

Determinants of childhood diarrhea among under-five year old children in Nigeria: A population-based study using the 2013 demographic and health survey data

Anselm S. Berde¹, Sıddıka Songül Yalçın², Hilal Özcebe³, Sarp Üner⁴, Özge Karadağ-Caman⁴

¹Africa Unit for Transdisciplinary Health Research, North-West University (Potchefstroom Campus), South Africa; ²Division of Social Pediatrics, Department of Pediatrics ³Department of Public Health, Hacettepe University Faculty of Medicine; ⁴Institute of Public Health, Hacettepe University, Ankara, Turkey. E-mail: get2anselm@gmail.com

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The study aims to identify socioeconomic, demographic, environmental and child baseline factors associated with Childhood Diarrhea (CD) among under-five year old children in Nigeria. We utilized cross-sectional data from the 2013 Nigerian Demographic and Health Survey (NDHS). The study covered 18,047 mother-baby pairs. The key outcome variable was CD. Chi-square tests and binary logistic regression were used to test for association between CD and related factors. The prevalence of CD was 12.6%. In the multivariate analysis, the following factors were significantly associated with increased risk of CD; younger mother's age, household size of seven and above, unsafe disposal of child's last fecal matter and younger child's age. Also, children living in all geopolitical zones as compared to the South South geopolitical zone had significantly higher risk of CD. Interventions such as information, education and communication programs on hygiene and sanitation aimed at reducing CD in Nigeria should focus more on groups at risk for CD highlighted in our study.

Key words: childhood diarrhea, Nigeria, mothers, children, under-five.

Diarrhea leads to the loss of 525,000 children under five each year and is the second leading cause of death in children of this age group.¹ In Sub Saharan Africa (SSA), diarrhea is a major cause of morbidity and mortality among children aged less than five years old.²⁻³ Also, nutritional deficits caused by diarrhea affect children's fitness, cognition, growth and performance at school.⁴⁻⁵

The higher prevalence of Childhood Diarrhea (CD) recorded in developing countries like Nigeria could be attributed to lack of safe drinking water, sanitation, and hygiene, as well as the overall poorer health and nutritional status of children.⁶ Nigeria is among the top 15 countries with the highest number of diarrhea deaths in children under 5 and as of 2015, approximately 77,000 under 5 year old

Nigerian children died as a result of diarrhea diseases.⁷ CD is recognized as a significant public health problem in the country.

The World Health Organisation (WHO) and the United Nations Children's Fund (UNICEF) recognise diarrhea and pneumonia as the two major preventable causes of child death and have launched the integrated "Global Action Plan for the Prevention and Control of Pneumonia and Diarrhea (GAPPD)" with a goal of ending preventable child deaths from pneumonia or diarrhea by 2025.⁸ To achieve this goal, a focused, coordinated, flexible and integrated national action on diarrhea control by all countries is needed.

Previous studies have shown that the determinants of CD are multi-factorial in nature

and involve socioeconomic, demographic, child baseline factors and environmental conditions.^{2, 9-11} In Nigeria, identifying children at greatest risk of diarrhea will help in planning national action on diarrhea control, thus, helping to achieve the GAPPD goal of ending child deaths through diarrhea by 2025 in Nigeria.

This study purpose was to identify key factors associated with CD and to update on previous knowledge with regards to CD in Nigeria.

Material and Methods

Sample

The study utilized data from the 2013 Nigeria Demographic and Health Survey (NDHS), which is the fifth in the series of Demographic and Health Surveys conducted so far in Nigeria. The survey used as sampling frame the list of enumeration areas (EAs) prepared for the 2006 Population Census Nigeria. The sample was selected using a stratified three-stage cluster design consisting of 904 clusters; 372 in urban areas and 532 in rural areas. In the interviewed households, a total of 39,902 women aged 15-49 years were identified as eligible for individual interviews, and 98 percent of them were successfully interviewed. Further details of the sampling techniques and data collection method can be found in the country's DHS manual.¹² Analysis for this study was restricted to (1) de jure residents (2) singleton births (3) last-born children (4) under five years of age, (5) alive and (6) living with mother. The total sample size was 18,047. After accounting for sample weights, this corresponded to a sample size of 18,376.

