Key Factors Influencing Diarrhea Occurrence among Children aged 0-5 in Nigeria

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Abstract

The paper examined key factors influencing diarrhea occurrence among children aged 0-5 in Nigeria. The dependent variable, defined as diarrhea occurrence within two weeks of survey. Explanatory factors include socio-economic factors, hygienic conditions indicators, health and nutritional behaviors. Data on 20,984 married women with children aged 0-5 who participated in the 2013 Nigeria Demographic and Health Survey (NDHS) were analyzed using logistics regression technique. Results showed that with respect to socio-economic factors, the odds of diarrhea occurrence decreased significantly by age (oldest category), region (southern), education (highest level), wealth status (richest category), and husband's age (oldest category). The odds of diarrhea occurrence increased significantly by region (northern), and type of work (office/non-office related). On hygienic conditions, the odds of diarrhea occurrence increased significantly for respondents who reported safe source of drinking water, flushed or pit toilet facilities, and those who reported shared toilet facilities with other households. Health and nutritional behaviors that showed negative effects on diarrhea occurrence were on awareness/use of oral rehydration, postnatal baby check within two months of delivery, child exposed to non-breast milk within three days after delivery, and breastfeeding at time of survey. The paper discusses the direct and indirect relationships with policy and program implications hinging on additional relevant information on safe source of drinking water, improved hygienic conditions through better access to portable water, and better breastfeeding practices to ameliorate the situation.

Keywords: diarrhea occurrence, hygienic conditions, socio-demographic factors, health behaviors, nutritional behaviors, children aged 0-5,

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Introduction

Despite efforts to control its occurrence, diarrhea is a major public health problem in Nigeria. The disease is prevalent in Nigeria due to high rate of poverty and illiteracy, poor sanitation and hygiene conditions (Wittenberg, 1998). In 2013 the government expended over 400 billion Naira, about 1.3 per cent of the country's Gross Domestic Product (GDP) in an effort to combat poor water, sanitation, hygiene and related conditions (Ojo, 2013). Success seems far off as only 31 per cent of the population has access to improved sanitation. According to WaterAid Nigeria, this implies that about 112 million Nigerians do not have access to improved sanitation while a staggering 37 million (23%) still defecate in the open (Ojo, 2013). Diarrhea prevalence rate of 18.8% in Nigeria is one of the highest in Sub-Sahara Africa (SSA) with an average of 16%. Diarrhea accounts for over 16% of child deaths in Nigeria, an estimated 150,000 deaths, mainly amongst children aged under-five (Asekun-Olarinmoye *et al*, 2014).

Diarrhea is prevalent in areas with high rate of poverty, illiteracy, overcrowding and environmental contamination (Wittenberg, 1998). Diarrhea is the passage of three or more loose or liquid stools per day or more frequent than normal for the individual (Mumtaz et al, 2014; Leslie et al, 2014). Diarrhea are of three types-- acute watery diarrhea – lasts several hours or days, and may include cholera; acute bloody diarrhea – also called dysentery; and persistent diarrhea that – lasts 14 days or longer (Wanzahun &, Bezatu, 2013). All three forms of diarrhea are common among under-five aged children, with incidence highest in the first two years of life (Asekun-Olarinmoye et al., 2014).

The danger of poor hygiene to household's health is evident in the intermittent outbreaks of cholera since its first appearance in Nigeria in 1972. In 2009, 260 people died of cholera an acute form of diarrhea. Year 2010 was marked with severe outbreak of cholera, which started from the northern part of Nigeria, and spread to 12 states involving approximately 3,000 cases and 781 deaths (Adagbada *et al*, 2012). In June 2015, at least 70 people were admitted in hospitals in Jos, Plateau State, following outbreaks of cholera and diarrhea (Alao & Ibrahim, 2015). Statistics on occurrence and deaths on the diseases are grossly underestimated since epidemiologic surveillance, which constitutes an important component of the public health response, is relatively limited in Nigeria (Adagbada *et al*, 2012).

