ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 9, Issue, 04, pp.49377-49385, April, 2017

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

PRACTICE OF ENVIRONMENTAL SANITATION AMONG RESIDENTS OF A COMMUNITY IN JOS NORTH LOCAL GOVERNMENT AREA OF PLATEAU STATE, NIGERIA

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ARTICLE INFO

Article History:
Received 20th January, 2017
Received in revised form
10th February, 2017
Accepted 18th March, 2017
Published online 30th April, 2017

Key words:

Environmental sanitation,
Water,
Solid waste management,
Sewage disposal,
Personal hygiene.

ABSTRACT

Access to safe water, proper refuse and sewage disposal, as well as good personal and environmental hygiene which affect the health of populations remains a challenge for many developing countries. Sanitation practices including water sanitation, solid waste management, sewage disposal and personal hygiene and the occurrence of fever and diarrhoea among respondents were assessed in this study. It was a cross- sectional study conducted in 3 settlements of Tudun Wada ward of Jos North LGA of Plateau State among 355 adult respondents selected by a multistage sampling technique. Data was collected using an interviewer administered questionnaire and a checklist and analyzed using SPSS version 20. The most common sources of drinking water were pipe-borne water and borehole. About 20% treated their water at home. Nearly 70% practiced insanitary refuse disposal methods. About 74% used the water closet that flushes into septic tank as toilet facility. Less than a quarter of respondents washed their hands after defecating and only 39.2% always washed their hands with soap. The prevalence of fever was 5.4% and that of diarrhea was 1.4% among the respondents. The study showed that most households generally practiced poor environmental sanitation and hygiene which affected their health status.

Citation: Miner, C. A., Okoh, E. O. and Dakhin, A. P. 2017. "Practice of environmental sanitation among residents of a community in jos north local government area of plateau state, Nigeria", *International Journal of Current Research*, 9, (04), 49377-49385.

INTRODUCTION

Access to safe water, adequate sanitation as well as proper hygiene decreases disease morbidity and mortality which in turns leads to improved health, poverty reduction and improved socio-economic development. However, the provision of these basic amenities is a challenge for many countries which continue to suffer from diseases associated with the lack of these amenities. The contamination of the environment by faeces which can serve as a potential source of transmission of pathogens into the environment is prevented by adequate environmental sanitation practices. Proper and regular hand washing with a washing agent such as soap can interrupt the transmission of faeco-oral pathogens and the practice of household water treatment and safe storage remains the interim solution to access safe drinking water at point-of-use. (Brown *et al*., 2013) Environmental Sanitation as defined in the National Environmental Sanitation Policy is 'the principles and practice of effecting healthful and hygienic conditions in the environment to promote public health and welfare, improve quality of life and ensure a sustainable environment'. (Environmental Health Watch, 2011) Important components of environmental sanitation include provision of adequate potable water, solid waste management, proper sewage disposal, food hygiene, to mention a few. A nation with a healthy environment is a healthy nation and all Nigerians have the right to live in such an environment. Diseases related to poor environmental sanitation cripple the economy of a nation and exacerbates poverty. (Environmental Health Watch, 2011) Even though national governments, support agencies and other stakeholders have harnessed their efforts in increasing the number of people using improved sanitation facilities to 1.3 billion and those using improved drinking water systems to 1.8 billion since 1990, 2.6 billion people globally still do not have adequate sanitation and 884 million lack improved sources of drinking water. Sub-Sahara African countries including Nigeria are worse affected. (UNICEF, 2010) According to the United Nations, the population of urban dwellers will increase by two billion globally before the year 2030 in which over 90% of this increase will be observed in least developed countries. (Tagurum *et al*, 2015) The highest proportion of urban dwellers living in slums is found in sub-Sahara Africa, which is 71.8%. In Nigeria this proportion is 75%. (Tagurum *et al*, 2015) The rapid population and economic growth witnessed by

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Nigeria in the last two decades has contributed to the poor state of the environment in the cities. (Jatau, 2013) This is because of associated problems of overcrowding and congestion, inadequate water supply, inadequate sewage disposal facilities, poor housing and poor solid waste management. These problems are also associated with poor personal and domestic hygiene which can lead to increased burden of infectious diseases in households. (Nath, 2003)