Dependent Variable

Our outcome variable "CD" was defined as having diarrhea in the last two weeks preceding the survey and was expressed as a dichotomous variable with "category 1" for having diarrhea in the last two weeks preceding the survey and "category 0" for otherwise.

Independent Variables

The explanatory factors were grouped into socioeconomic and demographic factors, child baseline factors and environmental conditions.

(i) Socioeconomic and demographic variables: Mother's age was recoded into "15-19", "20-24", "25-29", "30-34" and "≥35" years. Mother's

education was categorized as "no education", "primary", and "secondary and above". Type of place of residence was categorized as urban or rural. Household size was recoded into "six or less" and "seven and above" persons. Number of children under five years in the household was categorized into "two or less" and "three and above". DHS wealth index was categorized as "poorest", "poorer", "middle", "richer" and "richest". The index was constructed using household asset data via a principal components analysis. In terms of region, all the six regions in the country were considered.

(ii) Child baseline variables: Sex of child was grouped into "male" and "female". Age of child was categorized into "five or less", "6-11", "12-23", "24-35", "36-47", and "48-59" months.

(iii) Environmental conditions: Source of drinking water was categorized into "improved" and "non-improved source". Toilet facilities were classified into "improved not-shared", "improved-shared," and "non-improved" (Supplementary data). Disposal of the child's last faecal matter was classified into "safe" and "not safe" (Supplementary data).

Statistical Analysis

Factors associated with CD were analysed using Chi-square tests. Rate of diarrhea and distribution by different independent variables were reported as weighted percentages and then further assessed by binary logistic regression. Bivariate analyses were done with the chi-square tests and variables significant at the 0.25 level were included in the multivariate analysis. The multivariate analysis accounted for the sample design and sample weight using Statistical Package for Social Sciences (SPSS version 21) complex sample analysis method.

Ethics

The study was approved by the Ethics Committee of ICF International at Calverton, MD, USA and by the Nigeria National Health Research Ethics Committee. Informed consent was obtained from study participants prior to participation in the survey. Permission to use and analyze the data set was obtained by registering the study on the Demographic and Health Survey (DHS) website.

Results

Characteristics of the sample

Table I. Sample Characteristics, Nigeria, DHS 2013.

	N†	%†
Mother's age (years)		
15-19	1101	6.1
20-24	3496	19.4
25-29	4768	26.4
30-34	3795	21.0
≥35	4887	27.1
Mother's education		
No education	8232	45.6
Primary	3648	20.2
Secondary and above	6167	34.2
Type of place of residence		
Urban	6151	34.1
Rural	11896	65.9
Household size		
≤6 persons	9932	55.0
≥7 persons	8115	45.0
Number of children under-five in household		
≤2	13105	72.6
≥3	4942	27.4
Wealth Index		
Poorest	3932	21.8
Poorer	4079	22.6
Middle	3607	20.0
Richer	3385	18.8
Richest	3044	16.9
Region		
North Central	2794	15.5
North East	3597	19.9
North West	5589	31.0
South East	1506	8.3
South South	2164	12.0
South West	2397	13.3
Sex of child		
Male	9117	50.5
Female	8930	49.5
Age of child in months		
≤5	2830	15.7
6-11	3121	17.3
12-23	5371	29.8
24-35	3577	19.8
36-47	1936	10.7
48-59	1212	6.7
Source of drinking water		
Improved source	10153	56.4
Non-improved source	7862	43.6
Toilet Facility		
Improved, not shared	5696	31.6
Shared facility	3225	17.9
Non-improved	9083	50.4
Disposal of the child's last faecal matter		
Safe	10142	58.2
Unsafe	7281	41.8

† Unweighted.

Table II. Rates of Childhood Diarrhea Among Children Under Five Years of Age in Nigeria - Nigeria, DHS 2013.

