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Determinants of Diarrhea and Optimal Childcare among Under-Five Children in Nigeria: Insights from the 2013 Demographic and Health Survey

Kelechi Martins Nworie* **and Deborah Oyine Aluh**

University of Nigeria, Nigeria

***Corresponding author:** Kelechi Martins Nworie, University of Nigeria, Nigeria, Tel: +234 8063718781; E-mail: nworiekelechimartins@gmail.com

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Abstract

Background: Diarrhea in children is still a public health concern especially in developing countries. In under-five children, diarrhea often presents impairment in growth and development of children. In the present study, we assessed the prevalence of diarrhea and optimal childcare in under-five children in the Nigerian populace.

Method: Cross-sectional data obtained from the 2013 Nigeria Demographic and Health Survey (NDHS) was used for the study. Reproductive women of age 15-49 years were interviewed about socio-demographic factors, and a range of childcare. Prevalence of diarrhea was determined. Logistic regression analysis was used to assess association of diarrhea prevalence, as well as optimal childcare across different socio-demographic factors of children.

Results: The overall prevalence of diarrhea in under-five children in Nigeria was 10.3%. Prevalence was higher in children less than 2 years of age, 57%. Prevalence was also higher among children residing in rural areas and northern part of Nigeria. Other predictors of diarrhea in children included maternal education, source of drinking water, quality of toilet facility and household wealth. Concerning health practices, logistic regression analysis showed that place and region of residence, child's age, maternal education and household wealth were significant determinants of optimal childcare.

Conclusion: With regards to the predominant rate of diarrhea in children less than 5 years old and the attenuated optimal childcare among them, there is a need to facilitated concerted efforts towards effective and efficient public health interventions.

Keywords: Diarrhea; Pediatric; Health; Immune system

Introduction

Diarrhea is a common disease still presenting serious health problems in many parts of the world. It is common in developing countries occurring in about 1.7 to 5 billion people (mostly children) per year, with a mortality of 1.26 million in 2013 [1,2]. Infectious diarrhea continues to remain a major public health concern; it is rated second deadliest disease in children in developing countries with approximately 1.5 million deaths globally especially in Africa and Asia [3]. Diarrhea in under-5 may have a negative impact on both physical fitness and mental development of a child; it causes severe negative malnutrition and impairs cognitive functions resulting in poor school performances [4,5]. Diarrhea causes early childhood malnutrition, which subsequently reduces physical fitness and work capacity later in adulthood [4].

Poverty is a key indicator of high rate of infectious diarrhea in developing countries. This association stems from the conditions under which poor people live in; such as poor housing, overcrowding, unclean drinking water, unsanitary disposal of fecal waste (sanitation), dirt flocks, etc. Drinking unclean water is one of the most common causes of infectious diarrhea. Human feces contain a variety of potentially harmful human pathogens [6]; therefore improper disposal of fecal waste can lead to contamination of groundwater. This can result to a widespread of diarrhea infection in such communities, especially in the absence of adequate and efficient water purification system. Since children may not have a fully developed immune system; good nutrition in these individuals is very important for proper healthy functioning, and prevention of infectious disease e.g. diarrhea [7,8]. Deficiency of micronutrient is significantly associated with the proper functioning of the immune system [7]; hence, children with reduced level of zinc have increased frequencies of diarrhea, and diarrhea associated with fever [9].

Several studies have shown that improved access to clean drinking water and sanitation reduces risk of diarrhea [6]. Studies have highlighted that improving water and sanitation has a significant reduction in mortality rate associated with diarrheal disease [6,10]. Sanitation is a major strategy to disease prevention [11]. However, limitations to this arise from lack of access to clean water in many developing countries which can be solved by encouraging sanitation and sanitation behaviors.

In the present study, we determined the prevalence and predictors of diarrhea, and some health practices in the overall population. We also performed detailed analysis of their distribution within several categories in the Nigeria DHS report. The aim of this study is to alert and enlighten various non-governmental organizations, healthcare

providers, and health policy makers on appropriate target population for diarrhea prevention interventions.

