Journal of Agriculture, Food, Environment and Animal Sciences
Tarım, Gıda, Çevre ve Hayvancılık Bilimleri Dergisi
http://www.jafeas.com, ISSN: 2757-5659

J. Agric. Food, Environ. Anim. Sci.
4(1): 1-20, 2023

Relationship Between Water, Sanitation, Hygiene Practices and The Incidence of Water Borne Diseases Among Urban Slum Households in Lagos State, Nigeria

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Research Article

Article History:
Received: 28 September 2022
Accepted: 20 January 2023
Published online: 01 June 2023

Keywords:
Water
Sanitation
Hygiene
Water-borne diseases
Urban slum

ABSTRACT

Paucity of clean water, poor sanitation and poor personal hygiene practices impose high danger to life. Common water-borne diseases such as diarrhoea, dysentery, typhoid fever, hepatitis A and cholera are caused by unhealthy water, poor sanitation and poor personal hygiene practices. The study examined the relationship between water, sanitation, hygiene practices and the incidence of water borne diseases among urban slum households in Lagos State, Nigeria. Primary data were collected with the aid of questionnaire from 120 household heads selected from four Local Government Areas in the state using multistage sampling technique. Descriptive statistics and logit regression model were employed for data analysis. The results revealed that community borehole, vendor and pipe borne water were the major sources of water in the study area. Majority of the respondents defecate in pit latrine or lagoon and dump their wastes in the surrounding water bodies. The results further revealed that diarrhoea (71.8%), typhoid fever (67.5%) dysentery (45.3%), and cholera (32.5%) were the common water-borne diseases experienced by the respondents. The result of the logit regression model revealed that age, education, household size, occupation, water treatment, type of toilet facility, toilet sharing, refuse disposal method, environmental sanitation exercise, and using same container for bathing and cooking were major factors influencing the incidence of water-borne diseases in the study area. From the above listed results, it is recommended that people must be properly trained about the consequences of utilising contaminated water, poor sanitation and poor personal hygiene practices on their health in the study area.

To Cite : Aminu FO, Udeze E., 2023. Relationship Between Water, Sanitation, Hygiene Practices and The Incidence of Water Borne Diseases Among Urban Slum Households in Lagos State, Nigeria. Journal of Agriculture, Food, Environment and Animal Sciences, 4(1): 1-20.

INTRODUCTION

Safe drinking water, sanitation and hygiene are among five key strategies designed to confront neglected subtropical ailments (World Health Organization [WHO], 2015). Safe water is pivotal to effective sanitation and hygiene practices considering

its importance on health, social and economic development globally (Khalifa and Bidaisee, 2018). Households obtained their drinking water from various sources which are determined by quality, cost, accessibility, distance to water sources, perceived threat, and awareness of water treatment methods (Okpasuo et al., 2020). WHO and United Nations Education's Fund (UNICEF) (2015) defined "sanitation as a system that encourages proper disposal of human and animal waste for enhancing and protecting public and environmental health". A good sanitation facility includes toilets flushing to sewer systems or septic tanks, ventilated improved pit (VIP) latrines, pit latrines with a slab, or composting toilets (Umegbolu and Offor, 2017). The consequences of poor sanitation on the environment and human health have been broadly recognised to include vulnerability to dire excreta-related illness such as diarrhoea, dysentery, cholera, hepatitis A, and typhoid fever, environmental degradation, malnutrition, pollution of drinking water sources, and irregular children school attendance (WHO, 2016; Abubakar, 2017). Hygiene includes personal habit choices as frequency of hand wash, trim fingernails, bathe, change clothing, laundry and environmental cleaning (WHO, 2015; Bashir, 2019). Pollution of drinking water sources by pathogens and chemicals is high among urban slums in Lagos State, Nigeria due to poor hygiene practices, poor sanitation, high population growth and increased industrial activities (Kora et al., 2017).

