



Preliminary Investigation of the Probable Linkage between Water Quality, Sanitation and Health in Zaria Area, Nigeria

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ABSTRACT

The study examines the levels of enteric disease risk and overall health status of the population living in the Zaria area, posed by drinking objectionable water and deficient sanitation practices. Health data from Ahmadu Bello University Teaching Hospital (ABUTH), Zaria, for the period of 5 years was obtained (i.e., 2001-2005), from the medical microbiology department, on test results of patients submitting specimens for gastrointestinal infections (stool cultures) and bilharziasis (urine microscopy). Patient specimens diagnosed as positive or negative results were recorded, including the addresses where they reside. The result revealed that the incidence rate (IR) of waterborne diseases per 1000 of the population surveyed from ABUTH data over 1 year showed that Zaria City had the highest incidence rate (49.5) of gastrointestinal infections, including bilharziasis. It was observed that Zaria City had the highest number 1100(50.9%) of positive cases detected, while Samaru had the least number 302(14%) detected. The breakdown of the types of organisms detected in all four major residential areas of Zaria, includes *E. coli*, *Salmonella typhi*, *Salmonella paratyphi*, *Shigella spp.*, *Vibrio cholerae*, and *Klebsiella spp.*, and all the organisms detected are either waterborne or water-related disease-causing organisms. The microbiological examination detecting the presence and absence of Ova of *Schistosoma haematobium* (O.Sch H) from urine specimen results also revealed that Zaria City had the highest recorded number and frequency of the presence of Ova of *Schistosoma haematobium* 806(49.6%), while the low recorded cases were from Samaru area 260(16%). The next line of research directions is to visit the area with the highest number of reported cases of gastrointestinal infections and bilharziasis based on the addresses of the patients submitted. Brief conversational interviews and focus group discussion techniques are to be deployed. Designing and administration of questionnaire survey, water quality sampling and analysis and finally using statistical tools to develop a model to link the environmental factors to water-related disease incidence reported in the hospital.

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INTRODUCTION

Water is one of the basic necessities of life and therefore the delivery of potable water is

indispensable if the health and well-being of a population is to be presumed (Dinka, 2018; Howard *et al.*, 2020). Always, the progress of

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sanitation throughout the world has been evidently related to the availability of water; the larger the quantity and the better the quality of the water, the more rapid and extensive has been the advance of public health (Coussens, 2009; Mock *et al.*, 2017; Isukuru *et al.*, 2024). The role of water in promoting basic hygiene and sanitation through provision of safe drinking water, in food preparation, washing practices and in wastewater collection has been stressed by many authors (Manisha *et al.*, 2023; Imarhiagbe and Eghomwanre, 2023).

The supply of water is not only environmental but also has psycho-social implications for individuals and communities. A safe, adequate, and easily accessible water supply is considered a basic human right. Although advances in water purification and distribution technology have helped alleviate water related pathogens, waterborne diseases are still major threats to life, especially in developing countries (Islam *et al.*, 2020; Kombo Mpindou *et al.*, 2021). Even in today's advanced world, millions of people, mostly children, die each year due to several infectious diseases related to poor water and inadequate sanitation (Brown *et al.*, 2013). The right to health and water is intimately related, and social and economic disparities often restrict access to safe drinking water. Inadequate water quality and sanitation are also indicators of poverty, leading to a vicious cycle of disease and suffering. Globally, variations in water availability and access are reflected in disparities in public health. The three big interlinked topics water, environment, and health form a web of understanding (Sheel *et al.*, 2024).

The development and application of sanitation and water technologies are very closely linked, and the increase of human settlements and agriculture has always been very closely tied to water quality (Aboah & Miyittah, 2022; du Plessis, 2022; Irakoze Mukamana, 2024). The importance of water quality is often considered a mere survival variable and, to a large extent, is overlooked, as water quality plays a leading role in epidemiology and public health (Ali & Ghareeb, 2023). Waterborne, as well as water-washed, diseases causing illness and death, are significant

contributors to the global public health burden, particularly in the developing world where existing health systems are inadequate to deal with the multiple non-specific effects of diarrheal illnesses and other related environmentally induced health concerns (Chan *et al.*, 2021; Irakoze Mukamana, 2024).