A large number of the world's population (2.4 billion people), mostly children, are sickened and killed by diseases arising from inadequate access to safe water, sanitation and hygiene services.(UNICEF, 2015) In 2012, inadequate drinking water accounted for 502,000 diarrhoea deaths in low and middle income countries while poor sanitation accounted for 280,000 diarrhoea deaths. Poor hand hygiene also accounted for 297,000 deaths. Cumulatively, these three risk factors accounted for 842,000 diarrhoea deaths accounting for 58% of diarrhoeal disease burden that year. (Prüss-Ustün *et al*, 2014) About 88% of the 4 billion cases of diarrhoeal diseases that occur globally every year, claiming over 1.8 million lives mostly children under five years of age, are as a result of unsafe drinking water, poor sanitation and poor hygiene. (WHO, 2007) Studies have also shown that 25% to 27% of disease burden can be reduced by water supply interventions, 17% to 42% by water quality interventions, 22% to 37% by sanitation and 31% to 48% by hand washing intervention. (Pfadenhauer and Rehfuess, 2015) As a result of rapid urbanization and rapid population growth, emergence of slums and squalors in certain areas of major cities further exacerbates the menace of poor environmental sanitation. (Environmental Health Watch, 2011) The situation is not different in Plateau State Nigeria, where communities like Tudun Wada continue to harbor increasing number of settlers, not only as a result of rural-urban migration, but also due to migration of displaced persons from areas experiencing ethno-religious conflicts within and outside the State, as well as troubled areas of the north eastern part of the country. (Akintunde and Jambol, 2014), (Krause, 2011) The topic of environmental sanitation still remains relatively under-studied in this part of the world and country where diseases associated with this practice such as diarrhoea, continue to be of public health importance. (Hunter *et al*, 2014)Sanitation practices that were assessed include water sanitation, solid waste management, sewage disposal and personal hygiene. It also determined the occurrence of fever and diarrhea among respondents.

MATERIALS AND METHODS

It was a cross-sectional descriptive study conducted in an urban community of Jos North Local Government of Plateau State, Nigeria. Tudun Wada is an urban community, one of two communities that form the Tudun Wada/Kabong ward. It has a population of 64,387 and about 8,657 households made up of indigenous tribes of the Plateau indigenous tribe of Plateau as obtained from Tudun Wada Primary Health Care (PHC) Centre records. The population settlement is divided along the middle class and lower class social strata. The study population consisted of adult residents of the community. Minimum sample size was determined to be 340 using a prevalence rate of 67% from a previous study on sanitation facilities and hygiene practices. (Ordinioha and Owhondah, 2008) A multistage sampling technique was used to select respondents. From the 14 wards in Jos North LGA, Tudun Wada/Kabong ward was selected by balloting. Balloting was also used to select Tudun Wada as the study site and three of out of the 9 settlements that make up Tudun Wada namely Angwan Clinic, Angwan Abuja and Angwan COCIN church. Systematic sampling technique was used to select 355 households. In each household one eligible respondent was selected by balloting. An interviewer administered questionnaire and a checklist were used to collect data. The data was analyzed using SPSS version 20. A 95% confidence interval was used for the study and a probability value of ≤ 0.05 was considered statistically significant. Informed verbal consent was obtained from each participant before commencement of the study.

Table 1. Sociodemographic characteristics

Parameter	Frequency	Percentage
Age of respondents		
16 - 25	107	30.1%
26 - 35	126	35.5%
36 - 45	57	16.1%
46 - 55	50	14.1%
56 - 65	12	3.4%
66 - 75	3	0.8%
Total	355	100.0%
SEX		
Female	197	55.5%
Male	158	44.5%
Total	355	100.0%
Marital status		
	149	42.0%
Single	190	53.5%
Married	5	
Divorced/Separated	11	1.4%
Widowed	355	3.1%
Total		100.0%
Religion		
Christianity	352	99.2%
Islam	2	0.6%
Free thinker	1	0.3%
Total	355	100.0%
Occupation		
Trader	80	22.5%
Civil servant	74	20.8%
Student	64	18.0%
Artisan	56	15.8%
Unemployed	43	12.1%
Housewife	17	4.8%
Professional	17	4.8%
Farmer	4	1.1%
Total	355	100.0%
Highest educational level		
Tertiary	133	37.5%
Secondary	190	53.5%
Primary	19	5.4%
None	13	3.7%
Total	355	100.0%
Monthly Family Income (Naira)		
<10,000	81	22.8%
10,000 - 50,0000	208	58.6%
>50,000 – 100,000	46	13.0%
>100,000	20	5.6%
Total	355	100.0%
Total Number Of People In Household		
1 - 5	188	53.0%
6 - 10	157	44.2%
11 - 15	10	2.8%
Total	355	100.0%