Unhealthy drinking water, poor sanitation and poor personal hygiene are major contributors to water-borne diseases globally (Ayeni, 2014). Manetu and Karanja (2021) posited that waterborne diseases are contracted from drinking polluted water. This is enhanced by paucity of healthy drinking water, poor environmental conditions, poor sanitation and poor personal hygiene practices, as well as indiscriminate refuse disposal in an area. According to reports by UNICEF (2015), more than one billion people lack access to safe water and over 2 billion people live without endurable sanitation and hygiene practices. In Nigeria, about 66 million

people do not have access to portable water and more than 100 million people are without access to improved sanitation. More than 3.4 million people die from water related diseases annually, making it the leading cause of disease and death around the world (WHO, 2015). Death from water borne diseases cost Nigeria 2.5 billion dollars, while 191 million dollars was expended on health care for diarrhoea. Likewise, about half of patients visiting the health centres in Lagos State are being treated for water related ailments. This revelation further emphasizes the need to address this issue of poor hygiene and inaccessibility to clean water as a way of curtailing the growing cases of waterborne diseases in the state (WHO, 2015; Afuwape, 2017).

The United Nations Human Settlements (UNHS) defines a slum as low-income settlements with poor living conditions (UN-HABITAT, 2003). The quality of housing in such settlements varies from shanty to permanent structures, with limited access to water, electricity, sanitation and other basic amenities(Akinwale et al., 2013). Several studies (Akinwale et al., 2013; Ayeni, 2014; Yussuf et al., 2014, Abiodun 2021) reported that Lagos urban slum are crowded with more than five people living in a room, where poor personal hygiene habits and open defecation in ditches are widely practiced with no social value to toilets, inadequate water and electricity supplies, lack proper waste disposal facilities and good drainages which heightens the exposure of the residents to waterborne diseases like diarrhoea, dysentery, typhoid fever and cholera. Since fishing is the major occupation of the urban slum dwellers, the occurrence of these waterborne diseases might cause morbidity and have devastating effects on their outputs (Ayinde et al., 2015). This study therefore aims to examine the relationship between water, sanitation, hygiene practices and the incidence of water borne diseases among urban slum households in Lagos State, Nigeria.

MATERIALS and METHODS

Study Area: The study was conducted in Lagos State, Nigeria. Lagos State is located on the southwestern coast of Nigeria approximately between latitudes 6022'N and 6052'N and longitudes 2042'E and 3042'E. Geographically, Lagos State is surrounded by bodies of water with nearly a quarter of the state's area being lagoons, creeks and rivers. It has a total area of 3,577 km2 and an estimated population of 12,777,884 (NBS, 2019). The high population growth rate of Lagos has been largely attributed to rural-urban migration which accounts for up to 75% of the population increase (Abumere, 2004). It is therefore a common phenomenon to see most undeveloped land being taken over by the rural immigrants to satisfy their urban land needs. Such invasions usually lead to uncontrolled development of slum communities which lack basic infrastructural facilities and characterized by very poor environmental conditions (Akinwale et al., 2013).

Sample and Sampling Techniques: Multi-stage sampling technique was used in selecting the respondents for this study. First stage involved the purposive selection of 4 Local Government Areas (LGAs) in the state, which were Ajeromi-Ifelodun, Mainland, Apapa and Eti-osa LGAs. At the second stage purposive sampling techniques was used to select 1 community from the 4 LGAs which were Ajegunle, Makoko, Ijora and Ilaje respectively. These communities were purposively selected because they were classified as the slums and lack access to safe water, sanitation and hygiene practices. The third stage involved random selection of 30 respondents from each community making a total of 120 respondents for the study, out of which 117 representing 97.5% of the respondents were used for data analysis. Others were discarded due to incomplete information.

Qualitative data on socio-economic characteristics of the respondents, water sources, toilets systems, method of wastes disposal, and incidence of water borne diseases were collected, with the aid of questionnaire.

Analytical technique: Descriptive statistics and logit regression model were used for data analysis.

