% response rate in each of the survey rounds, 28,647 (2008), 31,482 (2013), 33,924 (2018) respondents were interviewed successfully, respectively. The combined study data were derived from 2008, 2013 and 2018 (n= 94,121) rounds of the DHS in Nigeria that provided information on basic demographic and health indicators, including childhood illnesses like diarrheal, immunization, breastfeeding, and health services use for children, among others. The NDHS is a five-year interval nationwide survey with a representative sample of children. The children recode files of all these survey rounds were used. The sampling, pretesting, and the general methodology of 2008, 2013, 2018 NDHS has been published elsewhere (1, 2, 3). Through the USAID-funded MEASURE DHS programme in Nigeria, ICF International provided technical and financial assistance to the National Population Commission, which implemented the survey with support from other agencies.

Variable Selection and Measurement

Outcome Variables: The study outcome variable was diarrheal outcome among under-five children at the study time. This variable was derived from the question "had diarrhea recently" in the dataset; the four responses were: "No", "Yes, last 24 hours", "Yes, last two weeks", "Don't know". For the study purpose, diarrheal outcome was recoded into "No =0" for those who had no diarrheal, "Yes =1" for those who had diarrheal.

Explanatory Variables: Twenty-four independent variables categorized into the child, parental and household socioeconomic factors were utilized in the study based on thorough literature review and datasets availability; the variables are listed in Table 1.

Statistical Analysis

The authors conducted descriptive and multivariate analyses. First, we used sample weighting to adjust for disproportionate sampling and non-response. For the descriptive analysis, Pearson's chi-square test was used to identify the association between the outcome variable and the independent variables in their categories. Study variables with a p-value <0.05 at the bivariate analysis level were considered for inclusion into the model. Lastly, we used a multivariable logistic regression model to assess the factors associated with the diarrheal disease among under-five children at 95% confidence interval (CIs) with computed adjusted odds ratios (aORs). All the study data were analyzed using IBM SPSS version 25.

Table 1: Definition of independent variables used in the analysis.

Variable	Definition and coding
Child Factors	
Child's sex	1=Male; 2=Female
Child's age	1=0-12 months; 2=13-24 months; 3=≥25 months
Number of under 5 children	1=0-1; 2 = 2-3; 3=≥ 4
Currently breastfeeding	0=No; 1=Yes
Ever vaccinated	0=No; 1=Yes
Measles vaccination	0=No; 1=Yes
Vitamin A supplication	0=No; 1=Yes
DPT 3 vaccination	0=No; 1=Yes
Polio3 Vaccination	0=No; 1=Yes
Parental Factor	
Mother's age	1=<18; 2=18-24; 3=25-34; 4=≥35
Mother's educational level	0=No Education; 1=Primary; 2=Secondary; 3=Higher
Mother's employment status	0=Not Working; 1=Working
Father's age	1=<18; 2=18-24; 3=25-34; 4=≥35
Father's educational level	0=No Education; 1=Primary; 2=Secondary; 3=Higher
Father's employment status	0=Not working; 1=Working
Household & socio-economic Factors	
Type of floor of the house	0= unimproved; 1= improved
Toilet facility	0= unimproved; 1= improved
Water source	0= unimproved; 1= improved
Stool disposal	0= unsafe; 1 = safe
Time to get water source	1= On premise; 2=<30 minutes; 3=>30 minutes
Household size	1=1-4; 2=≥5
Wealth index	1=Poor; 2=Middle; 3=Rich
Residence	1=Urban; 2=Rural
Region	1= North Central; 2= North East; 3= North West; 4= South East; 5= South South; 6 = South West

Ethical Approval

The dataset used for this research are freely available in the public domain and can be downloaded from https://dhsprogram.com/data/available-datasets.cfm. For confidentiality reasons, specific characteristics that could be used to identify participants in the study were excluded. However, MEASURE DHS/ICF International permitted the authors to use the datasets as secondary studies. Prior to the survey, the DHS project gained ethical approval from the National Health Research Ethics Committee of Nigeria and the ICF ethics committee.

RESULTS

Trend of diarrhea diseases among under-five children in Nigeria: 2008-2018

Figure 1 presents a pictorial view of the trend of diarrhea among under-five children in Nigeria. Generally, it was found that the prevalence of diarrhea diseases increased from 10.3% in 2008 to 12.8% in 2018.

Selected characteristics of under-five children in Nigeria: 2008-2018

Table 2 presents participants characteristics and bivariate analysis of the association between the explanatory variables and diarrhea among children under-five in Nigeria from 2008 to 2018. The proportion of diarrhea among children under five years in Nigeria was 11.3% (9447 children), with a 95% CI of 11.0% - 11.5%.