Literature Review

The literature provide insights from both local and national studies on factors contributing to diarrhea occurrence in the country. On the local front, Oni et al (1991) study of acute diarrhea occurrence in Kwara State showed that possession and use of a private kitchen lowers the incidents of diarrhea, which increases with a child's age. Risk factors associated with diarrhea in subsequent work by Oni (1996) include child's age, household kitchen facilities, parity, mothers' education, and feeding of semi-solid foods. While Oni dwelled more on household internal conditions, Ekanem et al (1991) focused more on environmental conditions in an epidemiological case-control study in Lagos state. Ekanem et al (1991) study suggest that diarrhea prevalence among children 6-36 months were related to the presence of faeces in and

around the toilet area, the habit of defecating and urinating in chamber pots in dwelling units, the indiscriminate disposal of waste and the source of domestic water. In a similar work, Ekanem et al (1994) found that source of food, and the use of maize pap (locally called ogi) as main diet were high risk factors of prolonged diarrhea. Ekanem (1994) study established the fact that children fed with street-vended foods, and those who fed on low energy and low nutrient density diets (such as ogi) had prolonged episodes of diarrhea.

Kolo et al (2014) highlighted the living conditions such as parents personal hygiene, types of accommodation, education, age of the child, and the feeding pattern played a key role in the occurance of diarrhea. Although these work was on northern Nigeria, it corroborates Oni's findings (1991 & 1996) that child's age increases the risk of diarrhea. Similarly, Yilgwan & Okolo's (2012) identified a strong correlation between maternal education levels and diarrhea morbidity. Iroegbu et al (2000) and Ene-Obong et al (2000) draw a correlation between a mother's occupation and childcare arrangements and the occurrence of diarrhea. The studies showed that children left at home with older siblings or house-help while mothers were at the markets were at higher risk of contracting diarrhea due to possibility of exposure to contaminated food. Findings of a study in urban slum of Kuramo community in Lagos State, Nigeria showed that diarrhea cases and upper respiratory tract infections (URTI) were most common infections amongst adults and children in the community. The infection was caused largely by low knowledge on the role of hand washing (hygiene) leading to diarrhea infection (Ogunsola, et al 2013; Asekun-Orimoloye et al 2014; Oloruntoba et al 2014; Ekanem & Johnson 2015; Orimoloye, et al 2015).

Similarly on the national platform, researchers have used the Nigeria Demographic and Health Survey (NDHS) data to shead light on possible factors contributing to diarrhea occurrence in the country. Kandala, Ji, Stallard, Stranges, & Cappuccio (2007) analysed pooled data from 1999 and 2003 NDHS with results suggesting significant association between diarrhea occurrence and explanatory factors such as; region, place of residence, asset index, mother's education, antenatal visits, place of child delivery, type of feeding, mother's age, and partner's education. Taura & Hassan (2013) examined the relationships between hygiene practices and microbiological qualities of household drinking water in some parts of Kano, Nigeria. Results suggest that household size, number of co-wife, number of children, and the person who fetch water (children vs. adult) had a significant impact on occurrence of microbes in drinking water and water contamination.

The literature reviewed thus far deals mainly with the social, demographic, and health factors influencing diarrhea occurrence in household at the local and national contexts. This study provides additional insights on determinants and casual relationships of factors influencing diarrhea occurrence among children aged 0-5 in Nigeria in a bit to provider deeper insights on solutions to alleviate the situation. The long-term aim is to provide more information that will enable policy makers produce program relevant policies and guidelines to reduce diarrhea occurrence and improve quality of life among children in the country.

Data & Methods

The study used the 2013 Nigeria Demographic and Health Survey (NDHS) data conducted among individual women aged 15-49. The survey was conducted in all the 36 states and Federal Capital Territory (FCT) in Nigeria. The data is nationally representative of the diverse socio-cultural milieu of the country geared to provide information on population and health indicators that may help in planning for development in Nigeria. The survey employed stratified 3-staged cluster design with sampling conducted at three levels i.e. state, local government authority (LGA), and locality and Enumeration Area (EA) levels. The study represents 40,320 households from 896 sample points, from which 38,904 occupied households were visited, and 38,522 of these were successfully interviewed with response rate of 99%. Of the 39,902 women aged 15-49 in the households, 38,945 (98%) were successfully interviewed. This study includes a sub-sample of 20,984 married women aged 15-49 who had children aged 0-5 at the time of survey.