Logit Regression model: This was used to analyze the factors influencing the incidence of waterborne diseases in the study area

Following Dare et al., (2019), the logit model was specified in the form below:

$$Pi= E(Y=1/Xi) =B0+B1X1+B2X2+B3X3+\ldots\ldots + B12X12 \ldots... \quad (1)$$

Where the dependent variable (Pi(Y)) =Incidence of waterborne diseases (1 if experienced any of diarrhea, dysentery, cholera, typhoid fever)

Xs are the explanatory variables which include: X1= Age of household head (years), X2= Level of education (years), X3=Household size (number), X4=Occupation (1-fishing, 0-otherwise), X5= water treatment (1if yes, 0-otherwise), X6=Use borehole for domestic purpose (1if yes, 0-otherwise), X7= Dug well for domestic purpose (1if yes, 0-otherwise), X8=toilet facilities (1if pit latrine, 0-otherwise), X9= sharing toilet (1if yes, 0-otherwise), X10= refuse disposal method (1if water, 0-otherwise), X11=environmental sanitation (1-if observed, 0-otherwise), X12= washing of hands (1if always, 0-otherwise), X13= same container for bathing and cooking (1if yes, 0-otherwise), e = error term, βs are the parameters to be estimates

RESULTS AND DISCUSSION

Socio-economic and demographic characteristics of the respondents

Result in Table 1 reveals that majority (55.6%) of the respondents were female. The mean age of the respondents was 37 years with respondents within 31-40 years constituting 35% of the total respondents.

Table 1. Selected socio-economic characteristics of the respondents (n = 117)

Variable	Frequency	Percentage (%)	Mean
Sex			
Female	65	55.6	
Male	52	44.4	
Age (years)			
≤30	36	30.8	37 (±4.332)
31-40	41	35.0	
41-50	31	26.5	
> 50	9	7.7	
Educational Qualification			
No Formal Education	3	2.6	
Primary Education	20	17.1	
Secondary Education	76	64.9	
Tertiary Education	18	15.4	
Marital Status			
Single	29	24.8	
Married	86	73.5	
Widowed	2	1.7	
Household Size (No)			
1-5	62	53.0	7 (±1.475)
6-10	75	47.0	
Primary Occupation			
Fishing	61	52.1	
Paid employment	18	15.4	
Artisan	38	32.5	
Monthly income			
≤10,000	14	12.0	25,038.46 (±155.1)
10,001-20,000	45	38.5	
20,001-30,000	25	21.4	
>30,000	33	28.2	

This implies that most of the respondents were within the active age group. Majority (64.9%) of the respondents had secondary education, 73.5% were married with a mean household size of 7 persons. The study also reveals that majority (52.1%) of the respondents engaged in fishing activities, 32.5% were artisan while 15.4% engaged in paid employment. The mean monthly income of ₦25,038.46 ($55.08) implies that the respondents were low income earners and this could have negative effect on their accessibility to safe water sources, good sanitation and hygiene practices in the study area. Akinwale et al., (2013) reported that most of the respondents in three urban slum areas in Lagos State were low income earners.

Table 2 presents the results on sources of drinking water in the study area. The result reveals that majority (52.1%) of the respondents purchased drinking water from water vendor, 21.4% sourced drinking water from borehole mostly provided by personal or communal efforts, 17.1% from pipe borne water and 9.4% from well. This implies that majority of the respondents' sources of water were not hygienic and could increase their susceptibility to waterborne diseases in the study area. This result corroborates the findings of Yusssuf et al., (2014) who stated that majority of residents of Ijora-Badia in Lagos State sourced drinking water from water vendor.

Table 2. Major sources of drinking water in the study area

Sources	Frequency	Percentage
Vendor	61	52.1
Borehole	25	21.4
Pipe borne water	20	17.1
Well	11	9.4

Treatment of drinking water is very important to prevent waterborne diseases because it removes contaminants or reduces their concentration which makes the water fit for consumption. Result in Table 3 reveals that majority (82.1%) of the respondents do not treat their water before drinking. Drinking untreated water could make the respondents vulnerable to waterborne diseases. Akowanou et al., (2016) reported that water treatment is required within the households to improve the quality and safety of water for drinking. Okpasuo et al., (2020) posited that households that do not treat their water before drinking probably perceive their water source was good for drinking. This is corroborated by the findings of Onjala et al., (2013) who mentioned that the riskier the individuals perceive the water source to be, the more likely they are to treat the water from that source.

