



Four-year retrospective survey of water, sanitation and hygiene associated diseases in Onitsha, Nigeria (2011-2014)

Michael Uchenna Orji¹, Ikechukwu Okoli*¹, and Emmanuel Emeka Ezenwaji²

¹Department of Applied Microbiology, Nnamdi Azikiwe University, P.M.B. 5025, Awka.

²Department of Geology, Nnamdi Azikiwe University, P.M.B. 5025, Awka.

*Corresponding Author

E-mail: ik.okoli@unizik.edu.ng

Phone: +234-706-117-4822

ABSTRACT

Objective: Ex-post-facto to research design was used to assess the occurrence of dysentery, diarrhea, typhoid and malaria in Onitsha, Nigeria within the period 2011-2014 using records available at four hospitals strategically located within the city. **Methods:** Responses from questionnaires and visual observations during on-the-spot check for practices of open defecation sources of water supply and waste disposal system in the city were used to substantiate information from the hospital records. **Results:** Occurrences of the four diseases were very high in the city. Malaria had the highest occurrence (16,393 in 2011, 14,974 in 2012, 12,720 in 2013 and 12,193 in 2014). Typhoid fever had occurrence of 6,459 in 2011, 4,865 in 2012, 5,010 in 2013 and 5,061 in 2014. Diarrheal diseases recorded 5,194 in 2011 while dysentery occurrence was 1,143 in 2011, 1488 in 2012, 1,011 in 2013 and 1,123 in 2014. The occurrence of the four diseases in the area was found not to be dependent on season. Diarrhea was found to occur more among age group 0-4 years. Malaria showed slightly higher occurrence in females than males. **Conclusion:** There were evidence of bad environmental hygiene and sanitation practices in the city and these were thought to be responsible for the high prevalence of the diseases in the area.

[Michael Uchenna Orji, Ikechukwu Okoli, and Emmanuel Emeka Ezenwaji. **Four-year retrospective survey of water, sanitation and hygiene associated diseases in Onitsha, Nigeria (2011-2014)**. *Nat Sci* 2022, 20(10):11-16]. ISSN 1545-0740 (print); ISSN 2375-7167 (online). <http://www.sciencepub.net/nature> 03. doi:[10.7537/marsnsj201022.03](https://doi.org/10.7537/marsnsj201022.03).

Keywords: water, sanitation, hygiene, diseases.

INTRODUCTION

Water in association with bad sanitation and poor environmental hygiene practices is known to be vehicle for the transmission of a number of human diseases. World Health Organization [1] estimated that up to 80% of ill-health in developing countries is water and sanitation related. Globally, diarrhea caused by inadequate drinking water, sanitation, and hand hygiene is responsible for an estimated 842,000 deaths every year, or approximately 2,300 people per day [2]. Such water and hygiene related diseases include cholera [3,4,5], diarrhea/ gastroenteritis [6,7,8], typhoid and paratyphoid fever [9-12], amoebiasis, rotavirus diarrhoea, campylobacteriosis, schistosomiasis [13-16], malaria [17,18].

The state of water supply services, sanitation and environmental hygiene practices in Onitsha is deplorable despite the fact that so much wealth is generated from the thriving commercial activities in the city. Onitsha is the commercial nerve centre of eastern Nigeria, especially Anambra State. It has a population

of about one million and is located at co-ordinates approximately 6° 05' N/6° 45' E, disposing tropical climatological indices.

A report on the design of integrated waste management facility in Onitsha [19] showed that Onitsha is a full fledge urban settlement (city), deposing one of the largest concentration of markets in west African sub-region with high prolific waste generation profile but lacks waste disposal facilities, and so has compounded environmental sanitation problems.

There are much intrinsic features that suggest obvious high prevalence of water sanitation and hygiene related diseases in Onitsha, but there are paucity of information from the literature that highlighted the degree of occurrence of such diseases in the area. This study was therefore designed to carry out a four year retrospective evaluation of the prevalence of water, sanitation and hygiene related diseases (2011-2014) in Onitsha.