Sample Description

Table 1: Percentage distribution of married women according to diarrhea occurrence among children aged 0-5 by socio-demographic factors, household hygienic conditions, health and nutritional behaviors in Nigeria

Explanatory Factors	(%)	Explanatory Factors Total N = 20,984	(%)	Explanatory Factors Total N = 20,984	(%)
SOCIO-DEMOGRAPHIC FACTORS		***Husband age in group***		***Antenatal care from private hospital/clinic***	
Age groups		34 or younger	27.3	No	88.3
15-19	6.2	35-49	51.1	Yes	11.7
20-24	17.1	50 or older	21.6	***Respondent check-up after delivery***	
25-29	24.3	***Husband education***		No	61.7
30-34	20.0	No education/don't know	39.4	Yes	38.3
35-39	16.1	Primary	19.2	***Received vitamin A dose in first 2 months after delivery***	
40+	16.3	Secondary	27.9	No	74.2
Region		Higher	13.4	Yes	25.8
North-Central	15.3	***Husband's type of work***		***Baby drank from bottle with nipple yesterday/last night***	
North-West	20.8	Not working/None-office work	62.4	No	90.5
North-East	32.6	Office-related work	37.6	Yes	9.5
South-East	7.6	**HYGIENIC CONDITIONS**		***Gave child plain water in first three days after delivery***	
South -South	10.8	***Source of drinking water***		No	55.6
South -West	12.9	Unsafe source	20.6	Yes	44.4
Place of Residence		Fairly safe	65.4	***Gave child non-breast milk in three days after delivery***	
Rural	67.2	Safe source	14.1	No	91.8
Urban	32.8	***Type of toilet facility***		Yes	8.2
Highest Education		No facility	32.8	***Currently breastfeeding***	
No education	48.6	Pit toilet	52.4	No	55.7
Primary	20.1	Flush toilet	14.9	Yes	44.3
Secondary	24.7	***Disposal of youngest child stool***		**CHILD DIARRHEA OCCURENCE**	
Higher	6.5	Unsafe disposal	43.5	***Child had diarrhea recently***	
Marital Status		Safe disposal	56.5	No	87.7
Never/once in union	19.4	***Shared toilet with other household***		Yes	12.3
Married/living together	80.6	No	68.2		
Household size		Yes	31.8		
1-4		**HEALTH & NUTRITIONAL BEHAVIORS**			
5-8	24.1	***Heard of oral rehydration***			
9+	48.4	Never heard	18.3		
Number of co- wives	27.6	Heard/used	81.7		
None		***Baby postnatal check within 2 months of delivery***			
1 or more	63.1	No	75.3		
Respondents' type of work	36.9	Yes	24.7		
Not working		***Antenatal care from government hospital***			
None-office work	28.9	No	75.1		
Office-related work	23.8	Yes	24.9		
Wealth Index	47.3	***Antenatal care from government health center***			
Poorest		No	81.8		
Poorer	23.2	Yes	18.2		
Middle	23.0				
Richer	19.2				
Richest	18.3				
	16.3				

Table 1 above presents descriptive information about the respondents and their husbands. The table shows that the majority of the respondents were aged 34 or younger (68%), from the northern regions (69%), were more of rural dwellers (67%), had primary/no education (69%), and the sampled population were married/living together with a spouse (81%). The majority of respondents were from large households of at least five members (76%), and over a third had at least one co-wife (37%). Over half of the respondents (53%), were not working or were engaged in non-office work, and 46% were in the poorer/poorest wealth status. The majority of husbands were older than their wives were, most were at least 35 years old (73%), and over a half (59%) of the husbands had primary/no education, and the majority were not working or were engaged in non-office work (62%).

On hygienic conditions of household, descriptive statistics in Table 1 shows that only 14% of respondents reported that their household obtained drinking water from safe source, only 15% used flushed toilets in their house, 57% disposed their youngest child stool through safe means, and 32% shared toilet facility with other households.

Descriptive statistics on health and nutritional behaviors showed that 82% of respondents have heard/used oral rehydration therapy, only 25% had baby postnatal check within two months of delivery, 25% reported receiving antenatal care from government hospital, 18% received from government health center, and 12% received from private hospital/clinic. On women's personal health care, 38% reported check-up two months after delivery, and 26% received vitamin A. Only 10% reported that their child drank from bottle with nipple a day/night before survey, 44% gave child plain water in the first three days after delivery, and 8% gave their child non-breast milk within three days after delivery. Of the 20,984 respondents 12% reported that their child had diarrhea (recently) within two weeks of the study.