Materials and Methods

Data source and study samples

The data for this study was obtained from the 2013 Nigeria DHS. The Nigeria DHS is a cross-sectional descriptive design program led by the USAID and implemented by the National Population Commission with technical assistance from ICF Macro International. The 2013 Nigeria DHS consists of nationally representative sample of 38,948 women aged 15-49 and 17,359 men aged 15-59 residing in 38,904 households [12]. Since the aim of this study was to examine the prevalence of diarrhea in under-5 children, children's data on diarrhea was obtained and used. Mothers of children less than five years of age were interviewed for their children's age, gender, household source of drinking water and quality of toilet facility, place and region of residence, incidence of diarrhea and household wealth index.

Diarrhea in children

For the indicator of diarrhea, mothers were asked to subjectively report if their children had frequent passage of watery stool at any time during the two-week period preceding the survey. The validity of this indicator is affected by the mother's perception of diarrhea as an illness and her capacity to recall the events. The main outcome of interest was prevalence of diarrhea in under-5 children.

Optimal childcare

The optimal practices assessed in the study included: treatment approach for diarrhea; feeding approach during diarrhea; and disposal of child's stool.

Ethical approval

Ethical approval for this study was obtained from the National Population Commission (NPC), Abuja, Nigeria. Further approval from respondents was not necessary because the respondents' data obtained was anonymous.

Statistical analysis

The prevalence of diarrhea in under-5 children along with 95% confidence intervals (CIs), were estimated for all explanatory variables. Logistic regression was used to predict association. All secondary analysis was performed using the Statistical Package for Social Sciences (SPSS) for windows v. 17 Chicago IL.

Results

Socio-demographic distribution of respondents is shown in Table 1. The dataset comprises a population of 28,950 children aged below 5 years. The mean age was 2 years. The most represented age group (age category: ≥ 2<5 years) comprised of 16,798 (58.0%) children. Only about 16,515 (57.1%) and 9,172 (31.7%) of the children had access to improved water sources and toilet facility respectively. Sixty-four percent of the children are rural dwellers. The proportion of children from poor and rich income households were 6,636 (22.9%) and 10,296 (35.6%) respectively.

Background characteristics	Percentage (%)	Sample size (n)
Age†		
<2 years	42	12152
≥ 2<5 years	58	16798
Sex		
Male	50.1	14509
Female	49.9	14440
Source of drinking water[1]		
Improved	57.1	16515
Not improved	42.8	12381
Toilet facility[2]		
Improved, not shared	31.7	9172
Shared[3]	19.2	5551
Non-improved	48.9	14141
Residence		
Urban	35.9	10403
Rural	64.1	18547
Region		
North	67.5	19538
South	32.5	9412
Maternal education		
No education	48.2	13945
Primary	19.2	5563
Secondary	26.6	7697
Post-secondary	6	1744
Household wealth status		
Poor	22.9	6636
Average	41.5	12017
Rich	35.6	10296
N	100	28950

†Only children below 5 years are included in the analysis.
[1]Categorical definition: Improved includes piped, public tap, borehole, protected well/spring, rainwater, bottled water; Non-improved includes unprotected well/spring, tanker truck, surface water, sachet water, other sources.
[2]categorical definitions: Improved includes flush to sewer/septic tank /pit latrine, VIP latrine, pit latrine with slab, compositing toilet; Non-improved includes flush not to sewer/septic tank/pit latrine, pit latrine without slab/open pit, bucket, hanging latrine, no facility/bush/field.
[3]Facilities would be considered improved if they were not shared by two or more households.

Table 1: Background characteristics of the study sample.

