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The association between water, sanitation and hygiene practices and the occurrence of childhood diarrhoea in Abia state, Nigeria

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Abstract
Childhood diarrhoea is a leading cause of morbidity and mortality in under-fives. Globally, poor water, sanitation and hygiene practices play a role in endemic disease transmission, causing childhood morbidity and mortality. However, the linkages between the WaSH practices and childhood diarrhoea have not been fully explored and established in Abia State. This study was thus designed to assess the association between the water, sanitation and hygiene practices and the occurrence of childhood diarrhoea in Abia State. A community based cross sectional study design was used to assess diarrhoeal disease among under-fives. A total of 1209 caregivers of children 0-5 years were recruited by multistage sampling technique, with one child from each household. Data were collected from the caregivers using the 2006 UNICEF and WHO harmonized checklist. Prevalence of diarrhoea among the children was 15.1%, and this was statistically significantly associated with access to water, sanitation practices and personal hygiene of their caregivers ($\rho<0.05$). This study concludes that poor access to water, and poor sanitation and hygiene practices of care givers are directly related to the occurrence of diarrhoea among their children. It is hereby recommended that access to water, proper sanitation and hygiene practices should be scaled up in Abia State in order to improve the overall health of the children below 5 years.

Keywords: Water, sanitation, hygiene, WaSH, diarrhoea, caregivers, children

1. Introduction
Availability of clean water, adequate sanitation and good hygiene practices are important for children's survival (Darvesh *et al.*, 2017) [6]. However in 2015, 61% of the global population still lacked access to safely managed sanitation facilities, 29% of the population lacked access to safely managed drinking water services, and only 27% of the least developed countries had basic handwashing facilities (United Nations, 2018) [31]. Consequently, the Sustainable Development Goal (SDG) six was conceptualized and includes specific targets for drinking water, sanitation and hygiene (WaSH) to aid in achieving the control or elimination of associated diseases (United Nations, 2015) [30].
Inadequate WaSH practices are considered a risk factor for diarrhoea, particularly in children (Wolf *et al*., 2018) [34]. Childhood diarrhoea can be caused by bacterial, viral, protozoa or parasitic organisms; and human faeces is an important reservoir for the pathogenic bacteria that cause diarrhoea in young children (Headey & Palloni, 2019) [12]. Transmission of microorganisms that cause diarrhoea are usually through the fecal oral route, including the ingestion of contaminated water or food (water), direct contact with infected faeces (sanitation) and person to person contact (hygiene) (WHO, 2017; Nwaoha *et al.*, 2016) [33, 21]. According to Amadi *et al.* (2019) [1], diarrhoea is mainly water borne or water related. With the current inadequate management of drinking water sources, it has been estimated that 10% of improved drinking water sources are heavily contaminated with fecal matter, a major cause of childhood diarrhoea (Bain *et al.*, 2014) [3].
Further on, the low sanitation coverage implies that at present, much of the global population live in fecally contaminated environments (Wolf *et al*., 2019) [35]. Additionally, only 19% of the global population in 2013 practiced hand washing with soap after contact with excreta (Freeman *et al.*, 2014) [10]. And the subsequent ingestion of water, food, hands or objects contaminated with feces containing pathogens can cause diarrheal diseases particularly in children under five years of age.

Despite the preventable and treatable nature of childhood diarrhoea, it remains the second leading cause of infectious mortality in under-fives globally (Nwaoha *et al*., 2016) [21]. Worldwide in 2015, childhood diarrhoea accounted for 8.6% of all deaths in children under five years of age (Liu *et al*., 2016) [15]. In Nigeria, childhood diarrhoea caused 11% of all under-five deaths, which is 90,900 children annually (Okafor & Ekwunife, 2017) [22]. In Abia State in the South East of Nigeria, 10% of all under-five deaths were attributed to diarrhoea (FMOH, 2018) [9].