Based on child factors, the proportion of diarrhea was highest among children within the 12-23 months age group (18.0%) and lowest within the 48-59 months age group (6.0%). Also, the proportion of diarrhea was higher among children who had never been vaccinated (12.7%), had no measles vaccination (13.3%), and had not received DPT3 vaccination. Based on parental factors, the proportion of diarrhea was higher among children whose mothers were below the age of 18 years (17.8%), had no education (14.1%) and not working (11.5%). Also, a higher proportion of diarrhea was among children whose fathers were between ages 18-24 years (14.5%), had no education (14.0%) and not working (12.3%). Furthermore, based on household socioeconomic factors, a higher proportion of diarrhea was recorded among children who lived in the rural area (12.4%), who lived in the northeast region (22.6%), had a poor wealth index (14.5%). Also, a higher proportion of diarrhea was found among under-five children who lived in a house with an unimproved floor (14.7%), an unimproved toilet facility (13.7%), unimproved water source (13.1%). Bivariate analysis indicated that child factors (child's age, current breastfeeding status, vaccination statuses), parental factors (age, educational level, work status) and household socioeconomic factors (household size, region, place of residence, wealth index, type of floor of the house, toilet facility, water source, stool disposal) were significant risk factors for diarrhea among children under-five in Nigeria.

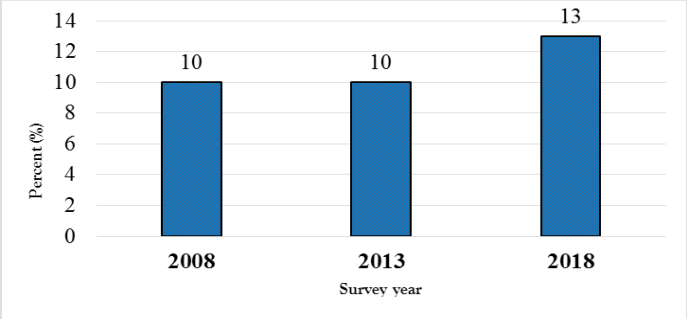

Figure 1: Prevalence of diarrhoea among under 5 in Nigeria (2008 – 2018).

Table 2: Characteristics of the weighted sample population (NDHS 2008-2018).

	Children in the Study	Under 5 Children with Diarrhea		P-value
	n	n	%	
Child's sex				0.323
Male	42376	4813	11.4	
Female	41590	4634	11.1	
Child's age (in months)				0.001*
0-11	18300	2270	12.4	
12-23	16750	3015	18.0	
24-35	15485	1873	12.1	
36-47	16224	1285	7.9	
48-59	15593	930	6.0	
Number of under-five children				0.001*
0-1	22564	20095	10.9	
2-3	50416	44910	10.9	
>4	10986	9514	13.4	
Currently breastfeeding				0.001*
Yes	36507	3606	9.9	
No	47459	5842	12.3	
Ever vaccinated				0.001*
Yes	34902	4022	11.5	
No	16827	2137	12.7	
Measles vaccination				0.001*
Yes	27424	2624	9.6	
No	43560	5796	13.3	
Vitamin A supplication				0.001*
Yes	28666	3171	11.1	
No	41638	5185	12.5	
DPT 3 vaccination				0.001*
Yes	26046	2433	9.3	
No	45014	6008	13.3	
Polio3 Vaccination				0.768
Yes	30070	3568	11.9	
No	40592	4846	11.9	
Mother's age				0.001*
<18	1059	188	17.8	
18-24	19170	2611	13.6	
25-34	42554	4452	10.5	
≥ 35	21181	2195	10.4	
Mother's education				0.001*
No education	38737	5459	14.1	
Primary	15826	1673	10.6	