Table 2 shows the prevalence of diarrhea. The overall prevalence of diarrhea among under-5 children was 10.3% (N=2966, 95% CI: 9.23-11.45). Prevalence of diarrhea in children less than 2 years old was higher (57.0%, N=1692, 95% CI: 54.60-59.37).Children in households with access to only non-improved source of drinking water also had a higher prevalence (11.2%, N=1387, 95% CI: 9.59-12.98).Prevalence in the urban population was relatively lower (9.2%, N=958, 95% CI: 7.45-11.21) than that of the rural population (10.8%, N=2008, 95% CI: 9.48-12.24). Prevalence estimates for the two regions were 11.9% (N=2325, 95% CI: 10.61-13.29) and 6.9% (N=649, 95% CI: 5.07-9.13) for North and South respectively. Prevalence of diarrhea among children decreased consistently with increased maternal education. Highest prevalence was also recorded in children from poor households (12.5%, N=830, 95% CI: 10.33-14.94).

Background characteristics	Prevalence of diarrhea*		
	(%)	(n)	95% CI
Age†			
<2 years	57	1692	54.60-59.37
≥ 2<5 years	43	1274	40.26-45.77
Sex			
Male	10.2	1482	8.71-11.85
Female	10.3	1484	8.80-11.96
Source of drinking water[1]			
Improved	9.5	1569	8.09-11.06
Not improved	11.2	1387	9.59-12.98
Toilet facility[2]			
Improved, not shared	10.1	926	8.23-12.22
Shared[3]	9.3	516	6.94-12.14
Non-improved	10.7	1513	9.19-12.37
Residence			
Urban	9.2	958	7.45-11.21
Rural	10.8	2008	9.48-12.24
Region			
North	11.9	2325	10.61-13.29
South	6.9	649	5.07-9.13
Maternal education			
No education	11.7	1638	10.18-13.36
Primary	9.9	553	7.54-12.70
Secondary	8.8	677	6.78-11.9
Post-secondary	5.6	98	1.97-12.17
Household wealth status			
Poor	12.5	830	10.33-14.94
Average	11	1322	9.36-12.81
Rich	7.9	814	6.14-9.97
Total	10.3	2966	9.23-11.45

*Children with diarrhea in the two weeks preceding the survey.
†Only children below 5 years are included in the analysis.
[1]Categorical definition: Improved includes piped, public tap, borehole, protected well/spring, rainwater, bottled water; Non-improved includes unprotected well/spring, tanker truck, surface water, sachet water, other sources.
[2]Categorical definitions: Improved includes flush to sewer/septic tank /pit latrine, VIP latrine, pit latrine with slab, compositing toilet; Non-improved includes flush not to sewer/septic tank/pit latrine, pit latrine without slab/open pit, bucket, hanging latrine, no facility/bush/field.
[3]Facilities would be considered improved if they were not shared by two or more households.

Table 2: Prevalence of diarrhea by background characteristics.

Table 3 shows the distribution of optimal practice. The use of ORS or RHF for treatment during diarrhea was much common. Predominantly, less amount of liquid was given to children during diarrhea. However, more than half of the children had their stool disposed properly. The predictors of diarrhea among under-5 children are detailed in Table 4. Older aged children (aged: ≥ 2 ≤ 5 years) were significantly less likely to have diarrhea (OR: 0.42; CI: 0.42-0.46) as compared to younger children (age:<2 years).Place of residence is a strong predictor of diarrhea in children; when compared to urban, those residing in rural are more likely to have diarrhea (OR: 1.2; CI: 1.10-1.30). The effect of region of residence in predicting diarrhea in children was also significant. Another significant predictor of diarrhea was source of drinking water; when compared to children who drank water form improved sources, children who drank from non-improved sources were at a higher risk of having diarrhea (OR: 1.20; CI: 1.11-1.30).Other determinants of diarrhea were household wealth status and maternal education. Children in poor households were more likely to have diarrhea (OR: 1.67; 95% CI: 1.50-1.84) as compared to children in rich households. Lower levels of maternal education were associated with increased diarrhea among their children.