Characteristics	Had diarrhea		
	n†	%†	p value
Mother's age (years)			
15-19	181	15.7	<0.001
20-24	527	14.6	
25-29	634	13.0	
30-34	444	11.5	
>=35	523	10.7	
Mother's education			
No education	1251	14.2	<0.001
Primary	429	12.3	
Secondary and above	629	10.4	
Type of place of residence			
Urban	760	11.5	0.001
Rural	1549	13.2	
Household size			
≤6 persons	1186	11.5	<0.001
≥7 persons	1123	13.9	
Number of under-five children in household			
≤2	1572	11.8	<0.001
≥3	736	14.7	
Wealth Index			
Poorest	631	14.9	<0.001
Poorer	592	14.5	
Middle	426	12.2	
Richer	363	11.0	
Richest	296	9.0	
Region			
North Central	254	9.8	<0.001
North East	793	25.5	
North West	750	11.1	
South East	192	12.7	
South South	102	5.9	
South West	218	8.1	
Sex of child			
Male	1146	12.4	0.527
Female	1163	12.7	
Age of child in months			
≤5	160	5.7	<0.001
6-11	515	16.4	
12-23	938	17.2	
24-35	476	12.9	
36-47	167	8.3	
48-59	52	4.1	
Source of drinking water			
Improved source	1250	11.9	0.001
Non-improved source	1057	13.5	
Toilet Facility			
Improved, not shared	721	12.5	0.267
Shared facility	433	11.9	
Non-improved	1153	12.9	
Disposal of the child's last faecal matter			
Safe	1325	12.1	0.025
Unsafe	896	13.2	

† Weighted

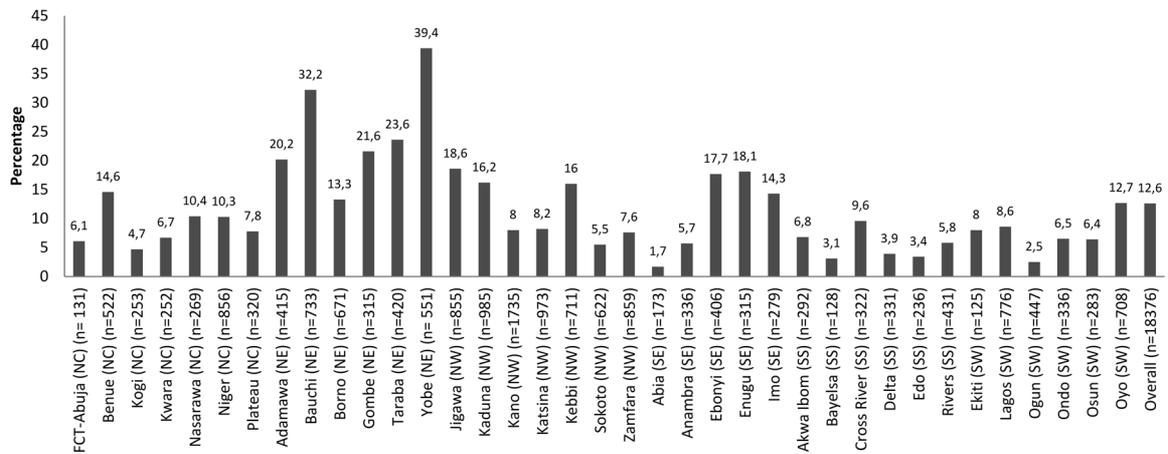


Fig. 1. Prevalence of childhood diarrhea in children under 5 years.

Table III. Risk Factors for Childhood Diarrhea Among Under-Five Children in Nigeria - Nigeria, DHS 2013.