Water borne diseases are among the leading causes of illness and death in most developing countries (Manetu *et al.*, 2021). Estimates by World Health Organization (WHO) in 1996, indicate that as much as 80 % of all diseases in the world is associated with water. Diarrhoea disease alone, caused over 3million deaths in 1995, with 80 % among children under age five, predominantly affecting the developing world (Troeger *et al.*, 2017; Kyu *et al.*, 2024). These diseases also reduce vigor and productivity of affected persons and indirectly inhibit development (Manetu *et al.*, 2021). Prevention of these diseases is highly essential, since they spread fast affecting an entire community. Regular monitoring of microbial quality of drinking water is an essential step in ensuring safe drinking water (Balasooriya *et al.*, 2023; Okafor *et al.*, 2024).

A child dies every 15 seconds from diarrhoea disease, attributable mainly to poor water supply and/or sanitation. 443 million school days are lost each year from diarrhea disease. Failure to meet the Millennium Development Goals (MDG) on water and sanitation can bring a 14-fold return (Bitew *et al.*, 2017; Peter & Umar, 2018; Okafor *et al.*, 2022). There has also been a welcome emphasis on the effects that improved water supply and sanitation can have on health (Hunter *et al.*, 2010; Merid *et al.*, 2023). The importance of water as a vehicle for the spread of diseases has long been recognized and there have been numerous publications and articles describing human health in relation to water supply and sanitation (Lin *et al.*, 2022; Shehu & Nazim, 2022). Most of the illness which prevails in developing countries, where water supply and sanitation are deficient, are infectious diseases caused by bacteria, protozoa, viruses or intestinal parasites (Cabral, 2010; Shayo *et al.*, 2023). The prevention of any communicable disease requires that the cycle of disease transmission be broken.

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Depending on the principal transmission route, different interventions in water supply and sanitation may be required.

Where water for domestic use is sourced from ponds or streams contaminations are suspected from the use of same water sources for bathing and convenience purposes (Mock *et al.*, 2017). Where the predominant toilet systems are latrines, contamination of underground water through effluent from the latrines is most suspected for the commonly adopted dug well water sources particularly where established minimum standard radii for locating the two facilities (wells and latrines) are not adhered to. Leachate from refuse dumps can contaminate groundwater, posing serious immediate or long-term health threats. However, in addition to the environmental nuisance they constitute (smell, ugly sights, road blockages, etc) refuse dumps, particularly when unattended, serve as breeding grounds for disease pathogens (Daniel *et al.*, 2021; Siddiqua *et al.*, 2022).

Poor drainage networks encourage the growth of disease pathogens and vectors; they as well encourage the spread of diseases (WHO, 2024; Shayo *et al.*, 2023). Poor sanitation and bad water supply will therefore have only negative implications on the state of health of the people in the area. It was necessary to also evaluate the contributions of educational and social factors to the prevalence of these disease conditions in the study area with a view to ascertaining the effect of awareness levels and beliefs on the health of the people within the study area. It was necessary to investigate the most common water sources/disease conditions of the people in the study area.

Zaria is an ancient city and has no frequent supplies of pipe borne water from the water works. Therefore, these people resort to fetching water from rivers, streams and to digging shallow hand-dug wells, without accurate well location and construction strategies in mind. It was necessary to conduct a survey with a view to ascertaining the incidence of diseases in the area which are either water borne, water related or occur as a result of the source/sources of water supply to the area with a view to identifying likely

sources of contamination to which prevalent disease conditions could be attributed.

MATERIALS AND METHODS

Study location

Zaria's position latitude 11°N and longitude 7°38'E coincides with the intersection of two major regional axes Sokoto/Jos and Kano/Kaduna main regions (Fig 1). It is located almost centrally within Kaduna state in Northern part of Nigeria. It is less than 80 km drive to Kaduna along the major highway. Zaria City is the most southernly of the four residential districts which make up Zaria urban area, the others being Tudun Wada, Sabon Gari and Samaru/University residential districts (<https://www.britannica.com/place/Zaria-Nigeria>).