	Percentage of children	
Treatment of Diarrhea *N=2966	(%)	(95% CI)
Sought advice from health facility or provider[1]	28.9	27.3-30.6
Fluid from ORS packets or pre-packaged liquid	33.7	32.0-35.4
Recommended home fluids (RHF)	9.7	8.7-10.8
Either ORS or RHF	38.1	36.4-39.9
Antibiotic drugs	34.5	32.8-36.2
Ant-motility drugs	2.4	1.9-3.0
Zinc supplements	2.3	1.8-2.9
Intravenous solutions	0.3	0.1-0.6
Feeding during Diarrhea *N=2966		
More amount of liquid given	10.2	9.1-11.4
Less amount of liquid given	28.9	27.3-30.6
More amount of food given	2.3	1.8-2.9

Less amount of food given	24.4	22.9-26.0
Disposal of child's stool **N=19288		
Stool disposed properly[2]	59.4	58.7-60.1
Child used toilet or latrine	5.4	5.1-5.7
Put or rinsed into toilet or latrine	51.9	51.2-52.6
Buried in soil	2	1.8-2.2
Put or rinsed into drain or ditch	4.3	4.0-4.6
Thrown into garbage	24	23.4-24.6
Left in the open	6.8	6.5-7.2

*Number of children with diarrhea; **Number of children surveyed;
[1]Excludes pharmacy, chemist/PMS, shop, traditional practitioner, market, and others;
[2]Children's stools are considered to be disposed of safety if the child used a toilet or latrine, if the fecal matter was put or rinsed into a toilet or latrine, or if it was buried;
ORS: oral rehydration salt.

Table 3: Optimal practices: treatment of diarrhea, feeding during diarrhea, and disposal of stool.

Background characteristics	**OR**	**95% CI**
Age[†]		
<2 years	1	
≥ 2 ≤ 5 years	0.42**	0.40-0.46
Sex		
Male	1	
Female	1.01	0.93-1.09
Source of drinking water[1]		
Improved	1	
Not improved	1.20**	1.11-1.30
Toilet facility[2]		
Improved, not shared	1	
Shared[3]	0.91	0.82-1.02
Non-improved	1.07	0.98-1.16
Residence		
Urban	1	
Rural	1.20**	1.10-1.30
Region		
North	1	
South	0.55**	0.50-0.60
Maternal education		
Post-secondary	1	
Secondary	1.62**	1.30-2.02
Primary	1.85**	1.49-2.32
No education	2.24**	1.81-2.76
Household wealth status		
Rich	1	
Average	1.44**	1.31-1.58
Poor	1.67**	1.50-1.84

**p<0.001; *p<0.05
[†]Only children below 5 years are included in the analysis.
[1]Categorical definition: Improved includes piped, public tap, borehole, protected well/spring, rainwater, bottled water; Non-improved includes unprotected well/spring, tanker truck, surface water, sachet water, other sources.
[2]Categorical definitions: Improved includes flush to sewer/septic tank /pit latrine, VIP latrine, pit latrine with slab, compositing toilet; Non-improved includes flush not to sewer/septic tank/pit latrine, pit latrine without slab/open pit, bucket, hanging latrine, no facility/bush/field.
[3]Facilities would be considered improved if they were not shared by two or more households.

Table 4: Overall prevalence of diarrhea by background characteristics.

Tables 5 and 6 represent the correlates of some optimal practices. In order to avoid a cumbersome data, we have only explained a few categorical outcomes.

Background characteristics	**OR**	**95% CI**
Age†		
< 2 years	1	
≥ 2 <5 years	0.78*	0.67-0.92
Sex		
Male	1	
Female	1.05	0.90-1.23
Residence		
Urban	1	
Rural	0.65**	0.55-0.77
Zone		
North	1	
South	1.12	0.93-1.36
Maternal education		
Post-secondary	1	
Secondary	0.27**	0.17-0.41
Primary	0.26**	0.17-0.41
No education		
Household wealth index		
Rich	1	
Average	0.68**	0.56-0.81

Poor	0.38**	0.31-0.48

**p<0.001; *p<0.05
†Only children below 5 years are included in the analysis.

Table 5: Correlates of mothers seeking advice from health facility/ provider.