Characteristic	Childhood Diarrhea			Childhood Diarrhea		
	OR	95% CI	p value	AOR	95% CI	p value
Mother's age (years)						
15-19	1.55	(1.25-1.92)	<0.001	1.36	(1.06-1.75)	0.015
20-24	1.42	(1.22-1.66)	<0.001	1.28	(1.07-1.52)	0.006
25-29	1.25	(1.07-1.46)	0.005	1.20	(1.03-1.41)	0.023
30-34	1.09	(0.93-1.27)	0.289	1.07	(0.91-1.25)	0.448
>=35	ref	ref	ref	ref	ref	ref
Mother's education						
No education	1.43	(1.24-1.65)	<0.001	1.01	(0.83-1.23)	0.904
Primary	1.22	(1.04-1.43)	0.016	1.09	(0.90-1.32)	0.373
Secondary and above	ref	ref	ref	ref	ref	ref
Type of place of residence						
Urban	ref	ref	ref	ref	ref	ref
Rural	1.17	(1.01-1.36)	0.042	0.87	(0.73-1.04)	0.128
Household size						
≤6 persons	ref	ref	ref	ref	ref	ref
≥7 persons	1.23	(1.10-1.38)	<0.001	1.14	(1.00-1.31)	0.045
Number of under-five children in household						
≤2	ref	ref	ref	ref	ref	ref
≥3	1.29	(1.16-1.45)	<0.001	1.09	(0.95-1.25)	0.225
Wealth Index						
Poorest	1.77	(1.42-2.21)	<0.001	1.09	(0.79-1.50)	0.601
Poorer	1.71	(1.40-2.10)	<0.001	1.22	(0.91-1.64)	0.189
Middle	1.40	(1.13-1.74)	0.002	1.12	(0.85-1.48)	0.412
Richer	1.25	(1.01-1.54)	0.037	1.08	(0.86-1.35)	0.496
Richest	ref	ref	ref	ref	ref	ref
Region						
North Central	1.74	(1.26-2.40)	0.001	1.64	(1.19-2.25)	0.003
North East	5.51	(4.18-7.27)	<0.001	5.76	(4.27-7.79)	<0.001
North West	2.01	(1.53-2.65)	<0.001	2.07	(1.50-2.83)	<0.001
South East	2.34	(1.65-3.31)	<0.001	2.22	(1.59-3.10)	<0.001
South West	1.43	(1.03-1.98)	0.031	1.56	(1.12-2.17)	0.008
South South	ref	ref	ref	ref	ref	ref
Age of child in months						
≤5	1.41	(0.95-2.08)	0.085	1.27	(0.83-1.96)	0.274
6-11	4.62	(3.22-6.63)	<0.001	4.47	(2.99-6.67)	<0.001
12-23	4.88	(3.38-7.05)	<0.001	4.80	(3.18-7.26)	<0.001
24-35	3.50	(2.37-5.15)	<0.001	3.63	(2.36-5.57)	<0.001
36-47	2.14	(1.46-3.14)	<0.001	2.24	(1.48-3.41)	<0.001
48-59	ref	ref	ref	ref	ref	ref
Source of drinking water						
Non-improved source	ref	ref	ref	ref	ref	ref
Improved source	0.87	(0.74-1.01)	0.061	0.99	(0.86-1.16)	0.968
Disposal of the child's last faecal matter						
Unsafe	1.11	(0.96-1.28)	0.158	1.32	(1.13-1.54)	<0.001
Safe	ref	ref	ref	ref	ref	ref

OR=Odds ratio, AOR=Adjusted Odds ratio, CI=Confidence interval, ref: Reference category

Table I gives the sample characteristics, the highest proportion of mothers (27.1%) were in the age group 35 and above years, 45.6% of mothers had no education, while 65.9% of mothers lived in rural area. A greater percentage of mothers (22.6%) belonged to the poorer wealth quintile and the highest proportion of mothers were from the North West (31.0%). Male and female children were more or less equal in the sample.

Prevalence of childhood diarrhea

The overall prevalence of CD in Nigeria was 12.6%. According to states in Nigeria the highest prevalence of CD was reported in Yobe (39.4%), Bauchi (32.2%), and Taraba (23.6%) while the lowest prevalence of CD was seen in Abia (1.7%) Ogun (2.5%) and Bayelsa (3.1) (Fig. 1).

Bivariate analyses

CD cases were significantly higher among the following: children whose mothers were in the age group 15-19 years, children whose mothers had no education, rural residence, household size of ≥ 7 persons, ≥ 3 number of under-five children in the household, poorest wealth index, North East region, children aged 12-23 months, non improved source of drinking water and unsafe disposal of child's last fecal matter (Table II).