Secondary	23577	1977	8.4	
Higher	5825	337	5.8	
Mother's employment status				0.094
Not working	15735	1790	11.4	
Working	59265	6463	10.9	
Father's age				0.001*
18-24	1390	202	14.5	
25-34	22007	2640	12.0	
≥ 35	57022	6207	10.9	
Father's education				0.001*
No education	30059	4223	14.0	
Primary	14590	1523	10.4	
Secondary	25207	2302	9.1	
Higher	10766	973	9.0	
Current Father's employment status				0.001*
Not working	26982	3318	12.3	
Working	56692	6107	10.8	
Type of floor of the house				0.001*
Improved	50099	4532	9.0	
Unimproved	32897	4827	14.7	
Toilet facility				0.001*
Improved	42693	4462	10.5	
Unimproved	17795	2436	13.7	
Water source				0.001*
Improved	49504	5162	10.4	
Unimproved	30845	4039	13.1	
Youngest Child's Stool disposal				0.001*
Safe	41961	5029	12.0	
Unsafe	28895	3061	10.6	
Time to get water source				0.337
On premise	21948	2430	11.1	
<30 minutes	43563	4912	11.3	
>30 minutes	16972	1960	11.5	
Household size				0.029*
1-4	20784	2252	10.8	
≥5	63181	7194	11.4	
Place of residence				0.001*
Urban	30025	2737	9.1	
Rural	53940	6709	12.4	
Region				0.001*
North Central	11591	974	8.4	
North East	14476	3270	22.6	
North West	28652	3464	12.1	
South East	8161	581	7.1	
South South	8725	421	4.8	
South West	12360	736	6.0	
Wealth Index				0.001*
Poor	37375	5419	14.5	
Middle	16501	1766	10.7	
Rich	30089	2262	7.5	

*statistically significant at p-value <0.05

Factors associated with diarrhea diseases among under-five children in Nigeria: 2008-2018

As shown in Table 3, three models of multivariate analysis were conducted. Variables in the bivariate analysis; child factors, parental factors, and household socioeconomic factors that were statistically significant at p-value <0.05 were further considered in the multiple logistic regression models of the adjusted odds ratios. In the first model, child factors associated with diarrhea diseases were examined, and the second model examined the relationship between parental factors and diarrhea disease. In contrast, the third model examined the household and socioeconomic factors associated with diarrhea diseases.

The first model in the Table 3 shows that children aged 12-23 months and 24-35 months had higher odds [aOR=1.79, 95% CI= 1.66-1.94], [aOR=1.19, 95% CI= 1.09-1.31] while children 36-47 months and 48-59 months had lower odd [aOR=0.67, 95% CI= 0.60-0.75] [aOR=0.51, 95% CI= 0.45-0.57] of having diarrhea disease compared to children 0-11 months. Further, children under five who had not received measles vaccination had higher odds [aOR=1.62, 95% CI= 1.51-1.75] of having diarrhea than those who had measles vaccination. Children who had not received DPT3 vaccination had lower odds of getting diarrhea than those vaccinated [aOR=0.82, 95% CI= 0.76-0.88].

Table 3: Multivariate Logistic Regression of Factors Associated to Diarrhea among under-five children in Nigeria (NDHS 2008 -2018).

Variables	NDHS 2008 – 2018 Pooled data		
	Model I	Model II	Model III
	AOR (95%CI)	AOR (95%CI)	AOR (95%CI)
Child's age (in months)			
0-11	1		
12-23	1.79 (1.66-1.94)*		
24-35	1.19 (1.09-1.31)*		
36-47	0.67 (0.60-0.75)*		
48-59	0.51 (0.45-0.57)*		
Currently breastfeeding			
Yes	1		
No	0.98 (0.92-1.06)		
Ever vaccinated			
Yes	1		
No	0.98 (0.91-1.04)		
Measles vaccination			
Yes	1		
No	1.62 (1.51-1.75)*		
Vitamin A supplication			
Yes	1		
No	0.96 (0.91-1.04)		
Polio3 Vaccination			
Yes	1		
No	0.82 (0.76-0.88)*		
Mother's age			
<18		1	
18-24		0.86 (0.71-1.03)	
25-34		0.69 (0.57-0.83)*	
≥ 35		0.66 (0.54-0.79)*	
Mother's education			
No education		1	
Primary		0.78 (0.73-0.83)*	
Secondary		0.58 (0.54-0.63)*	
Higher		0.38 (0.33-0.44)*	
Father's age			
18-24		1	
25-34		0.95 (0.81-1.12)	
≥ 35		0.91 (0.77-1.07)	
Father's education			
No education		1	
Primary		0.86 (0.80-0.92)*	

Secondary		0.86 (0.81-0.92)*	
Higher		1.05 (0.96-1.16)	
Current Father's employment status			
Working		1	
Not working		0915 (0.66-1.25)	
Type of floor of the house			
Improved			1
Unimproved			1.17 (1.09-1.26)*
Toilet facility			
Improved			1
Unimproved			1.00 (0.94-1.07)
Water source			
Improved			1
Unimproved			1.01 (0.94-1.07)
Youngest Child's Stool disposal			
Safe			1
Unsafe			1.01 (0.94-1.08)
Household size			
1-4			1
≥5			0.85 (0.79-0.91)*
Number of under five children			
0-1			1
2-3			0.83 (0.77-0.89)*
>4			0.84 (0.077-0.93)*
Place of residence			
Urban			1
Rural			0.97 (0.89-1.05)
Region			
North Central			1
North East			2.82 (2.48-3.19)*
North West			1.33 (1.17-1.51)*
South East			0.75 (0.64-0.88)*
South South			0.54 (0.45-0.64)*
South West			0.81 (0.69-0.95)*
Wealth Index			
Rich			1
Middle			1.25 (1.12-1.39)*
Poor			1.16 (1.05-1.27)*