RESULTS

Socio-demographic characteristics

The total number of respondents was 355. Mean age of respondents was 33.5 + 11.5 years. There were slightly more females than males (55.5% and 44.5% respectively). More of the respondents were married (53.5%) and were Christians (99.2%). Occupations of respondents included traders, civil servants, students and artisans (77.1%) and the highest level of education was secondary education (53.5%). Over half (58.6%) of the respondents earned between N10,000 to N50,000. The mean number of persons in households was 5.3± 1.8 (ranging from 1 – 17 persons).

Water Management practices

The most common source of drinking water was pipe-borne water for 41.7% of respondents, followed by borehole (23.1%) and well water (14.9%). These served as main sources of drinking water all year round for 57% of respondents. However, rain water served as an alternative drinking water source during other parts of the year for 79.5% of respondents.

Over 70% travel for a period of less than 30 minutes and 56.6% travel for a distance of less than 50 meters to get water. Ninety percent of respondents store water at home and the reasons for storage were mainly because of irregular pipe-borne water supply (36.2%), the need to reduce fetching of water frequently (29.2%) and far distances (22.0%). Most of the respondents (99.7%) store their water in containers with covers and get them cleaned regularly. Though at the point of data collection, only 60.8% had cleaned their storage containers within the week. Household water treatment was practiced by 19.7% of respondents. Methods used included boiling (40%), addition of household chemicals (34.3%), use of alum (17.1%), water filtration and exposure to sunlight. Amongst them, 55.7% stated that they do not spend any money on water treatment. Whereas those that do, spend an average of N65 per day. Those who earned over N100,000 were found to be more likely to treat water at home than those who earned lower incomes. Specifically, they were 6 times more likely to treat their water than those whose income ranged between N10,000 to N50,000. Source of drinking water was found to be significantly associated with water treatment at home. Respondents whose sources were borehole and pipe-borne water were 39.8% and 43.3% respectively, less likely to treat their drinking water than those who used well.

Table 2. Water management practice

PARAMETER	FREQUENCY	PERCENTAGE
MAIN SOURCE OF DRINKING WATER		
Pipe-borne water	148	41.7%
Borehole	82	23.1%
Well	53	14.9%
Sachet water	35	9.9%
Tanker truck water	31	8.7%
Vendor provided water	6	1.7%
Total	355	100.0%
DO YOU USE THIS MAIN SOURCE ALL YEAR		
Yes		
No	205	57.7%
Total	150	142.3%
	355	00.0%
MAIN SOURCE OF DRINKING WATER DURING THE OTHER PART OF THE YEAR		
Rainwater		
Sachet water	171	79.5%
Well	37	17.2%
Total	7	3.3%
	215	100.0%
DISTANCE OF WATER SOURCE FROM THE HOUSE		
Lessthan 50meters		
Greater than 50meters		
Indoors	201	56.6%
Total	110	31.0%
	44	12.4%
	355	100.0%
TIME TAKEN TO AND FROM THE WATER SOURCE		
Less than 30mins	249	70.1%
More than 30mins	106	29.9%
Total	355	100.0%
DRINKING WATER STORED AT HOME		
Yes	319	89.9%
No	36	10.1%
Total	355	100.0%
WHY DO YOU STORE WATER		
Irregular pipe-borne water supply	135	36.2%
Reduce the need to frequently fetch water	109	29.2%
Far distance from water source	82	22.0%
Absent potable water supply	23	6.2%
Prevent contamination	23	6.2%
Limit/reduce water treatment task	1	0.3%
Total	373	100.0%