The world is presently in the SDG era which commenced in 2016, and several sustainable development goals target WaSH and childhood morbidity and mortality. Specifically, the SDG goal 3.2 aims at ending preventable deaths of children under five years of age; the goal 3.3 aims at combating water-borne diseases; goal 6.1 aims at achieving access to safe drinking water; and goal 6.2 aims at achieving access to adequate sanitation and hygiene for all by 2030 (United Nations, 2019) [32]. This paper thus provides information on associations of WaSH practices and childhood diarrhoea to add to the information base and advocacy tool to meet the SDG targets and improve overall child health.

2. Materials and Methods

The study area is Abia State, located in the Southeast geopolitical zone of Nigeria. Abia State is within latitudes 4º40' and 6º14' north and longitudes 7º10' and 8º east. The study population were children aged 0 to 59 months with their caregivers in all 3 senatorial zones of Abia State.

This was a community based cross sectional study, carried out from 2015 to 2018 (three years) in 9 of the 17 LGAs of Abia State. A multistage sampling technique was used to select study participants. A total of 1,209 under-fives who had experienced passage of loose or watery stools at least thrice a day, or more frequently than is normal for the child in the previous six months, and their caregivers from 1,209 households were randomly selected from 27 communities which has an estimated total population of 11,349 under-fives.

The data analysis for this study was with Statistical Package for Social Sciences (SPSS) version 22 (International Business Machine, 2015). The methods of data analysis were: descriptive statistics with frequency tables and graphs; and inferential statistics using multiple regression analysis and chi square to determine relationships between variables.

3. Results

3.1 Age and Sex Characteristics of Under-Fives

Table 1 shows the age and sex characteristics of the 1,209 children in the study. There were 271 (22.4%), 181 (15.0%), 116 (9.6%), 394 (32.6%) and 247 (20.4%) children aged between 0-11 months, 12-23 months, 24-35 months, 36-47 months and 48-59 months respectively. From the above age groups, 36-47 month olds were the modal class, followed by 0-11 month olds, then 48 to 59 month olds, 12-23 month olds and 24-35 month olds. With respect to sex, 623 (51.5%) of all children below five years were male and 586 (48.5%) were female.

Table 1: Age and Sex Characteristics of the Under-Five Children

Age Group (Months)	Male n (%)	Female n (%)	Total N (%)
0-11	98 (8.1)	173 (14.3)	271 (22.4)
12-23	143 (11.8)	38 (3.2)	181 (15.0)
24-35	50 (4.1)	66 (5.5)	116 (9.6)
36-47	164 (13.6)	230 (19.0)	394 (32.6)
48-59	168 (13.9)	79 (6.5)	247 (20.4)
Total	623 (51.5%)	586 (48.5%)	1,209 (100.0%)

Source: Author's Fieldwork, 2019

3.2 Diarrhoea Prevalence in Children Under Five

Table 2 shows that the six-month childhood diarrhoea prevalence is 15.1%.

Table 2: Prevalence of Diarrhoea in the Under-Five Children

Characteristic	Frequency	Percentages (%)
Diarrhoea	183	15.1
No Diarrhoea	1026	84.9
Total	1209	100.0

Source: Author's Fieldwork, 2019

3.3 Relationship of Water Supply Practices and Childhood Diarrhoea

The result of the multiple regression analysis run to predict childhood diarrhoea from water supply practice predictors as in table 3 shows that: main source of drinking water, main container for water storage, means of getting water from container, use of covered containers and reasons for no private piped water statistically significantly predicted prevalence of diarrhoea among children aged 0-59months, $F(6, 1202) = 36.047$, $p = 0.000$, $R = 0.391$.