Zaria has a tropical continental/tropical savanna climate, and is located some 640 km from the sea (as the crow flies). The temperature spread through the year ranges from 14 °C – 31 °C. April being the hottest month at times temperature rising up to a maximum of 36 °C. Prevailing wind directions are two-North/East wind (Oct/Dec/April) and South/West wind (April/June/Oct) each generally marking the dry and wet seasons respectively. Zaria lies within Sudan savanna, which is probably the largest vegetation zone in Nigeria. It is grassy and a sparsely wooded region and most of the trees are of the acacia family.



Figure 1. Map of Nigeria showing Zaria (Source: Google Maps, 2015).

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Hospital data

Health data from Ahmadu Bello University Teaching Hospital (ABUTH), Zaria, for the period of 5 years was obtained (i.e., 2001 to 2005), from the Medical Microbiology Department, on the test results of patients submitting specimens for gastrointestinal infections (stool culture) and bilhaziasis (urine microscopy). Patient specimens diagnosed as positive or negative results were recorded. The ages, sex, dates and the addresses of the patients were also collected from the Medical Records Department of the hospital. The addresses are used to trace the area where most of the complains come from, in order to be able to link the diseases to the environment, where the patients live or reside.

Ahmadu Bello University Teaching Hospital, Zaria, Tudun Wada was chosen for the surveillance of the gastrointestinal infections because; it is a government/public hospital. The hospital also has proper documentation of the records needed to carry out this study and one of the best and biggest for reference in the treatment of tropical diseases in Zaria and neighboring towns. Its clientele (the majority from lower-and middle-income families) extends all over the city.

Field survey

A visit to the study areas where most of the cases diagnosed and recorded in the hospital, as having the highest incidence/prevalence rates based on the addresses of the patients, was

undertaken to obtain information on sanitation programme in the community, household that have improved latrines and excreta disposal for individual households, observation of the daily life of the community e.g., water-carrying tasks and water reuse practices in the area, the problems associated with obtaining water in the community, indirect observation of domestic/personal hygiene and latrine use habits and socio-economic determinants influencing the behaviour and attitudes of the household/community members. These include; level of education (e.g, primary school and above and uneducated) and income level.

DISCUSSION OF RESULTS

Hospital Data

The data collected from medical microbiology and medical records units of the hospital for stool culture and urine microscopy for five years (2001 – 2005) are presented. Test results diagnosed as positive and negative are shown in Tables 2 and 8. The frequency distribution of the organisms detected from the specimens examined from each residential area (Tables 3 and 9) and the breakdown of each type of organisms found from the specimens are shown in Tables 4, 5, 6, and 7 respectively. The hospital incidence rates of water borne diseases based on the reported cases were calculated for each residential area, using the following relationship:

$$IR = \left(\frac{\text{No of cases (positive)}}{\text{Population surveyed (positive + negative) x 5yrs}} \right) \times 1000 \dots\dots\dots 1$$

Population surveyed is the total number of patients sampled. The results are shown in Table 1

Table 1: Hospital incidence rates (1R) of water borne diseases per 1000 of the population surveyed over a 1-year period.

Residential areas	IR (stool culture)	IR (urine microscopy)	IR (stool & urine)
Sabon Gari	25.9	20.8	23.4
Zaria city	54.0	44.5	49.5
Tudun Wada	26.4	22.6	24.6
Samaru	22.0	21.0	21.5

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The incidence rate (IR) of water borne diseases per 1000 of the population surveyed from A.B.U Teaching hospital data over a 1-year period showed that Zaria City had the highest incidence rate (49.5) of gastrointestinal infections, including bilhazaisis (Table 1). The number and frequency distribution of the results of organisms detected from stool specimen submitted for stool culture tests at ABUTH, Zaria in Tables 2 and 3, showed that the percentage of the total organisms detected from that Sabon Gari Area was 361(16.7%), Zaria City 1100(50.9%), Tudun Wada 398(18.4%), and Samaru 302(14 %). It was observed that Zaria City had the highest number (1100) of positive cases detected, while Samaru had the least number (302) detected. The breakdown in Tables 4, 5, 6, 7, of the types of organisms detected in all the four major residential areas of Zaria from 2001 to 2005, includes *E. coli*, *Salmonella typhi*, *Salmonella paratyphi*, *Shigella* spp., *Vibrio cholerae*, and *Klebsiella* spp. All the organisms detected are either water borne or water related disease causing organisms.