Continue……

LENGTH OF DRINKING WATER STORAGE		
3 to 5days	159	49.7%
1 to 2days	67	20.9%
6 to 7days	47	14.7%
1 to 2weeks	35	10.9%
2weeks to 1month	7	2.2%
more than 1 month	5	1.6%
Total	320	100.0%
DRINKING WATER STORAGE CONTAINER CLEANED		
Yes		
No	319	99.7%
Total	1	0.3%
	320	100.0%
IF YES, LAST TIME THESE WERE CLEANED		
This week		
Today	194	60.8%
This month	58	18.2%
Dont know	41	12.9%
More than a month ago	17	5.3%
Total	9	2.8%
	319	100.0%
DEDICATED FETCHER AVAILABLE		
Yes	152	47.5%
No	168	52.5%
Total	320	100.0%
COVERAGE OF STORAGE CONTAINER		
Yes	319	99.7%
No	1	0.3%
Total	320	100.0%
DRINKING WATER IS TREATED		
Yes	70	19.7%
No	285	80.3%
Total	355	100.0%
IF YES, METHODS OF WATER TREATMET		
Boil	28	40.0%
Chlorination	24	34.3%
Use of alum	12	17.1%
Water filtration	5	7.1%
Put under the sun	1	1.4%
Total	70	100.0%

Table 3. Logistic regression showing predictors of water treatment

PREDICTORS	WATER TREATMENT			ODDS RATIO	p-value	95% C.I. for OR	
	YES (%)	NO (%)	TOTAL			Lower value	Upper value
Monthly income							
10,000 - 50,0000	30 (14.4)	178 (85.6)	208	1			
<10,000	18 (22.2)	63 (77.8)	81	1.709	0.124	0.863	3.383
>50,000 – 100,000	12 (26.1)	34 (73.9)	46	1.848	0.131	0.833	4.102
>100,000	10 (50.0)	10 (50.0)	21	6.387	0.001*	2.230	18.292
Total	70 (19.7)	285 (80.3)	355				
Main source of drinking water				1			
				0.398			
Well	18 (34.0)	35 (66.0)	53	0.433			
Borehole	15 (18.3)	67 (81.7)	82	0.000	0.031*	0.173	0.918
Pipe-borne water	25 (16.9)	123 (83.1)	148	0.740	0.024*	0.209	0.897
Sachet water	0 (0.0)	35 (100.0)	35	1.919	0.998	0.000	
Tanker truck water	9 (29.0)	22 (71.0)	31		0.569	0.263	2.081
Vendor provided water	3 (50.0)	3 (50.0)	6		0.458	0.343	10.740
Total	70 (19.7)	285 (80.3)	355				

Solid waste management

The more common wastes generated by the households included polythene (23.8%), followed by leaves/vegetables (22.3%) and waste food (19.2%), many of which were generated on a daily basis (57.2%). Over half (58.0%) of these wastes were stored in uncovered bins before finally being disposed mainly in specific open places (36.7%) or burnt with fire (31.0%). In most households, adult women were responsible for final waste disposal. Most of the households (99.4%) also do not spend any money on solid waste disposal. Occupation and marital status were found to be associated with general condition of environment. The highest proportion of respondents living in filthy and untidy environments were farmers (50%) compared to professionals (94%) who had the highest proportion of respondents living in clean and tidy environments (x^2 = 14.72; p = 0.040). The divorcees and widows were found to live in cleaner and tidier environments than the married, single or separated. (x^2 = 11.06; p = 0.026)

Sewage disposal practices

The most common type of toilet facility was the water closet that flushes into septic tank (73.9%), followed by simple pit latrine (18.6%). Out of the 4.2% that did not have any toilet facility, 85.6% defecated in bushes and backyards.