Table 3. Treatment of water before drinking

Water treatment	Frequency	Percentage
No	96	82.1
Yes	21	17.9

The types of toilet facility in the study area as shown in Table 4 reveals that a larger percentage (38.5%) of the respondents make use of pit latrine located at the back of their houses, 25.6% depend on lagoon and 15.4% use canal while 20.5% use water closet system. This result is an indication that open defecation is still widely practiced in the study area which may cause offensive odour, housefly infestation, contaminate water source and predispose them to waterborne diseases. The main reason given for the use of canal and lagoon was inadequate water supply which makes it difficult to maintain water closet. This result agrees with those of Kaoje et al., (2019) that 40% of the respondents in Tunga Magaji community of Sokoto State practice open defecation and about 60% disposed their children's excreta in an open unsanitary manner. Furthermore, about 86% of the respondents shared toilet facilities in the study area. Sharing toilet facilities by many people has bad consequence on the environment and health of the dwellers. This concurs with the reports of Akinwale et al., (2013) that shared toilets in urban slums are often germy and poorly maintained which increases exposure to diseases.

Table 4. Types of toilet facility and toilet sharing

Toilet facility	Frequency	Percentage
Canal	18	15.4
Lagoon	30	25.6
Pit latrine	45	38.5
Water closet	24	20.5
Toilet sharing		
No	16	13.7
Yes	101	86.3

Table 5 presents the result on methods of waste disposal in the study area. The result reveals that a sizeable percentage (44.4%) of the respondents dumped their waste in surrounding water bodies, 27.4% used open dump site and 20.5% disposed their waste through Private Sector Participation/Lagos State Waste Management Authority (PSP/LAWMA), while 7.7% burnt their wastes. This result is an indication that majority of the respondents disposed their wastes in an unhygienic way.

Dumping waste in water or open dump site not just pollute the environment and heightens the incidence of infectious diseases but also, passerby and residents are also left to battle with the offensive stench that comes from such practice. This result agrees with the submission of Foday et al., (2013); Aminu et al., (2020) who reported that the effect of air and water pollution from open dump site is worse in the rainy season as a result of offensive and disease-laden odour, as well as ground water pollution while the smoke from the incineration of the wastes is an important source of air pollution for people living both near and away from the dumpsite in the dry season.

Table 5. Methods of waste disposal

Method	Frequency	Percentage
Water body	52	44.4
Open dump site	32	27.4
PSP/LAWMA	24	20.5
Burning	9	7.7

Environmental sanitation is a periodic community cleaning exercise that ensures a healthy living environment devoid of communicable diseases as clean environment hinders the spread of diseases. Result in Table 6 indicates that 29.9% of the respondents do no observe environmental sanitation in the study area, just as 35.9% observe weekly environmental sanitation, 1.7% observe it every other week while 32.5% observe environmental sanitation monthly in the study area. This implies that majority of the respondents observe environmental sanitation which should reduce the incidence of waterborne diseases in the study area.

Table 6. Frequency of environmental sanitation

Environmental sanitation	Frequency	Percentage
None	35	29.9
Weekly	42	35.9
Fortnightly	2	1.7
Monthly	38	32.5

Results on the personal hygiene of the respondents is presented in Table 7. According to WHO (2016), people with access to handwashing facility in-dwelling are more likely to wash their hands. Result in Table 7 reveals that only 11.1% of the respondents had handwashing facility fixed in their household while majority (88.9%) lack such facility.