The number and frequency distributions of the results of the microbiological examination

detecting the presence (+ve) and absence (-ve) of Ova of schistosoma haematobium (O.Sch H) from urine specimens submitted at ABUTH, Zaria from 2001 to 2005 are shown in Tables 8 and 9. The results of the urine microscopy also revealed that Zaria City had the highest recorded number and frequency of the presence of Ova of schistosoma haematobium 806(49.6%), while the low recorded cases were from Samaru area 260(16%).

The low level of the number of organisms detected from Samaru area might not be unconnected to the fact that they are more enlightened and most of the inhabitant engage in white collar jobs and live in organized clustered settings that portray a semi-urban as area, compared to the inhabitant of Zaria City, who still maintain its traditional settings and ancient way of living and interaction that encourages bad practices towards handling drinking water, sanitation and hygiene, which might contribute to the high level of organisms detected and frequency of reported cases in the hospital.

Table 2: Microbiological examination detecting the presence (+ve) and absence (-ve) of organisms from stool Specimens submitted at ABUTH, Zaria

Year	2001		2002		2003		2004		2005		TOTAL	
	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve
Town												
S/GARI	62	450	69	498	63	490	79	501	88	488	361	2427
Z/CITY	150	578	184	596	220	598	264	592	282	610	1100	2974
T/WADA	68	499	78	489	82	468	86	568	84	596	398	2620
SAMARU	54	488	62	463	60	492	58	502	68	503	302	2448
TOTAL	334	2015	393	2046	425	2048	487	2163	522	2197	2161	10469

Table 3: Frequency distribution of organisms detected from stool specimens submitted for stool culture test at ABUTH, Zaria

Year	2001		2002		2003		2004		2005		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Towns												
S/GARI	62	18.6	69	17.6	63	14.8	79	16.2	88	16.9	361	16.7
Z/CITY	150	44.9	184	46.8	220	51.8	264	54.2	282	54.0	1100	50.9
T/WADA	68	20.4	78	19.8	82	19.3	86	17.7	84	16.1	398	18.4
SAMARU	54	16.2	62	15.8	60	14.1	58	11.9	68	13.0	302	14.0

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Year	2001		2002		2003		2004		2005		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Towns												
TOTAL	334	100	393	100	425	100	487	100	522	100	2161	100

No = Number of organisms detected

Table 4: A break-down of Organisms detected from stool specimens examined at ABUTH, Zaria

Towns	Year	2001		2002		2003		2004		2005		Total	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
SABON GARI	Organisms Detected												
	E. Coli	12	19.4	14	20.3	10	15.9	13	16.5	16	18.2	65	18.0
	Salmonella Typhi	11	17.7	12	17.4	10	15.9	13	16.5	14	16.0	60	16.6
	Salmonella Paratyphi	10	16.1	13	18.8	12	19.0	17	21.5	18	20.5	70	19.4
	Shigella spp	8	12.9	9	13.0	10	15.9	14	17.7	15	17.0	65	15.5
	Vibro cholerae	16	25.8	17	24.6	18	28.36	20	25.3	21	23.9	92	25.5
	Klebsiella spp	5	8.1	4	5.80	3	4.8	2	2.53	4	4.55	18	4.99
	Total	62	100	69	100	63	100	79	100	88	100	361	100

No = Number of organisms detected

Table 5: A break-down of Organisms detected from stool specimens examined at ABUTH, Zaria

Towns	Year	2001		2002		2003		2004		2005		Total	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
ZARIA CITY	Organisms Detected												
	E. Coli	30	20.0	39	21.2	47	21.4	51	19.3	62	22.0	229	20.8
	Salmonella Typhi	28	18.7	33	17.9	40	18.2	46	17.6	48	17.0	195	17.7
	Salmonella Paratyphi	21	14.0	26	14.1	33	15.0	42	15.9	43	15.2	165	15.0
	Shigella spp	20	13.3	24	13.0	30	13.6	41	15.5	42	14.9	157	14.3
	Vibro cholerae	51	34.0	60	32.6	70	31.8	80	30.3	85	30.1	346	31.5
	Klebsiella spp	0	0	2	1.1	0	0	4	1.5	2	0.7	8	0.7
	Total	150	100	184	100	220	100	264	100	282	100	1100	100