Table 4. Solid waste management

Parameter	Frequency	Percentage
TYPE OF WASTE GENERATED (multiple responses allowed)		
Polythene	333	23.8%
Leaves and vegetables	311	22.3%
Wastefood	268	19.2%
Papers	254	18.2%
Cans	134	9.6%
Plastics	63	4.5%
Bottles	34	2.4%
Total	1397	100.0%
FREQUENCY OF WASTE GENERATION	203	57.2%
Daily	152	42.8%
Weekly	355	100.0%
Total		
STORAGE OF WASTE BEFORE DISPOSAL	206	58.0%
Uncovered bin	106	29.9%
Covered bin	22	6.2%
Don't store	15	4.2%
Polythene bags	4	1.1%
Sacks	2	0.6%
Carton	355	100.0%
Total		
WASTE DISPOSAL METHOD (multiple responses allowed)		
Specific open place	180	36.7%
Burn with fire	152	31.0%
Into dino bins provided by Govt.	73	14.9%
Into nearby surface water like rivers	24	4.9%
In backyard	22	4.5%
Into open drains or gutters	15	3.1%
Any open place	11	2.2%
Compost pit	11	2.2%
Buried underground	2	0.4%
Total	490	100.0%
PERSON RESPONSIBLE FOR FINAL DISPOSAL		
Adult female	219	61.7%
Adult male	47	13.2%
Anybody	33	9.3%
Male child under 15	31	8.7%
Female child under 15	23	6.5%
Dont know	2	0.6%
Total	355	100.0%
DOES IT COST ANYTHING TO DISPOSE WASTE?		
Yes	2	0.6%
No	353	99.4%
Total	355	100.0%

Table 5. Factors associated with the general condition of the environment observed

PARAMETER	GENERAL CONDITION OF ENVIRONMENT				
	CLEAN/ TIDY (%)	FILTHY/ UNTIDY (%)	TOTAL	X^2	p-value
Marital status					
Divorced	4 (100.0)	0 (0.0)	4		
Married	147(77.4)	43(22.6)	190		
Separated	0 (0.0)	1(100.0)	1	-	0.026*
Single	112(75.2)	37(24.8)	149		
Widowed	11(100.0)	0 (0.0)	11		
Total	274(77.2)	81(22.8)	355		
Occupation					
Artisan	42(42.9)	14(57.1)	56		
Civil servant	64(86.5)	10(13.5)	74		
Farmer	2(50.0)	2(50.0)	4		
Housewife	11(64.6)	6(35.4)	17	-	0.040*
Professional	16(94.1)	1(5.9)	17		
Student	37(57.8)	16(42.2)	64		
Trader	61(76.3)	19(23.7)	80		
Unemployed	31(72.1)	12(27.9)	43		
Total	247(77.2)	81(22.8)	355		

*=Fisher's exact

Many of those that practiced open defaecation (60.0%) reported that it was due to financial constraints. Over half (70%) of the respondents that had toilet facilities had never experienced filling of their septic tanks while 25% have had theirs evacuated by either night soil men or Government Agencies. Most (85.9%) of the respondents did not know what happened to the waste after it had been removed. The type of toilet used in households was significantly associated with marital status, level of education and occupation. The use of water closet/ septic tank was commonest among professionals, those with tertiary education and widows; lack of any type of facility was highest among those with no form of education, singles and artisans; while the use of pit latrine and public toilets was higher among traders and respondents with primary education.

Table 6. Sewage disposal practices

Parameter	Frequency	Percentage
TYPE OF TOILET FACILITY		
Flush into septic tank or pit	261	73.5%
Simple pit latrine	66	18.6%
Don't have any	15	4.2%
Public latrine of any type	12	3.4%
VIP latrine	1	0.3%
Total	355	100.0%
DEFAECATION AREA FOR RESPONDENTS WITHOUT TOILET FACILITY	8	53.3%
Bushes	5	33.3%
Backyard	1	6.7%
Open land	1	6.7%
Rivers and streams	15	100.0%
Total		

Hand washing practices

About 20.5% of respondents washed their hands only when dirty, 19.2% before eating and 19.5% after eating. Only 13.2% of respondents washed their hands after defecating and 3.2% after cleaning an infant who has defecated. Only 29.3% households had readily available water for hand washing while 28.5% had readily available soap. However, hand washing with soap was practiced by 87.6% of respondents and only 39.2% always washed their hands with soap. Sex of respondent was found to be associated with frequency of hand washing with soap ($X^2 = 8.15$; $p = 0.043$) as more females (47.7%) were found to always wash their hands with soap compared to males (31.0%). The level of education was also significantly associated with hand washing frequency ($X^2 = 22.20$; $p = 0.008$). More of the respondents with higher levels of education washed their hands always with soap compared to their counterparts with lower educational levels.