Table 7. Personal hygiene of respondents

Hand washing facilities	Frequency	Percentage
Fixed facility/sink	13	11.1
No hand washing facility indwelling	104	88.9
Washing of hands after using toilet		
Yes, always	54	46.2
Yes, sometimes	63	53.8
Handwashing material		
Use water only	89	76.1
Use soap and water	28	23.9
Same containers for cooking and bathing		
No	42	35.9
Yes	75	64.1
Presence of rodents in the household		
No	18	15.4
Yes	99	84.6

This result is not surprising considering the types of the building, most of which are the Brazilian (face me and face you) buildings or rooming apartment which do not give room for the provision of fixed handwashing facility in the study area. Also, majority (53.8%) of the respondents claimed they sometimes washed their hands after using the toilet. Skipping hand washing after using the toilet could contaminate the hands which aids the spread of infectious diseases. This result corroborates the report of World Bank (2020) that washing hands after toilet is essential as human feces are the source of germs like salmonella and norovirus. Moreover, 76.1% of the respondents washed their hands using only water while 23.9% used soap and water. Washing hands thoroughly with soap and water can help prevent the spread of infectious diseases. When asked about the use of containers in the households, all the respondents claimed to have separate container for drinking water but majority

(64.1%) of the respondents used the same container for bathing and cooking. This practice could also predispose them to waterborne diseases in the study area. Furthermore, 84.6% of the respondents indicated the presence of rodents in their households. Rodents can spread virus that cause diseases within the household. This result is in tandem with those of Koaje et al., (2019) who reported that 88.3% of the respondents in Sokoto State indicated the presence of rodents in their households.

Result in Table 8 reveals that (74.4%) of the respondents had experienced one or more of the listed waterborne diseases while 25.6% claimed not to have experienced any of the diseases in the study area.

Table 8. Incidence of waterborne diseases

Waterborne diseases	Frequency	Percentage
No	30	25.6
Yes	87	74.4

Waterborne diseases associated with water source, sanitation and hygiene practices in the study area.

This study is exclusively on self-reported waterborne diseases associated with water source, sanitation and hygiene practices of urban slum households in the study area. The respondents reported multiple waterborne diseases such as diarrhoea (71.8%), typhoid fever (67.5%), dysentery (45.3%) and cholera (32.5%). This result is consistent with the findings of Akinwale et al., (2013); Yussuf et al; (2014) who attributed waterborne diseases to poor personal hygiene habits and open defecation in ditches widely practiced in the urban slums in Lagos State.

Table 9. Type of Waterborne diseases experienced in the study area

Waterborne diseases	Frequency	Percentage
Diarrhea	84	71.8
Typhoid	79	67.5
Dysentery	53	45.3
Cholera	38	32.5
None	30	25.6

*Multiple responses

Table 10 presents the result on type of treatment sought to treat waterborne diseases by the respondents in the study area. The result indicates that majority (57.3%) of the affected respondents visited the chemist or purchase drugs from vendor. This is a home-based care of self-medication that involves purchasing and taking drugs without being prescribed by a qualified medical practitioner. This seems to be affordable and readily available to the respondents; however, this practice is dangerous and could further endanger the health of the respondents. About 30% of the respondents sought medical intervention in the clinic/hospitals, 19.7% used local herbs and 10.3% of the respondents used Oral Rehydration Solution (ORS) while 12.8% allowed the disease to recede without undergoing any treatment This suggests that self-medication was the most popular treatment source among the respondents in the study areas.

Table 10. Type of treatment sought during illness in the study area

Treatment	Frequency	Percentage
Use ORS	12	10.3
Visit chemist/Purchase drugs from vendor	67	57.3
Use herbs	23	19.7
Visit hospital	35	29.9
Do nothing	15	12.8
Do not fall sick	30	25.6

Factors predisposing urban slum households to incidence of waterborne diseases in the study area.

Table 11 presents the result of the logit regression analysis on the factors predisposing urban slum households to incidence of waterborne diseases in the study area. The results of the chi square was significant at 1% alpha level, indicating that the logit model fits the data well. The discussion of the estimates of the factors predisposing urban slum households to waterborne diseases are presented in the following order, diarrhoea, dysentery, cholera and typhoid.