Multivariate Results

This study examined factors that contribute to incidence of diarrhea among children aged 0-5 in households in Nigeria. The dependent variable is occurrence of diarrhea among children aged 0-5 in the last two weeks before the survey, and the ultimate independent variable is socio-demographic factors, and other independent variables intermediating between occurrence of diarrhea and socio-demographic factors are hygienic conditions, health, and nutritional behaviors.

Model Specification & Analysis

$DO = f(DO_1, DO_2, DO_3, DO_4)$……(1)

$DO_1 = f(SD)$

$DO_2 = f(HC)$, and $HC = f(SD)$

$DO_3 = f(HB)$, and $HB = f(SD)$

DO_4 = f (NB), and NB = f (SD)

And:

DO_1 = f (SD) = f (X_1 X_2 X_3……..X_n) …….(2)

DO_2 = f (HC) = f (Z_1 Z_2 Z_3……...Z_n)……..(3)

DO_3 = f (HB) = f (K_1 K_2 K_3…….. ...K_n)…….(4)

DO_4 = f (NB) = f (M_1 M_2 M_3……..M_n)……....(5)

Therefore;

DO = f [(X_1 X_2 X_3……..X_n) (Z_1 Z_2 Z_3……...Z_n) (K_1 K_2 K_3…….. ...K_n)
(M_1 M_2 M_3……...M_n)]…….(6)

Where: DO = Diarrhea occurrence, with cumulative effects from DO_1, to DO_4; SD = socio-demographic factors i.e. X_1 to X_n; HC = Hygienic conditions represented as Z_1 to Z_n; HB = Health behaviors itemized as K_1 to K_n, and NB = Nutritional behaviors captured as M_1 to M_n.

Based on a binary dependent variable (diarrhea occurrence 0 vs. 1), logistics regression techniques of the type specified below is applied:

$\Phi = \log (p/(1-p)) = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \ldots\ldots\ldots + \beta_nX_n$

Linearized logistic regression equations for four models are presented below:

$DO_1 = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \ldots\ldots\ldots + \beta_nX_n + \varepsilon_1$ …….. (Reduced Model 1)

$DO_2 = \beta_0 + \beta_1Z_1 + \beta_2Z_2 + \beta_3Z_3 + \ldots\ldots\ldots + \beta_nZ_n + \varepsilon_2$ ……...(Reduced Model II)

$DO_3 = \beta_0 + \beta_1K_1 + \beta_2K_2 + \beta_3K_3 + \ldots\ldots\ldots + \beta_nK_n + \varepsilon_3$……..... (Reduced Model IIIa)

$DO_4 = \beta_0 + \beta_1M_1 + \beta_2M_2 + \beta_3M_3 + \ldots\ldots + \beta_nM_n + \varepsilon_4$.....(Reduced Model IIIb)

$DO = \beta_0 + \beta_1Y_1 + \beta_2Y_2 + \beta_3Y_3 + \ldots\ldots\ldots + \beta_nY_n + \varepsilon_5$.....(Full Model IV)

Where β_0 = constant, β_1 to β_n = logit coefficients, X_1 to X_n, Z_1 to Z_n, K_1 to K_n, M_1 to M_n, and Y_1 to Y_n are independent predictors, and ε_1 to ε_5 are error terms in the equations. Models IIIa and IIIb are combined in the analysis.

Table 2: The odds of diarrhea occurrence among children aged 0-5 according to married women and their husbands' selected socio-demographic factors, hygienic conditions, health and nutritional behaviors in Nigeria