Prevalence of fever and diarrhea

The prevalence of fever was 5.4% and that of diarrhea was 1.4% among the respondents. Diarrhea was found to be associated with source of drinking water as those who used vendor-provided water, bore hole and tap had more cases of diarrhea compared to users of other sources. Predictors of fever included the use of soap in hand washing as well as drinking water sources. Respondents who did not use soap to wash their hands were about 3.5 times more likely to have fever than those who used soap to wash their hands. The use of borehole water was less associated with fever than the use of tanker water, vendor-provided water and well water, but more associated with fever than use of pipe-borne water. However these associations were not statistically significant.

Table 7. Factors associated with toilet type

PARAMETER	TYPE OF TOILET						X^2	p-value
	NONE (%)	FLUSH INTO SEPTIC TANK (%)	PUBLIC LATERINE (%)	SIMPLE PIT (%)	VIP	TOTAL		
Marital status								
Divorced	0 (0.0)	1 (25.0)	0 (0.0)	3 (75.0)	0 (0.0)	4		
Married	3 (1.6)	145 (76.3)	9 (4.7)	33 (17.4)	0 (0.0)	180		
Separated	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0)	0 (0.0)	1	26.74	0.045
Single	12 (8.1)	105 (70.5)	3 (2.0)	28 (18.8)	1 (0.7)	149		
Widowed	0 (0.0)	10 (90.1)	0 (0.0)	1 (9.1)	0 (0.0)	11		
Total	15 (4.2)	261 (73.5)	12 (3.4)	66 (18.6)	1 (0.3)	355		
Highest educational level								
None								
Primary	2 (15.4)	8 (61.5)	1 (7.7)	2 (15 2)	0 (0.0)	13		
Secondary	0 (0.0)	7 (36.8)	3 (15.8)	9 (47.4)	0 (0.0)	19	51.87	0.000
Tertiary	13 (6.9)	127 (66 8)	7 (3.7)	42 (22.1)	1 (0.5)	190		
Total	0 (0.0)	119 (89.5)	1 (0.8)	13 (9.8)	0 (0.0)	133		
	6 (10.7)	261 (73.5)	12 (3.4)	66 (18.6)	1 (0.3)	355		
Occupation								
Artisan	6 (10.7)	36 (63.3)	1 (1.8)	13 (23.2)	0 (0.0)	56		
Civil servant	1 (1.4)	65 (87.8)	1 (1.4)	7 (9.5)	0 (0.0)	74		
Farmer	0 (0.0)	2 (50.0)	0 (0.0)	2 (50.0)	0 (0.0)	4	45.99	0.017
Housewife	0 (0.0)	16 (94.1)	0 (0.0)	1 (5.9)	0 (0.0)	17		
Professional	0 (0.0)	16 (94.1)	1 (5.9)	0 (0.0)	0 (0.0) 0	17		
Student	5 (7.8)	46 (71.9)	2 (3.1)	11 (17.2)	(0.0) 0	64		
Trader	2 (2.5)	51 (63.8)	6 (7.5)	21 (26.3)	(0.0)	80		
Unemployed	1 (2.5)	29 (64.4)	1 (2.3)	11 (25.6)	1 (2.3)	43		
Total	15 (4.2)	261 (73.5)	12 (3.4)	66 (18.6)	1 (0.3)	355		

Table 8. Hand washig practices

PARAMETER	FREQUENCY	PERCENTAGE
DO YOU WASH YOUR HANDS?		
When hands are dirty	343	20.5%
After eating	326	19.5%
Before eating	321	19.2%
Before preparing food	228	13.6%
After defecating	221	13.2%
When returning to house from work	129	7.7%
After cleaning infant who has defecated	53	3.2%
After touching animals	30	1.8%
After disposal of animal feces	25	1.5%
Total	1676	100.0%
HAND WASHING WITH SOAP		
Yes	311	87.6%
No	44	112.4%
Total	355	00.0%
FREQUENCY OF HAND WASHING WITH SOAP		
Often	161	45.4%
Always	139	39.2%
Never	44	12.4%
Rarely	11	3.1%
Total	355	100.0%