Diarrhea

Table 11 reveals that the significant factors predisposing urban slum households to diarrhea disease were household size ($p<0.05$), main occupation ($p<0.01$), water treatment ($p<0.01$), use borehole water for domestic purposes ($p<0.05$), toilet sharing ($p<0.01$), environmental sanitation ($p<0.01$), hand washing ($p<0.05$) and use of same container for bathing and cooking ($p<0.01$).

The coefficients of household size, main occupation being fishing, sharing toilet and use of same container for bathing and cooking had direct significant relationship with incidence of diarrhoea in the study area. This implies that the probability of experiencing diarrhoea increases with these variables in the study area. Conversely, the coefficients of water treatment, use borehole water for domestic purposes, participation in environmental sanitation exercises and regular hand washing were found to have negative significant relationship with incidence of diarrhoea in the study area. This implies that these variables decrease the probability of diarrhoea incidence in the study area. Urban slum households who treated their water before drinking, used water from borehole for domestic purposes, participated in environmental sanitation exercise and practiced regular hand washing were probably less susceptible to diarrhoea disease in the study area.

Dysentery

Water treatment ($p<0.01$), sharing toilet facility ($p<0.01$), refuse disposal method ($p<0.01$) and hand washing ($p<0.05$) were the significant factors predisposing urban slum households to incidence of dysentery in the study area. The coefficients of water treatment and hand washing were negative and significant. This implies that the probability of dysentery incidence decreases with treating water before drinking and regular handwashing in the study area.

On the other hand, the coefficients of sharing toilet facility and refuse disposal method were positive and significant at 1% alpha levels. This result implies that probability of respondents experiencing incidence of dysentery increases with the respondents sharing toilet facilities and disposing waste in water bodies in the study area. This result agrees with the findings of Aminu et al., (2020) that disposing waste in water or open dump sites increase the vulnerability of households to environmental and health effect of improper waste disposal in Ikenne Local Government Area of Ogun State.

Table 11. Determinants of the factors predisposing urban slum households to incidence of waterborne diseases in the study area

Variables	Diarrhea	Dysentery	Cholera	Typhoid
Age (years)	0.027 (0.381)	-0.006 (0.034)	-0.08(4.56)***	0.1 (3.19)***
Education (years)	0.220 (0.410)	-0.131 (0.212)	-0.571(3.08)***	-0.39 (2.10)**
Household size	0.194 (2.195)**	0.023 (0.016)	0.44 (4.65)***	0.141 (0.704)
Occupation	0.00(4.86)***	0.311 (0.790)	0.334 (1.301)	0.29 (2.26)**
Water treatment	-0.740(2.78)***	-1.88(4.753)***	-1.76(2.87)***	-0.33 (2.29)**
Use borehole for domestic purposes	-0.86 (2.07)**	-0.412 (0.378)	-1.042 (1.275)	-0.55 (2.42)**
Toilet facility	0.002 (0.023)	0.182 (0.480)	0.41(2.036)**	0.59(3.08)***
Sharing toilet	0.157 (2.050)**	1.362(2.977)***	-0.190 (0.063)	0.311 (0.189)
Refuse disposal	0.144 (0.924)	0.43(6.133***)	0.316(3.78)***	0.124 (0.682)
Env. Sanitation	-1.01 (3.74)***	-0.204 (0.155)	-1.54 (2.84)***	-1.153(4.87)**
Hand washing	-0.282 (2.09)**	-0.23 (2.409)**	-1.76(2.87)***	-0.015 (1.643)
Same container	1.16 (2.77)***	1.018(1.613)	1.260 (2.316)**	2.08(7.48)***
Constant	-4.003 (4.321)	-1.476 (2.046)	-1.667 (1.911)	0.765 (1.825)
Chi square	21.549 (0.001)	32.294 (0.000)	28.530 (0.000)	33.494 (0.008)
Log likelihood	135.264	118.263	131.993	139.028