Background characteristics	OR	95% CI
Age†		
<2 years	1	
≥ 2<5 years	0.88	0.75-1.03
Sex		
Male	1	
Female	1.19*	1.02-1.38
Residence		
Urban	1	
Rural	0.49**	0.42-0.58
Region		
North	1	
South	1.31*	1.10-1.57
Maternal education		
Post-secondary	1	
Secondary	0.40**	0.26-0.62
Primary	0.25**	0.16-0.39
No education	0.21**	0.14-0.33
Household wealth status		
Rich	1	
Average	0.56**	0.47-0.68
Poor	0.29**	0.23-0.35

**p<0.001; *p<0.05
†only children below 5 years are included in the analysis.

Table 6: Correlates of treatment with ORS packets or pre-packaged liquid.

Correlates of mothers seeking advice from a health facility or provider during child's diarrhea are shown in Table 5. Child's age, place of residence, maternal education, and household wealth persisted as significant predictors of a mother's tendency to seek medical advice from a health facility or provider. When compared to children residing in urban areas, mothers in rural areas were less likely to seek advice from health facility or provider (OR: 0.65; 95% CI: 0.55-0.77). A decrease in educational attainment of a mother was associated with lower odds of seeking advice from a health facility or provider.

Correlates of treating child with ORS packets or pre-packaged liquids during diarrhea are shown in Table 6. The outcome shows that place and region of residence, household wealth and maternal education are significant predictors of treating a child with ORS packets or pre-packaged liquids during diarrhea. Children in poorer households were less likely to use ORS packets or pre-packaged liquids for treatment (OR: 0.29; 95% CI: 0.23-0.35) as compared to children in rich households. Older children were also less likely to use ORS packets or pre-packaged liquids during diarrhea. With regards to maternal education, mothers with no formal education had lower odds of treating their child with ORS packets or pre-packaged liquids.

Correlates of sanitary disposal of child's stool are shown. Place and region of residence, child's age, quality of toilet, maternal education, and household wealth were all predictors of sanitary disposal of a child's stool. With regards to this, households in rural areas were less likely to dispose their children's stool in a toilet/latrine (OR: 0.77; 95% CI: 0.68-0.87) than households in urban areas. Likewise, households in the northern region were less likely to dispose their children's stool in a toilet/latrine (OR: 0.84; 95% CI: 0.73-0.96) than households in the southern region. Concerning household wealth, poor households were significantly ($p<0.001$) less likely to indulge in sanitary disposal of their child's stool (OR: 0.76; CI: 0.64-0.90) than rich households. Regarding maternal education, mothers with no formal education were less likely to engage in sanitary disposal of their child's stool (OR: 0.52; CI: 0.42-0.64) than those who attained post-secondary school education.

Discussion

Findings from this study indicates that diarrhea among under-five children is relatively high (10.3%, N=2966, 95% CI: 9.23-11.45) in the Nigerian population, emphasizing a major child health concern. We also observed that diarrhea prevalence in children vary across different age category, sex, place of residence as well as other background characteristics. Higher prevalence of 57.0% was observed in children less than 2 years old, meaning that almost half of children less than 2 years of age are affected by diarrhea. The prevalence of diarrhea in older children (age category: ≥ 2<5 years) was also high, where 43.0% of the children were found to have diarrhea. The difference in the prevalence of diarrhea between younger children less than 2 years old and older ones was statistically significant ($p<0.001$). The high prevalence among children less than 2 years of age is of extreme concern. For children under 2 years and living in rural and poor households, this may be attributed to malnutrition which can negatively undermine the immune capacity of children against diarrhea-causing pathogens [13,14]. In most rural areas of Nigeria, protein-containing foods such as meat and egg are introduced to a child's diet after weaning, which is often between 19-22 months.