No = Number of organisms detected

Table 6: A break-down of Organisms detected from stool specimens examined at ABUTH, Zaria

Towns	Year	2001		2002		2003		2004		2005		Total	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
	Organisms Detected												
	E. Coli	12	17.6	14	17.9	13	15.9	20	23.3	13	15.5	72	18.1
	Salmonella Typhi	10	14.7	12	15.4	12	14.6	16	18.6	11	13.1	61	15.3

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Towns	Year	2001		2002		2003		2004		2005		Total	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
TUDUN WADA	Organisms Detected												
	Salmonella	17	25.0	14	17.9	13	15.9	14	16.3	16	19.0	74	18.6
	Paratyphi												
	Shigella spp	11	16.2	13	16.7	12	14.6	10	11.6	15	17.9	61	15.3
	Vibro cholerae	16	23.5	22	28.2	28	34.1	24	27.9	25	29.8	115	28.9
	Klebsiella spp	2	2.94	3	3.8	4	4.90	2	2.3	4	4.8	15	3.77
Total		68	100	78	100	82	100	86	100	84	100	398	100

No = Number of organisms detected

Table 7: A break-down of Organisms detected from stool specimens examined at ABUTH, Zaria

Towns	Year	2001		2002		2003		2004		2005		Total	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
SAMARU	Organisms Detected												
	E. Coli	13	24.1	9	14.5	10	16.7	14	24.1	10	14.7	56	18.5
	Salmonella Typhi	15	27.8	18	29.0	19	31.7	19	32.8	18	26.5	89	29.5
	Salmonella Paratyphi	10	18.5	12	19.4	10	16.7	10	17.2	15	22.1	57	18.9
	Shigella spp	4	7.41	8	12.9	6	10.0	4	6.9	6	8.82	28	9.27
	Vibro cholerae	11	20.4	12	19.4	12	20.0	10	17.2	15	22.1	60	19.9
	Klebsiella spp	1	1.85	3	4.84	3	5.0	1	1.72	4	5.88	12	3.97
	Total		54	100	62	100	60	100	58	100	68	100	302

No = Number of organisms detected

Table 8: Microbiological examination detecting the presence (+ve) and absence (-ve) of Schistosoma haematobium eggs from urine specimens submitted at ABUTH, Zaria

Towns	Year	2001		2002		2003		2004		2005		Total	
		+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve
SABON GARI	Ova of schistosoma heamatobium (O.Sch H)	48	460	58	489	46	408	54	498	62	460	268	2315
ZARIA CITY	Ova of schistosoma heamatobium (O.Sch H)	132	520	148	601	169	540	177	558	180	599	806	2818
TUDUN WADA	Ova of schistosoma heamatobium (O.Sch H)	48	452	66	486	52	460	58	399	68	498	292	2295

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Towns	Year	2001		2002		2003		2004		2005		Total	
		+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve
SAMARU	Ova of schistosoma haematobium (O.Sch H)	56	392	42	531	48	402	51	410	63	485	260	2220
	TOTAL	284	1824	314	2107	315	1810	340	1865	373	2042	1626	9648

No = Number of organisms detected

Table 9: Frequency distribution of Schistosoma haematobium eggs from urine specimens submitted at ABUTH, Zaria

Towns	Year	2001		2002		2003		2004		2005		Total	
		No	%	No	%	No	%	No	%	No	%	No	%
SABON GARI	Ova of schistosoma haematobium (O.Sch H)	48	16.9	58	18.5	46	14.6	54	15.9	62	16.6	268	16.5
	TOTAL	132	46.5	148	47.1	169	53.7	177	52.1	180	48.3	806	49.6
ZARIA CITY	Ova of schistosoma haematobium (O.Sch H)	48	16.9	66	21.0	52	16.5	58	17.1	68	18.2	292	18.0
	TOTAL	56	19.7	42	13.4	48	15.2	51	15.0	63	16.9	260	16.0
TUDUN WADA	Ova of schistosoma haematobium (O.Sch H)	56	19.7	42	13.4	48	15.2	51	15.0	63	16.9	260	16.0
	TOTAL	284	100	314	100	315	100	340	100	373	100	1626	100