Explanatory Factors	Model I	Explanatory Factors Total N = 20,984	Model I	Explanatory Factors Total N = 20,984	Model III
SOCIO-DEMOGRAPHIC FACTORS		***Husband age in group***		***Antenatal care from government hospital***	
Age groups	1.00	34 or younger (ref.)	1.00	No (ref.)	1.00
15-19 (ref.)	1.37**	35-49	0.89*	Yes	0.99
20-24	1.38***	50 or older	0.66***	***Antenatal care from government health center***	
25-29	1.28*	***Husband education***		No	1.00
30-34	1.12	No education/don't know (ref.)	1.00	Yes	0.96
35-39	0.66***	Primary	1.06	***Antenatal care from private hospital/clinic***	
40+		Secondary	1.00	No (ref.)	1.00
Region	1.00	Higher	0.93	Yes	0.79**
North-Central (ref.)	3.65***	***Husband's type of work***		***Respondent check-up after delivery***	
North-West	1.31***	Not working/None-office work (ref.)	1.00	No (ref.)	1.00
North-East	1.56***	Office-related work	1.08	Yes	0.92
South-East	0.57***	**HYGIENIC CONDITIONS**	**Model II**	***Received vitamin A dose in first 2 months after delivery***	
South -South	1.01			No (ref.)	1.00
South -West		***Source of drinking water***		Yes	0.78***
Place of Residence		Unsafe source (ref.)	1.00	***Baby drank from bottle with nipple yesterday/last night***	
Rural (ref.)	1.00	Fairly safe	0.73***	No (ref.)	1.00
Urban	1.16*	Safe source	1.03	Yes	1.03
Highest Education		***Type of toilet facility***		***Gave child plain water in first three days after delivery***	
No education (ref.)	1.00	No facility (ref.)	1.00	No (ref.)	1.00
Primary	1.01	Pit toilet	3.30***	Yes	1.19***
Secondary	0.93	Flush toilet	1.65*	***Gave child non-breast milk in three days after delivery***	
Higher	0.65**	***Disposal of youngest child stool***		No (ref.)	1.00
Household size		Unsafe disposal (ref.)	1.00	Yes	1.35***
1-4 (ref.)	1.00	Safe disposal	1.08	***Currently breastfeeding***	
5-8	1.06	***Shared toilet with other household***		No (ref.)	1.00
9+	1.32***	No (ref.)	1.00	Yes	1.42***
Number of co- wives		Yes	0.79***		
None (ref.)	1.00	**HEALTH & NUTRITION BEHAVIORS**	**Model III**		
1 or more	0.82***	***Heard of oral rehydration***			
Respondents' type of work		Never (ref.)	1.00		
Not working (ref.)	1.00	Heard/use	1.53***		
None-office work	1.15*	***Baby postnatal check within 2 months of delivery***			
Office-related work	1.15*	No (ref.)	1.00		
Wealth Index		Yes	1.16*		
Poorest (ref.)	1.00				
Poorer	1.03				
Middle	0.99				
Richer	0.85				
Richest	0.76*				

Ref. = reference category, Test of statistical significance * = 0.05, ** = 0.01, and *** = 0.001 levels;
Model I: Chi-square = 1038.88, -2 Log likelihood = 14340.75, Nagelkerke R^2 = 0.093;
Model II: Chi-square = 168.15, -2 Log likelihood = 9312.81, Nagelkerke R^2 = 0.026;
Model III: Chi-square = 223.34, -2 Log likelihood = 13754.18, Nagelkerke R^2 = 0.023

Table 2: The odds of diarrhea occurrence among children aged 0-5 according to married women and their husbands selected socio-demographic factors, hygienic conditions, health and nutritional behaviors in Nigeria (continued)