Table 9. Factors associated with hand washing frequency

PARAMETER	FREQUENCY OF HAND WASHING WITH SOAP					X^2	p-value
	NEVER (%)	ALWAYS (%)	OFTEN (%)	RARELY (%)	TOTAL		
Sex							
Female	23(911.7)	90 (45.7)	79 (40.1)	5 (2.50)	197		
Male	21 (13.3)	49 (31.0)	82 (51.9)	6 93.8)	159	8.145	0.043
Total	44 (12.4)	139 (39.2)	161 (45.4)	11 (3.1)	100		
Highest educational level							
None	4 (30.8)	4 (30.8)	4 (30.8)	1 (7.6)	13		
Primary	6 (31.6)	6 (31.6)	6 (31.6)	1 (5.2)	19		
Secondary	20 (10.5)	64 (33.7)	99 (52.1)	7 (3.7)	190	22.201	0.008
Tertiary	14 (10.5)	65 (48.9)	52 (39.1)	2 (1.5)	133		
Total	44 (12.4)	139 (39.2)	161 (45.4)	111 (3.1)	355		

Table 10. Logistic regression of factors associated with fever

PARAMETER	FEVER			ODDS RATIO	p-value	95% C.I. for OR	
	YES (%)	NO (%)	TOTAL			Lower value	Upper value
Hand washing with soap	13 (4.2)	298 (95.8)	311	0.287	0.029	0.93	0.882
Yes	6 (13.6)	38 (86.4)	44	1			
No	19 (5.4)	336 (94.6)	355				
Total							
Main source of drinking water							
Borehole							
Pipe-borne water	5 (6.1)	77 (93.9)	82	1			
Sachet water	4 (2.7)	144 (97.3)	148	0.488	0.302	0.125	1.904
Tanker truck water	0 (0.0)	35 (100.0)	35	0.000	0.998	0.000*	
Vendor provided water	3 (9.7)	28 (90.3)	31	2.244	0.307	0,476	10.586
Well	2(33.3)	4 (66.7)	6	6.570	0.064	0.895	48.236
Total	5 (9.4)	48 (90.6)	53	1.498	0.546	0.404	5.558
	19 (5.4)	336 (94.6)	355				

Table 11. Factors asociated with diarrhoea

PARAMETER	DIARRHOEA			X^2	p-value
	YES (%)	NO (%)	TOTAL		
Main source of drinking water					
Borehole	3 (3.7)	79 (96.3)	82		
Pipe-borne water	1 (0.7)	147 (99.3)	148		
Sachet water	0 (0.0)	35 (100.0)	35	15.32	0.009
Tanker truck water	0 (0.0)	31 (100.0)	31		
Vendor provided water	1 (16.7)	5 (83.3)	6		
Well	0 (0.0)	53 (100.0)	53		
Total	5 (1.4)	350 (98.6)	355		

DISCUSSION

This study showed that the most common source of drinking water was pipe-borne water. Only a few (19.8%) treated their water at home mostly by boiling and chlorination. This low level of water purification at home may be due to the fact that most respondents accessed improved water sources and perceived that these sources were safe enough to drink without treatment. Another study conducted in a similar community in Plateau State found that shallow wells served as the main drinking water source for 43.8% of households and 37.5% boiled their water before drinking.[4] This shows the popularity of boiling as a method of water purification in households. Another study also conducted within Plateau State revealed that household water treatment was practiced by 54% of households, however, the commonest method was addition of alum (practiced by 43.3%). (Miner *et al*, 2015) Studies conducted within Sub-Saharan Africa have shown that over half of its urban population use pit latrines especially low income earners and open defecation remains a problem in the region. (Nakagiri *et al*, 2015), (Galan *et al*, 2013) This study has shown lower utilization of simple pit latrine among respondents most of whom were less educated, traders, students and unemployed. The use of better toilet facilities (water closet flushing into septic tank and VIP latrines) was practiced by more of the respondents, even though this practice was highest among professionals and among those with higher levels of education. These households may invariably belong to those in the higher socio-economic group which may explain their better access to proper toilet facilities. They may also be more knowledgeable on the importance of using these facilities. The use of public toilets was high among traders probably because of the nature of their jobs which warrants being away from home for most parts of the day. Insanitary refuse disposal methods such as open dumping (36.7%) and burning (31.0%) were mostly practiced which are known to be poor waste management and environmental sanitation practices. Even though solid waste management was not significantly associated with level of education or income of respondents, those who were professionals were found to live in tidier and cleaner environments on a general outlook than other individuals. In another study conducted in Plateau State, pit latrine was the most commonly used method of sewage disposal and burning as the main refuse disposal method by half (50%) of the respondents. (Tagurum *et al*, 2015) The low level of hand washing after defecation (13.2% of respondents) and after cleaning an infant who has defecated (3.2%) which was observed in this study is similar to findings from a systematic review which revealed that only about 19% of the global population washes hands with soap after coming in contact with feaces. (Freeman *et al*, 2014) Even though most (87.6%) of our respondents reported hand washing with soap, only 28.5% of them were observed to have readily available soap for washing hands and only 39.2% washed their hands always. This shows that unavailability of soap and other hand washing facilities may affect hand washing behavior. This reason was given for the low level of hand washing with soap among some refugees. (Zeleke *et al*, 2012) However, another study showed that 100% of respondents washed their hands after defecation (out of which 59% washed their hands with soap) but 21.7% washed hands after changing babies' diapers and disposing their faeces. (Ray *et al*, 2009) In our study a higher level of education was more associated with hand washing than a lower level of education and this was similar to findings from a Kenyan study. (Schmidt *et al*, 2009) This may be due to a higher level of media exposure among the educated. Just as hand washing was found to be associated with sex in this study, other studies have shown similar results. (Miko *et al*, 2012) This suggests that hand washing behavior is higher among women than men. However, another study conducted in Africa did not show any significant difference between sexes. (Mariwa *et al*, 2012) Married respondents also reported less hand washing behavior compared to singles, widowed or divorced which was similar to observations among university students in Bangladesh where hand washing as a