No = Number of organisms detected

CONCLUSION

The incidence rate (IR) of water borne diseases per 1000 of the population surveyed from A.B.U Teaching hospital data over a 1-year period showed that Zaria City had the highest incidence rate (49.5) of gastrointestinal infections, including bilhazais. It was observed that Zaria City had the highest number (1100) of positive cases detected, while Samaru had the least number (302) detected. The breakdown of the types of organisms detected in all the four major residential areas of Zaria, includes *E. coli*, *Salmonella typhi*, *Salmonella paratyphi*, *Shigella* spp., *Vibrio cholerae*, and *Klebsiella* spp., and all the organisms detected are either water borne or water related disease causing organisms. The number and frequency distributions of the results

of the microbiological examination detecting the presence and absence of Ova of schistosoma haematobium (O.Sch H) from urine specimens submitted at ABUTH, Zaria from 2001 to 2005 from urine microscopy results also revealed that Zaria City had the highest recorded number and frequency of the presence of Ova of schistosoma haematobium 806(49.6%), while the low recorded cases were from Samaru area 260(16%).

THE NEXT LINE OF RESEARCH DIRECTIONS

Field survey

A visit to the study areas where most of the cases diagnosed and recorded in the hospital, as having the highest incidence/prevalence rates based on the addresses of the patients, was undertaken to obtain information on sanitation programme in the community, household that

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have improved latrines and excreta disposal for individual households, observation of the daily life of the community e.g., water-carrying tasks and water reuse practices in the area, the problems associated with obtaining water in the community, indirect observation of domestic/personal hygiene and latrine use habits and socio-economic determinants influencing the behaviour and attitudes of the household/community members. These include; level of education (e.g, primary school and above and uneducated) and income level.

Questionnaire Survey

Structured questionnaires were designed that fit the prevailing local conditions and to be allotted to the four major areas in Zaria City, where the diseases are prevalent (i.e., Limanchi ward, Kusfa ward, Juma ward and Kanfage ward) in Zaria City, as obtained from the hospital

records. The questionnaires would be distributed using the random sampling methods, and purposive sampling as the case may demand, following the old primary health care (PHC) house numbering system. The data collected through questionnaire would be analyzed using a Statistical Package for Social Science (SPSS). With this package multiple regression analysis (stepwise) would be performed on the data obtained. Descriptive statistics for this survey would also be generated using the SPSS (Statistical Package for Social Science) software. The hospital Incidence rate (IR) would be considered the dependent variable, while all other variables will represent the independent variables. The community incidence rate of water borne diseases determined from the questionnaire survey would be calculated using the equation given below and compared with the hospital incidence rates:

$$IR = 1000 \left(\frac{\text{Reported cases}}{\text{Household population} \times 2\text{years}} \right) \dots\dots\dots 2$$

Water Quality Sampling and Analysis - Well Water

Bacteriological analysis of water was selected for sampling well water. This is as a result of the fact that a high number of the population living in Zaria city and areas with highest numbers of reported cases of gastrointestinal infection including bilhaziasis consume well water. Also, water borne diseases transmission occurs when the pathogen is in water, and is drunk by a person, or an animal that becomes infected. A total of 24 well water would be sampled at various locations in the four major areas, where the reported cases of the disease have high prevalence (i.e., Limanchi ward, Kusfa ward, Juma ward and Kanfage ward of Zaria City). The well water samples would be collected for analysis during the dry and rainy seasons. Dry season sample collection and analysis would be carried out for six (6) weeks and the rainy season sample collection and analysis would also be carried out for six (6) weeks duration.

Development of Strategic Plan for Remediating Observed Causes of Disease Incidence in Zaria City

Strategic plan for improving drinking water quality, sanitation and hygiene in Zaria would be developed into phases after finding out the causes of disease incidence rates in the area, under the following headings; Actions; Stakeholders Responsible; and then the Time Frame needed to execute the project.

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