***; ** and * indicate significance at 1%, 5% and 10% levels respectively. Figures in parentheses are T-values.

Cholera

Results in Table 11 further reveals that the probability of experiencing cholera increase with household size at 1% level of probability. This implies that respondents with large household size were more prone to cholera incidence than small household sized respondents in the study area. Also, type of toilet facility used ($p<0.05$), waste disposal method and use of same container for bathing and cooking

increase the likelihood of cholera in the study area. Pit latrines are often times associated with bad and unpleasant odours which attracts insect and rodent vectors that can spread diseases such as cholera and dengue fever. This result agrees with the findings of Nkwocha et al., (2012) that fly breeding, offensive odors and fouling of toilets were some of the nuisance connected with pit latrines.

Conversely, age was found to reduce the probability of cholera incidence as it had an inverse significant relationship with cholera incidence at 1% alpha level respectively. This implies that younger respondents were more prone to cholera incidence occasioned by unsafe water, poor sanitation and unhygienic practices than the older respondents in the study area. This affirms the findings of Awunyo-Vitor et al., (2013) who reported that older people are more conscious about their health and sanitation of the environments and are therefore more willing to pay high amounts for water and improved waste management systems than the younger ones. The coefficient of educational level of the respondents was also negative and significant at 1% alpha level. This implies that the likelihood of experiencing cholera disease decreases with educational level of the respondents. Educated respondents were likely to take precaution about their water source, hygiene and sanitation practices because they are more exposed and knowledgeable about the consequences of these variables on their health. This result agrees with the findings of Okpasuo et al., (2020) that knowledge of proper hygienic practices can reduce the risk of illness and death from waterborne diseases. Moreover, the coefficients of water treatment and hand washing were also negative and significant at 1% alpha levels, implying that the probability of experiencing cholera disease reduces with drinking treated water and regular washing of hands in the study area. This result concurs with the findings of Aminu and Odunlade (2022) that farming households who treat their water before use are less susceptible to cholera outbreak in Kwara State, Nigeria.

Typhoid Fever

The probability of experiencing typhoid as a result of water, sanitation and hygiene practices increases with age ($p<0.01$), occupation ($p<0.05$), toilet facility ($p<0.01$) and use of same container for bathing and cooking while it deceases with education ($p<0.05$), water treatment ($p<0.05$), use of water from borehole for domestic purposes ($p<0.01$) and participation in environmental sanitation exercises ($p<0.05$) in the study area. This implies that older respondents who were engaged in fishing activities and used pit latrine were likely to be more prone to incidence of typhoid fever in the study area. This result is in consonance with the findings of Dalves (2018) that, the immune system becomes less effective with age and this predisposes older people to some infections and cancers.

CONCLUSION

The study examined the interplay between water, sanitation, hygiene practices and the incidence of water borne diseases among urban slum households in the study area. It has been established that the residents of these urban slums were vulnerable to waterborne diseases such as diarrhea, dysentery, cholera and typhoid fever. Age, education, household size, occupation, water treatment, type of toilet facility, toilet sharing, refuse disposal method, environmental sanitation exercise and using same container for bathing and cooking were the major factors influencing incidence of waterborne diseases in the study area. The study concluded that, there is a significant relationship between water, sanitation, hygiene practices and the incidence of water borne diseases in the study area. Therefore, the respondents must be properly educated about the adverse effect of contaminated water, poor sanitation and hygiene practices on their health in the study area. Also, intervention packages that address safe water supply, environmental sanitation, personal hygiene and health care seeking behaviour should be implemented by the government and other relevant agencies in the study area. Furthermore, sanitary inspectors should be

deployed and adequately equipped to monitor sanitation practices and ensure compliance to the constituted standard of the state.

Conflict of Interest

The authors have declared that there are no competing interests.

Authors Contribution

Aminu, FO contributed to the paper's idea, questionnaire design, data analysis and wrote the manuscript. Udeze, E collected and coded the data.

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