behavior was also higher among the unmarried students. (Sultana *et al*, 2016)

Prevalence of fever in this study was 5.4%. This was in contrast to the fever prevalence of Nigeria and that of Plateau State which were 13% and 12.5% respectively in the 2013 NDHS. (National Population Commission, 2014) Unlike a systematic review that revealed that children from wealthier families in Nigeria and three other African countries had reduced prevalence of fever, this study did not show any significant association between fever and parents income. (Nonvignon and Nonvignon, 2012) Fever was rather found to be associated with hand washing with soap as well as drinking water source especially the vendor-provided water, tanker water and well water. Some other studies have shown a relationship between drinking water sources such as contaminated well water and febrile conditions like typhoid fever and cholera. Enteric infections are known to be associated with contaminated drinking water. (Farooqui *et al*, 2009), (Taylor *et al*, 2015) Hand washing with soap can also interrupt transmission of enteric organisms that can cause infections which can present as fever. (Brown *et al*, 2013) Several hospital-based studies have shown reduced infection rates as a result of improved hand hygiene which was mainly as a result of reduced risk of transmission of pathogenic organisms. (Pittet, 2001) Prevalence of diarrhoea in this study was 1.4%, unlike in the 2013 NDHS where the prevalence of diarrhoea was 10% for the whole of Nigeria and 5.6% for Plateau State. (National Population Commission, 2014) This may be attributable to differences in time and season of conducting the studies. In this study, diarrhoea was found to be associated with source of drinking water. It was highest among those who drank vendor-provided water, followed by borehole water. This may be due to the fact that that water sold by vendors could have been obtained from any source, not necessarily improved sources. Water from improved sources such as boreholes could also be contaminated at any point from source through storage to point of consumption. This finding is of great concern considering the poor practice of household water treatment. However, since water from these sources were not tested for diarrhoeal organisms, these association could have been confounded by other factors. A study conducted in a rural African setting also showed association between diarrhoea and drinking water source. It showed that the use of surface water such as streams and springs exposed children to a higher risk of diarrhoea than the use of deep water sources like wells. (Plate *et al*, 2004)

Conclusion

The study showed that most respondents generally have access to improved water sources but engage in poor water management practices; they engage in poor waste management practices and access to hand washing facilities does not translate to good hand washing practices. Improvements in water management at home as well as personal hygiene would reduce morbidity especially among young children. The Government as well as community health care workers should intensify efforts in educating communities on the importance and practice of environmental sanitation and personal hygiene.

Acknowledgement

The authors are grateful to Onyike Abraham, Onyeachonam Chimezie and Magni Makyang for assisting in the data collection during the period of the study.

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