Explanatory Factors	Model VI	Explanatory Factors Total N = 20,984	Model IV	Explanatory Factors Total N = 20,984	Model IV
SOCIO-DEMOGRAPHIC FACTORS		***Husband age in group***		***Antenatal care from government hospital***	
Age groups		34 or younger (ref.)	1.00	No (ref.)	1.00
15-19 (ref.)	1.00	35-49	0.96	Yes	0.99
20-24	1.00	50 or older	0.75*	***Antenatal care from government health center***	
25-29	0.97	***Husband education***		No (ref.)	1.00
30-34	0.88	No education/don't know (ref.)		Yes	0.99
35-39	0.84	Primary	1.00	***Antenatal care from private hospital/clinic***	
40+	0.63**	Secondary	1.18	No (ref.)	1.00
Region		Higher	1.14	Yes	1.18
North-Central (ref.)	1.00	***Husband's type of work***	1.01	***Respondent check-up after delivery***	
North-West	4.21***	Not working/None-office work (ref.)	1.00	No (ref.)	1.00
North-East	1.49**	Office-related work	1.02	Yes	1.08
South-East	1.32	**HYGIENIC CONDITIONS**		***Received vitamin A dose in first 2 months after delivery***	
South -South	0.61**	***Source of drinking water***		No (ref.)	1.00
South -West	0.87	Unsafe source (ref.)	1.00	Yes	1.14
Place of Residence		Fairly safe	0.88	***Baby drank from bottle with nipple yesterday/last night***	
Rural (ref.)	1.00	Safe source	1.37**	No (ref.)	1.00
Urban	1.13	***Type of toilet facility***		Yes	1.07
Highest Education		No facility (ref.)	1.00	***Gave child plain water in first three days after delivery***	
No education (ref.)	1.00	Pit toilet	1.72*	No (ref.)	1.00
Primary	0.86	Flush toilet	1.72*	Yes	0.99
Secondary	0.86	***Disposal of youngest child stool***		***Gave child non-breast milk in three days after delivery***	
Higher	0.63**	Unsafe disposal (ref.)	1.00	No (ref.)	1.00
Household size		Safe disposal	0.89	Yes	1.30**
1-4 (ref.)	1.00	***Shared toilet with other household***		***Currently breastfeeding***	
5-8	1.04	No (ref.)	1.00	No (ref.)	1.00
9+	1.25*	Yes	1.16*	Yes	1.31***
Number of co- wives		**HEALTH & NUTRITION BEHAVIORS**			
None (ref.)	1.00	***Heard of oral rehydration***			
1 or more	1.07	Never (ref.)	1.00		
Respondents' type of work		Heard/use	1.47***		
Not working (ref.)	1.00	***Baby postnatal check within 2 months of delivery***			
None-office work	1.21*	No (ref.)	1.00		
Office-related work	1.22**	Yes	1.18*		
Wealth Index					
Poorest (ref.)	1.00				
Poorer	1.11				
Middle	0.96				
Richer	0.80				
Richest	0.62**				

Ref. = reference category, Significance at * = 0.05, ** = 0.01, and *** = 0.001;
Model IV: Chi-square = 722.36, -2 Log likelihood = 8133.163, Nagelkerke R^2 = 0.116

Multivariate analysis were conducted producing four separate models; in the first, only the direct relationships between socio-demographic factors and diarrhea occurrence were examined, the second examined only the relationships between hygienic conditions and diarrhea occurrence,

the third modeled the direct relationships between health and nutrition behaviors and the dependent variable. The full model included all the explanatory factors in other to tease out direct, indirect, and the most significant relationships in the equation.

A critical review of the goodness of fit of the four models shows that the -2 log likelihood of model IV is the smallest, and the explained variance (Nagelkerke R^2) of 12% is the highest thus, making it the most robust and best fitted of the four models. Model I only shows the relationship between socio-demographic factors and diarrhea occurrence. The odds of occurrence or none occurrence in Table 2 ranged from 0 to 1 and above, such that odds less than 1 are interpreted as less than the reference category benchmarked at 1, and the odds above 1 are more than the reference category.

Reduced Models: Diarrhea Occurrence vs. Block of Predictors

Results in Table 2, reduced model I show that the odds of diarrhea occurrence among children aged 0-5 decreased by respondent's age, education, wealth status, and husband's age, and it increased by household size, and occupation of respondent, and it varied significantly by region, and residence.

The reduced model II in Table 2 shows that the odds of diarrhea occurrence among children aged 0-5 varied significantly by source of drinking water, type of toilet facility, and whether household shared toilet facility with other households. Likewise, Table 2 showed the reduced model III on health and nutritional behaviors. The results in Model III shows that the odds of diarrhea occurrence varied significantly by whether respondent ever heard about oral rehydration, whether baby's postnatal check was done within two months of delivery, obtained antenatal care from private hospital/clinic, and whether respondent received vitamin A dose in the first two months after delivery. In addition, the odds that children aged 0-5 had diarrhea hinges on whether respondent gave child water in the first three days after delivery, whether respondent gave child non-breast milk in the first three days after delivery, and whether respondent was breastfeeding at the time of survey.