Multivariate Analysis

Results from the multivariate analysis (Table III) indicated that mother's age, household size, region, child's age and disposal of the child's last fecal matter were the determinants of CD.

The following were associated with significantly higher likelihood of CD; younger mothers' age, larger household size, all geopolitical zones as compared to the South South geopolitical zone, younger child's age and unsafe disposal of child's last fecal matter which was associated with a 1.32 times higher odds of having CD as compared to safe disposal of child's last faecal matter.

Discussion

This study identified key factors associated with CD in Nigeria. The overall prevalence of CD in the study was 12.6%. The prevalence of CD showed variability among states in Nigeria, with states like Yobe (39.4%) and Bauchi (32.2%) recording higher prevalence

of CD and states like Abia (1.7%) and Ogun (2.5%) recording lower prevalence. Geopolitical zone was significantly associated with CD. The odds of CD were relatively high in all the geopolitical zones as compared to the South South. Regional differences in CD could be attributed to regional differences in educational, industrial and financial development within regions. Parents from regions with higher educational levels and industrial development are likely to have more health-care knowledge which could effectively lower CD associations.¹³

We also found statistically significant associations between CD and the following variables; mother's age, household size, age of child and disposal method of child's last fecal matter.

In the current study, the odds of CD was higher for children with mothers in the younger age group as compared to mothers, who were 35 years old and above. The study finding was in consonance with what was observed in a previous study done in Nepal; in the study, diarrhea was found to be more common among the children of younger mothers aged 16 - 25 years.¹⁴ A possible explanation for the observed association between younger mothers age and increased risk of CD might be explained by the fact that younger mothers lack prior experience in childcare, hygiene and feeding practices.¹⁵

Household size was also another significant predictor of CD. Children from households with seven or more members had higher likelihood of diarrhea as compared to children from smaller household sizes. This finding is in consonance with another study which was done in Kenya which showed that children belonging to household with big size had higher odds of CD as compared to children belonging to household with small size.¹⁰ Our finding with regards to household size and CD might be explained by the fact that big household size is more likely to be associated with poorer water handling practices, lower hygiene standards due to congestion as well as poorer socio economic status.

Also, this study found the likelihood of diarrhea to be higher among children within the age groups "6-11", "12-23", "24-35", and "36-37" months of age as compared to children, who were in the age range 48-59 months. In the current study, the prevalence of diarrhea peaked

at 12-23 months and then began to fall at 24-35 and 36-47 month of age. The pattern observed in our study is consistent with that of previous studies done in Ethiopia which showed that CD peaked at 12-23 months of age and began to fall after 24 months of age.¹¹ The higher risks observed at these ages could be attributed to the fact that children at these ages are either crawling or walking and can easily pick dirt or other contaminated objects for playing or eating.¹¹ Furthermore, the period of 6-11 months of age, is when most children start additional food.

Our study findings also revealed that disposal of child's last fecal matter had a strong influence on CD. Unsafe disposal of child's last fecal matter was associated with a higher likelihood of CD as compared to safe disposal. Our finding is in consonance with previous studies.¹⁶⁻¹⁸ The finding with regards CD and unsafe disposal of child's fecal matter may be due to direct fecal contamination of the child's hands or play areas, poor hygiene practices of caregivers or geophagy.¹⁹⁻²⁰

Although this study was conducted using a nationally representative sample data, there are some limitations that must be mentioned. One of the limitation of this study was that the findings were based on cross-sectional data and therefore caution must be exercised in making causal influence of the identified determinants of CD. Also, the study was a secondary analysis of data and some factors that might have effect on diarrhea morbidity were not accounted for.

The finding of factors associated with CD is of public health significance in Nigeria as CD is a major and preventable cause of death among children under five. For Nigeria to achieve the GAPPD goal of ending preventable child death from diarrhea by 2025, there is a need for public health interventions such as an information, education and communication (IEC) programs on sanitation and hygiene, these interventions should focus more on at risk groups of CD highlighted in our study.

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Supplementary data is available at:

<http://www.turkishjournalpediatrics.org/uploads/turkjped.2018.04.001.S1.pdf>

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