Table 3: Assessment of Water Supply Practices of Caregivers and the Occurrence of Childhood Diarrhoea

Water Supply Practices	Childhood Diarrhoea		P-Value
	Yes	No	
Main Source of Drinking Water			0.000
Improved water sources	105	587	
Non-improved water sources	78	439	
Total	183	1026	
Main Container for Water Storage			0.000
Plastic bucket	25	143	
Plastic jerry can	61	343	
Plastic drum/barrel	54	304	
Storage tank	18	100	
Clay water pot	1	5	
Metallic drum/barrel	17	95	
Metallic bucket	0	3	
Other (moulded drum)	6	34	
Total	182	1027	
Means of Getting Water from Container			0.000

Pour from container	62	350	
Container has spigot/faucet	33	185	
Use dipper with handle	47	264	
Use dipper without handle	37	210	
Other (drink from container)	3	18	
Total	182	1027	
Use of Covered Containers			0.022
Yes	152	850	
No	31	176	
Total	183	1026	
Reasons for No Private Piped Water			0.000
Rented house: owner didn't install	67	374	
Installation too expensive	43	242	
Financial problem	37	209	
Have private well	11	63	
Easy access to public taps	8	45	
Easily available water vendor	5	31	
Rain water used when available	3	20	
Do not feel its importance	1	5	
Do not know	1	5	
Total	176	994	

***Source*:** Author's Fieldwork, 2019

3.4 Relationship of Sanitation Practices and the Occurrence of Childhood Diarrhoea

As in table 4, the multiple regression analysis to predict childhood diarrhoea from sanitation predictors show that: where the toilet wastes go statistically significantly predicted prevalence of diarrhoea among children aged 0-59months, F (6, 1202) = 6.461, p = 0.000, R = 0.177.

Table 4: Assessment of Sanitation Practices of Caregivers and the Occurrence of Childhood Diarrhoea

Sanitation Practices	**Childhood Diarrhoea**		**P-Value**
	Yes	**No**	
Disposal of Toilet Wastes			0.008
Septic tank/sewer	70	393	
Pit latrine	90	507	
Other (bucket, mounted, channel)	7	39	
Total	167	939	

***Source*:** Author's Fieldwork, 2019

3.5 Relationship of Hygiene Practices and the Occurrence of Childhood Diarrhoea

The multiple regression analysis to predict childhood diarrhoea from hygiene practices predictors show that location of place of hand washing, cleansing agents at place of hand washing and availability of place of hand washing statistically significantly predicted prevalence of diarrhoea among children aged 0-59months, F(6, 1202) = 10.363, p = 0.000, R = 0.222 (table 5).

Table 5: Assessment of Hygiene Practices of Caregivers and the Occurrence of Childhood Diarrhoea

Hygiene Practices	**Childhood Diarrhoea**		**P-Value**
	Yes	**No**	
Place of Hand washing Observed			0.001
Yes	19	108	
No	164	918	
Total	183	1026	
Cleansing Agents Observed at Place of Hand washing			0.000
Water only	1	8	
Water and soap/detergent	11	62	
Ash or sand or mud	0	1	
Soap and no water	3	15	
No water, no soap, nor other cleansing agents	4	22	
Total	19	108	
Location of Place of Hand washing			0.000
Inside or near toilet facility	5	31	
Inside or near kitchen/cooking place	7	42	
Elsewhere in yard/compound	3	18	
Outside yard/compound	1	7	
No specific place	2	11	
Total	18	109	

Source: Author's Fieldwork, 2019

4. Discussion

There were 1209 under five children in the study area, made up of more males (52.1%) than females (47.9%). This pattern closely aligns with the reports by the national population estimate for under-fives in Nigeria (NPopC, 2018) [20], the Multiple Indicator Cluster Survey of 2016 to 2017 (NBS & UNICEF, 2017) [16]; as well as with the National Demographic Health Survey of 2013 (NPopC & ICF, 2014) [19]. Thus, the age structure of the under-fives in this study is a close reflection of the demographic structure of Abia State and Nigeria and shows that there was minimal age bias within the study participants.