Full Model: Diarrhea Occurrence vs. All Predictors

Results in Table 2 shows that key socio-demographic factors that had significant effects on diarrhea occurrence among children aged 0-5 were age, region, education, household size, type of work, wealth status, and husband's age. The odds of diarrhea occurrence for children aged 0-5 of respondents aged 40+ was 0.63 times (p-value = 0.01) compared to their counterparts aged 15-19. The odds of diarrhea occurrence among children aged 0-5 in the northwest region was 4.21 times (p-value = 0.001) compared to that of the north central region, it was 1.49 times (p-value = 0.01) for children aged 0-5 in the northeast region, and lower odds of 0.61 times (p-value = 0.01) in the south-south region compared to the reference category, north –central. The odds of diarrhea occurrence among children aged 0-5 was 0.63 times (p-value = 0.01) for women with higher education compared to those with no education. The odds were 1.25 times for children of women who reported nine or more household size compared to those who were 1-4. Results of this study showed that type of work had inversely relationship with diarrhea occurrence. The

odds that children aged 0-5 had diarrhea occurrence was 1.21 times (p-value = 0.5) for respondents who reported none-office work than their counterpart who were not working, and it was 1.22 times (p-value = 0.01) for those who reported office-related work compared to those who did not work. Respondents in the richest wealth status were 0.62 times (p-value = 0.01) to report diarrhea for children aged 0-5 compared those in the poorest wealth index. Of all husband's predictors, only age was inversely related to diarrhea occurrence. The odds of diarrhea occurrence among children aged 0-5 was 0.75 times (p-value = 0.05) among husbands aged 50 or older compared to those aged 34 or younger in the reference category.

Table 2 Model IV above, shows the relationships between diarrhea occurrence and household hygienic conditions. Results show that diarrhea occurrence among children aged 0-5 was significantly related with source of drinking water, type of toilet facility, and whether toilet were shared with other households. The odds of diarrhea occurrence among children aged 0-5 was 1.37 times (p-value = 0.01) for respondents who said their source of drinking water was safe compared to those who reported that their source of drinking water was unsafe. Another interesting and quite unexpected findings of this study was that the odds of diarrhea occurrence among children aged 0-5 was 1.72 times each (both p-value = 0.05) for respondents with pit toilet, and flush toilet compared to those with no facility. As expected, study results showed that the odds of diarrhea occurrence among children aged 0-5 was 1.16 times (p-value = 0.05) among respondents whose household shared toilet with other households compared to those whose household do not.

On health and nutritional behaviors, results suggest that heard of oral rehydration, baby postnatal check within two months of delivery, gave child non-breast milk in three days after delivery, and current breastfeeding status were significantly related with diarrhea occurrence among children aged 0-5. The odds of diarrhea occurrence for children aged 0-5 was 1.47 times (p-value = 0.001) for respondents who heard/used oral rehydration compared to those who never heard. The odds of diarrhea occurrence among children aged 0-5 was 1.30 times (p-value = 0.01) among respondents who gave their child non-breast milk within three days after delivery compared to those who did not. Likewise, the odds of diarrhea occurrence for children aged 0-5 was 1.31 times (p-value = 0.001) for mothers bread feeding at the time of survey compared to those who were not breath feeding.

Discussions & Conclusions

Table 3: Types of relationships between diarrhea occurrence, socio-demographic factors, hygienic conditions, health and nutritional behaviors among children aged 0-5 in Nigeria				
SOCIO-DEMOGRAPHIC FACTORS	**Model I**	**Model II**	**Model III**	**Model IV**
Age	**-ve , +ve**			**+ve**
Region	**-ve, +ve**			**-ve, +ve**
Residence	**-ve**			
Respondent education	**+ve**			**+ve**
Household size	**-ve**			**-ve**
Number of co-wives	**+ve**			
Respondent's type of work	**-ve**			**-ve**
Wealth Index	**+ve**			**+ve**
Husband's age	**+ve**			**+ve**
Husband's education				
Husband's type of work				
HYGIENIC CONDITIONS				
Sources of drinking water		**+ve**		**-ve**
Type of toilet facility		**-ve**		**-ve**
Disposal of youngest child's stool				
Shared toilet with other household		**+ve**		**-ve**
HEALTH & NUTRITIONAL BEHAVIOUR				
Heard of oral rehydration			**-ve**	**-ve**
Baby postnatal check within two months of delivery			**-ve**	**-ve**
Antenatal care from government hospital				
Antenatal care from government health center				
Antenatal care from private hospital/clinic			**+ve**	
Respondent check-up after delivery				
Respondent received Vitamin A after delivery			**+ve**	
Baby drank from bottle with nipple yesterday/last night				
Gave child plain water in the first 3 days after delivery			**-ve**	
Gave child non-breast milk in 3 days after delivery			**-ve**	**-ve**
Currently breastfeeding			**-ve**	**-ve**