The occurrence of high prevalence rate of diarrhea in the rural areas of Nigeria will likely be due to: malnutrition, as a result of limited consumption of balanced diet due to poverty and less favorable socio-economic status [15]; lack of access to good drinking water and better sanitation facilities [16], resulting to increased rates of disease occurrence; lower levels of education among mothers, which is associated with decreased knowledge of disease prevention and control [17].

The high incidence of diarrhea in the Northern part of the country can be attributed to the fact that this particular region is mostly rural characterized by lower levels of education and higher rates of poverty in households. Furthermore, Nigeria is a lower income country with most people living in intense socio-economic disadvantage [18]. Since poverty is known to be associated with poor sanitation, malnutrition,

lower levels of education, and lack of access to good drinking water [11,19]; hence the study further confirms poverty as one of the leading factors of diarrhea in children.

The study examined patterns of optimal child health practice among households in Nigeria. Given the consistent child health promotion campaigns by government and non-governmental organization, the prevalence of optimal childcare still remains very poor. The national survey findings in 2013 showed that most childcare were less than half of the overall population of children. In relation to treatment of diarrhea practices, the use of ORS packets and antibiotic drugs were noted to be predominant. Nonetheless, lower rates in childcare were also observed in the proportion of children who were given more amount of fluid/food when they had diarrhea. Concerning the possible determinants of optimal childcare, the study noted that place of residence, region of residence, maternal education, child's age and household wealth were correlates of optimal childcare in Nigeria. Subsequently, we also discussed some background characteristics that are associated with some of these childcare and existing factors that may have influenced the rates.

A logistic analysis was conducted using socio-economic and demographic variables to examine some of the factors influencing the prevalence of some of the childcare. Findings from our study revealed that place and region of residence, maternal education, household wealth and child's age were significant correlates of optimal child health practice. Starting with place and region of residence, this study has showed that there are significant regional and urban-rural differences in health practices among children in Nigeria. In the context of seeking advice from health facility/provider, mothers of children residing in rural areas were at higher risk of not seeking advice from health facility/provider. Urban-rural differences were also observed in treatment with ORS packets and disposal of child's stool in a toilet/latrine. In 2013, households in the Northern region were less likely to treat their children with ORS packets and disposed their stool in a toilet/latrine. This may be because major households in this region are plagued by poverty and lower rates of education, hence leading to poor sanitation and treatment of child during diarrhea.

Concerning household wealth and maternal education as significant factors of optimal childcare, findings from other documented studies have also showed that households from poor or lower socioeconomic status tend to exhibit suboptimal health practices [20-23]. While noting improvements in the national prevalence of optimal health practices from 2008to 2013, findings from regression analysis still prove that poverty and lower educational attainment are still significant barriers towards achieving optimal childcare in Nigeria. This may insinuate that period phenomena and health activities over the 10-year period, were not significant enough to influence any changes in maternal education and household poverty, and hence was not adequate enough to ensure optimal health practices for children in lower socioeconomic class.

The study is not without strength and limitations. The main strength relates to the use of data estimate which is nationally representative and enables an evaluation that precedes 2 years to the year of survey. The major limitation concerns the use of retrospective, self-reported behavior that is subject to recall bias [24].

Conclusion

We examined the prevalence of diarrhea and optimal health practices among under-five children in Nigeria using data from the 2013 Demographic Health Survey. Although the overall proportion of under-five children with diarrhea in Nigeria was fairly low based on the WHO criteria, there was no decrement in prevalence as compared with the same survey in 2008. In 2013, overall lower rates were observed in the proportion of children who received optimal childcare. Insufficient child health promotion activities and staggering changes in socioeconomic conditions could have influenced this phenomenon, as the practices worsened. Therefore, while making concerted efforts to address this dilemma, there is need to take note of the underlying factors that influence child health in Nigeria, such as place and region of residence, maternal education, child's age and household wealth. Further study is recommended to determine appropriate targeted interventions.

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