The result of the childhood diarrhoea prevalence in the study was 15.1%. This result is similar to recent studies: the National Nutrition and Health Survey reported 13.5% (NBS, 2015) [17]; Degebasa *et al.* (2018) [7], reported 13.4%; Tessema (2017) [29] reported 15%; Elmi & Dioso (2017) [8] reported 16%; and Peter & Umar (2018) [26] reported an 18.8% prevalence of childhood diarrhoea.

This study identified nine major WaSH practices associated with the occurrence of diarrhoea which add to the sanitation and disease data for Abia State. In this study, childhood diarrhoea was predicted by main source of drinking water, main container for water storage, means of getting water from container, use of covered containers and reasons for no private piped water ($\rho<0.05$). These findings correlate with a study in Ibadan, Nigeria which showed significant association of diarrhoea with main container for storing water, means of getting water from storage container, and if container is covered (Oloruntoba *et al.*, 2014) [25]. This association could be through poor handling of water, especially through dipping of cups, dippers or hands, becoming a source of drinking water contamination and increased occurrence of diarrhoea (Jagals *et al.*, 2003) [13].

This study findings of an association between childhood diarrhoea and main source of drinking water is similar to findings in other studies in Malaysia (Aziz *et al.*, 2018) [2] and Ethiopia (Bitew *et al.*, 2017) [4]. The explanation for the association of diarrhoea to main source of drinking water may be due to exposure of unprotected water sources to contamination with human and animal wastes containing pathogenic microorganisms that cause childhood diarrhoea.

In this study, childhood diarrhoea was predicted by reasons for not owning private piped water. This is similar to Rohmawati *et al.* (2012) [27] and Boadi & Kuitunen (2005) [5] s' reports that childhood diarrhoea is associated with ownership of piped drinking water source in Indonesia and Ghana respectively. This association could be due to use of vended water in the absence of private piped water. And there is an increased risk of contamination of vended water from poor storage and mishandling, with subsequent increased possibility of transmission of pathogenic organisms for childhood diarrhoeal disease.

Additionally, childhood diarrhoea in Abia State was predicted from sanitation practices of caregivers on disposal of toilet wastes ($\rho<0.05$). This is consistent with findings of Bitew *et al.* (2017) [4] that the method of disposal of excreta was associated with the occurrence of childhood diarrhoea. This could be because human excreta contains disease causing microorganisms, and poor management of human excreta pollutes the environment and can contaminate children during playing, crawling and walking (Bitew *et al.*, 2017) [4]. Also, improperly disposed toilet waste may contaminate drinking water sources and food, as well as promote breeding of vectors which further cause diarrhoea.

Hand washing is an important contributor to adequate hygiene (Olalekan *et al*., 2019) [24]. Childhood diarrhoea in Abia State was also predicted by hygiene practices of caregivers which are: where hand washing takes place, materials used to wash hands and availability of hand washing device ($\rho<0.05$), similar to the findings of Darvesh *et al.* (2017) [6]. This could possibly be because during defecation, human hands may get contaminated with microorganisms. And according to Gerbu *et al.* (2014) [11]: in the absence of a place for hand washing, hand washing device or hand washing materials, pathogenic microorganisms are not washed off; and the contaminated fingers may become major means of feco-oral transmissions for diarrhoeal diseases.

5. Conclusion

The results of this study showed that in general, there were poor water, sanitation and hygiene practices among caregivers of under-fives in Abia State and these were statistically significantly associated with high childhood diarrhoea prevalence of 15.1%. This study has specifically identified nine key WaSH practices that are associated with diarrhoea in Abia State.

Thus, there is need to intensify health education to caregivers on adequate WaSH practices to change behaviours and social norms in order to reduce the occurrence of childhood diarrhoea. The government needs to ensure clean water sanitation facilities in Abia State, and the State Ministry of Health raising awareness on WaSH strategies to prevent occurrence of diarrhoea in children under five years of age.

There is also need for this research to be carried out in other States of the country in order to find out the effects of their sociocultural peculiarities. This will help in better targeted programming and faster attainment of the targets of the sustainable development goals (SDGs).

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