The results of the second model show that children under five whose mother are aged 25-34 years and more than 35 years had lower odds [aOR=0.69, 95% CI= 0.57-0.83], [aOR=0.66, 95% CI= 0.54-0.79] of having diarrhea disease compared to mothers less than 18 years. Also, there are lower odd of diarrhea disease among children under five whose mother had primary, secondary and higher level of education [aOR=0.78, 95% CI= 0.73-0.83], [aOR=0.58, 95% CI= 0.54-0.63], [aOR=0.38, 95% CI= 0.33-0.44] compared to those with no education. Similarly, children under five whose father had primary or secondary education had lower odd of diarrhea disease [aOR=0.86, 95% CI= 0.80-0.92], [aOR=0.81, 95% CI= 0.81-0.92] compared to those with no education.

A further result from the third model shows that children under five living in a household with unimproved floor type had higher odds of diarrhea disease [aOR=1.17, 95% CI= 1.09-1.26] than those with an improved floor. Also, children under five from more than five households had lower odds of diarrhea disease [aOR=0.85, 95% CI= 0.79-0.91] compared to those with less than four household sizes. Furthermore, children under 5 five whose households had middle and poor wealth indexes had higher diarrhoea odds [aOR=1.25, 95% CI= 1.12-1.32] [aOR=1.16, 95% CI= 1.05-1.27] compared to those with rich wealth index. Finally, children under 5 five from the northeast and north-west had higher odds of having diarrhea [aOR=2.82, 95% CI= 2.48-3.19] [aOR=1.33, 95% CI= 1.17-1.51] compared to those from north-central region, however, children from south-east, south-south and south-west had lower odd of diarrhea disease [aOR=0.75, 95% CI= 0.64-0.88] [aOR=0.54, 95% CI= 0.45-0.64] [aOR=0.81, 95% CI= 0.69-0.95].

DISCUSSION

Findings from these analyses highlighted child's age in months as one of the factors leading to the occurrence of diarrhea in Nigeria.

Results showed that children aged 12-23 months had a higher percentage of diarrheal patients than children aged 0-11, 24-35, 36-47, and 48-59 months, respectively. This is easily reconcilable with the fact that children within this age are being weaned and are gaining some independence from their mothers. Children take time to get accustomed to the demands of weaning; which implies some level of independence from their mothers [16]. The 12-23 month age range seems to be like a transition phase for kids, as they transcend from a period of intensive maternal care to a period of slight independence when they become more exposed to the environment [17]. Consequently, their immune system becomes more open to certain illnesses, which they would need some time to adjust.

Furthermore, feedback from the study population revealed that breastfeeding increases children's resistance to diarrhea. This was evident from the statistics, as only 9.9% of children being breastfed had diarrhea, in comparison to the 12.3% figure of children not being breastfed. There's a great chance that this could be because breastfeeding offers essential antibodies to kids, which boosts their immunity, and reduces their chances of contracting diseases [18]. Breastfeeding prevents the incidence of diarrhea as well as its implications on the gut, as breast milk has protective functions for a child's gastrointestinal system [19]. Child vaccination also has protective functions for a child's health, as it boosts body immunity [20]. The results of our study confirm that vaccinated children contracted diarrhea at a lesser rate than unvaccinated children. Furthermore, only 9.6% of children who were vaccinated against measles contracted diarrhea, compared to 13.3% of those who were not vaccinated, contracted it. This proves that children without measles vaccination have a greater chance of contracting diarrhea than those that have been vaccinated [21]. A similar study in the Democratic Republic of Congo, Pakistan, and India revealed that diarrhea occurrence fell by 22%, 19%, and 12% respectively, following the vaccination of children against measles [22].

The study results also observed that DPT 3 vaccination plays a role in the prevention of diarrhea; about 9.3% of children vaccinated contracted diarrhea, whereas 13.3% of children who were not vaccinated contracted the disease. Furthermore, kids whose diets were supplemented with vitamin A had lesser cases of diarrhea (11.1%), compared to kids whose diets were not supplemented with vitamin A (12.5%). Vitamin A supplementation in children's diet counters mild watery diarrhoea and reduces the chances of contracting the disease during the summer seasons [23].