Note: +ve i.e. this signifies reduction in diarrhea occurrence; -ve = increase in diarrhea occurrence

This study examined socio-demographic factors, hygienic conditions, health, and nutritional behaviors influencing diarrhea occurrence among children aged 0-5 in Nigeria with a view to providing more insights on how to reduce occurrence and ameliorate the situation. Table 3 summarizes the types and direction of significant relationships between diarrhea occurrence and predictors for three reduced models and a full model. The positive sign '+ve' implies reduced odds of diarrhea occurrence, while the negative '-ve' implies increased odds of diarrhea occurrence. Results in Table 3 showed that socio-demographic factors had significant relationships with diarrhea occurrence (Kandala, et al., 2014). Findings showed that respondent's age (oldest age group), region (southern), education (highest level), wealth status (richest category), and husband's age (oldest category) had direct positive relationships with diarrhea

occurrence. While region (northern), household size (large), and type of work (office/none office work) had negative effects on diarrhea occurrence. Results showed that residence, and number of co-wives had indirect relationships with diarrhea occurrence and thus, should not be top priorities in designing customized effective programming for change.

The northern vs. southern regions dichotomy in diarrhea occurrence support other literature that the northern regions are more prone to diarrhea occurrence, for example the first outbreak of cholera in 2012 started from the northern region (Adagbada et al., 2012). Another key finding is the negative effects of type of work, i.e. either engaged in office-related or none office-related work, caused by the inadequacies and increased risk from childcare arrangement when mothers had to work away from home and house girl or nannies take on the responsibilities of parenting (Ene-Obong, et al., 2000). Findings of this study corroborated others that higher education (Kolo, et al., 2014; Wittenberg, 1998; Oni, 1996), and richest wealth category (Kandala, et al., 2014) were positive factors contributing to diarrhea reduction among children aged 0-5.
This study corroborates others in the literature that hygienic conditions in households are vital to diarrhea occurrence among children (Ekanem & Johnson, 2015; Orimoloye, et al., 2015; Asekun-Orimoloye, et al, 2014; Oloruntoba et al., 204; and Ogunsola, et al., 2013). In this study however, children of respondents who reported safe source of drinking water, and those who reported pit, flush toilets, or shared toilets (Kolo et al., 2014) were more at risk of diarrhea occurrence than their counterparts who reported otherwise. These results bring to question the meaning of safe drinking water or the value of flush or pit toilets in contexts where portable treated water is not standardized or easily accessible across communities. Lack of portable water is a serious danger that could cause the presence of faeces or other environmental hazards around toilets (Ekanem et al., 1991), thus attenuating the effectiveness of the campaign on hand washing and cleanliness by some stakeholders. Effective policies and programming must provide mothers and household decision makers with information on what constitute "safe drinking water" which anecdotal evidence suggest may be occluded by various cultural interpretations. Likewise, there is the need for policies and programming to provide easy access to treated portable water so that household can flush toilets and clean surroundings of pit latrine at all times.

Results of this study suggest that the odds of diarrhea occurrence increased for children of respondents who heard/used oral rehydration, and for those who had postnatal check within two months of delivery. It seemed plausible to think of a reverse causation in these relationships since respondents whose children had diarrhea may attempt to seek information and help to cure the disease. This reverse causation possibility was not examined in this study and may be an area for further research. Results of this study showed that the odds of diarrhea occurrence increased for children given non-breast milk in three days after delivery, and those being breastfed at the time of study. These results strengthen the usefulness of exclusive breastfeeding for children at the early stage of life, and ginger the need for mothers to maintain cleanliness during breastfeeding to reduce breast milk contamination. Policies and programs should provide specific guidelines and campaign efforts should be geared towards promoting the usefulness of exclusive breastfeeding in the early stage of life while encouraging women to maintain hygienic conditions during the period of breastfeeding.

This study has revealed crucial gaps in efforts to reduce diarrhea occurrence among vulnerable children in Nigeria. Key gaps such as clear understanding of what is safe drinking water,

environmental cleanliness, and hygienic conditions facilitator such as access to treated portable water, which will engender cleaner body and environmental maintenance, should be addressed by policies and programs geared to ameliorate the situation. These gaps should be addressed with taking cognizance of the specifics of significant socio-demographic factors i.e. age, region, education, household size, type of work, wealth status, and husband's age for maximum results and impact.

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