Some parental factors such as mother's age, mother's education, father's age, education, and occupation also determined the rate of diarrhea incidence. Results from the study showed that mothers below the age of 18 had a much higher percentage of diarrhea occurrence amongst their children (17.8%), compared to mothers within the age ranges of 18-24 (13.6%), 25-34 (10.5%), and 35+ (10.4%). The higher the age ranges of mothers, the lower the cases of diarrhea amongst their kids. This is quite logical, given that the older one gets, the more experienced and informed they get. Hence, older female populations are more knowledgeable and versed in child illnesses, their means of prevention, and cure, than younger female populations [24]. Also, the results from our study show that the educational level of mothers determines the rate at which their children contract diarrhea; mothers who attained tertiary education level had the lowest percentage of children with diarrhea (5.8%), compared to mothers who had secondary education (8.4%), mothers who had primary education (10.6%), and mothers with no education at all (14.1%). This is because there is a strong link between parents' level of education and their ward's health outcome [25], as more learned caregivers have more knowledge about disease prevention and cure than unlearned ones [26]. This was also the same case in the research carried out on fathers' education level, as fathers with no education, primary education, secondary education, and tertiary education each had 14.0, 10.4, 9.1, and 9.0 percentages of children with diarrhea respectively. Also, as in the case of the mothers, the study shows that younger fathers had a greater percentage of diarrhea-affected children than older ones. There also exists a connection between a father's employment status and the health outcome of his ward, as a man is primarily the breadwinner in a typical African home [27]. Results from the study revealed that unemployed fathers had a diarrhea occurrence of 12.3% among their wards, whereas employed fathers had a percentage of 10.8 among their wards. The employment status of caregivers in a family determines the wealth index of that family, and transitively, the standard of living of that family [28]. Families with a higher wealth index seem to be at a better standpoint of preventing diarrhea, than families with a lower wealth index, as shown by our results.

On an investigation into other factors that determine diarrhea occurrence among children, it was gathered that household factors such as household size, type of floor of the house, toilet facility, as well water source all play a role. Smaller families ranging from 1-4 persons had a 10.8% diarrhea incidence among their wards, whereas larger households, ranging from 5 persons and above, had 11.4% rate of occurrence of the disease. Also, according to statistics from the study, improved toilet facilities, house flooring, and water source all gave lower figures for diarrhea occurrence compared to the reverse scenario. In addition to this, safe disposal of the fecal deposit of the youngest child in a family was also shown to reduce diarrhea incidence. Due to modernization and better quality of life in urban areas, they had a notably lower incidence of diarrhoeal disease (9.1%), compared to the rural area (12.4%). An analysis of the diarrhea occurrence in the six geopolitical zones in Nigeria showed that the Northeast region had the highest occurrence (22.6%), followed by the Northwest region (12.1%), the North Central (8.4%), Southeast (7.1%), Southwest (6.0%), and then the South-south (4.8%). The prevalence of the diarrhea disease in the Northern part of Nigeria is chiefly due to the limited availability of clean drinking water [29].

STUDY LIMITATIONS

Since the survey was cross-sectional, causal relationships between variables of interest could not be determined. There might be some level of recall bias in the study and non-response could also influence the accuracy of the data.

CONCLUSION

The prevalence of diarrheal diseases among under-5 years in Nigeria was low and had increased in 2018 by 3% and associated factors were child's age, measles and polio vaccination, mother's age and education, father's education, types of house's floor, household size, number of under-5 children, region and household wealth index. There is a need to design and promote house hold and community-level water, sanitation and hygiene programs especially in the northern region of the country. Government should design robust, community-based social and behavioral change communication strategies and programs with strong elements of awareness raising at household and community levels.

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AVAILABILITY OF DATA AND MATERIALS

Data for this study were sourced from Demographic Health Survey (DHS) and available here: https://www.dhsprogram.com/data/available-datasets.cfm

AUTHORS' CONTRIBUTIONS

AA, PCA & AB conceptualized the study, prepared the study design, reviewed literature, analyzed data, and wrote the results. All authors critically reviewed the manuscript for its intellectual content. AB had final responsibility to submit for publication.

COMPETING INTERESTS

The authors declare that they have no competing interests.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethics approval for this study was not required since the data is secondary and is available in the public domain. More details regarding DHS data and ethical standards are available at: http://goo.gl/ny8T6X

CONSENT FOR PUBLICATION

No consent to publish was needed for this study as we did not use any details, images or videos related to individual participants. In addition, data used is available in the public domain.

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