MATERIALS AND METHODS

General Hospital Onitsha (government hospital), Boromeo Hospital (church-owned) and two private hospitals; Toronto Hospital and Idemili Hospital were used for the study. The choice of the hospitals was predicated on their strategic locations within the city, easy access to the public, and their rate of patronage by patients.

The number of in- and out-patients treated of any of the water, sanitation and hygiene related diseases at the designated hospitals within the period of 2011-2014 were obtained from the hospital records. The water and sanitation related diseases found in the hospital records include dysentery, diarrhea, typhoid fever and malaria. Cases of worm, amoebic and bacterial dysentery were simply recorded as dysentery while gastroenteritis and all diarrheal cases were recorded as diarrhea.

Records of each of the diseases from the four hospitals were added together to obtain the monthly and yearly occurrence of the respective diseases in the area. The monthly records of each of the diseases and their record with respect to age and sex were obtained. The monthly records were used to estimate the influence of season on occurrence of the disease using months of May to October as wet season, and months of November to April as dry season.

Structured questionnaires designed to elicit responses that would give information on sources of drinking water, sanitation practices, level of open defecation, common diseases in the area, how often they were treated of the diseases and where they are treated were administered to 500 households randomly within the study area.

Transect walk was conducted round some areas within the city to have on-the-spot check of practices of open defecation, sources of water supply and waste disposal points. Statistical analysis using analysis of variance (ANOVA) was used to check whether there was significant difference in occurrence of the diseases over the study years, age, sex and season.

RESULTS

The occurrence of dysentery, diarrhea, typhoid fever and malaria in Onitsha for the period 2011-2014 is shown in Figure 1. The result showed high occurrence of the four diseases in the area over the period with malaria showing the highest occurrence. The results also showed a significant decrease in occurrence of malaria over the study period but no significant decrease in occurrence of the other three diseases.

Occurrence of the diseases with respect to age and sex is shown in Tables 1 and 2 respectively. The results showed that diarrhea occurred more among ages group 0-14 with age group 0-1 showing the highest occurrence. Malaria showed high occurrence among all the age groups with slight reduction in age group 65-above. Typhoid fever occurred highest among age group 15-44.

Statistical analysis did not show significant difference in occurrence of any of the four diseases with respect to sex except malaria that showed slightly higher occurrence in females than males. Table 3 shows the influence of season on the occurrence of the four diseases. The result showed that wet and dry season did not have significant influence in the occurrence of the diseases over the period except malaria that recorded very slight higher occurrence in wet than in dry season in 2014 with the number of occurrence being 6,142 in wet season and 6,051 in dry season.

DISCUSSION

Occurrence of water, sanitation and hygiene-associated diseases with particular reference to dysentery, typhoid fever, diarrhea and malaria over the study period (2011-2014) was very high and showed neither a progressive increase nor decrease over the period. The high occurrence of the four diseases as recorded may not be surprising when the predisposing factors for each of the diseases in Onitsha are considered. For instance, municipal water supply services in Onitsha by the state water corporation has been moribund for over six years leaving the distribution of water in the city in the hands of water vendors/hawkers who obtain water from river Niger and few boreholes dug by wealthy individuals. The potability of water supplied by these water vendors/hawkers is better imagined especially as they use the same containers to fetch water from river Niger and the boreholes with regardless of the hygienic compromise. Onitsha has no properly planned waste disposal facilities, hence solid waste are dumped indiscriminately even in water ways and gutters/drains especially around Nwangene and Otumoye creek to the extent that foul smelling pools of stagnated water are found even around residential areas and gutters within the city. Result of the study showed that malaria had the highest occurrence over the study period. The result is expected since there are so much stagnant waters and other mosquito breeding habitats in the area. It is an established fact that malaria is spread through the bite of plasmodium-carrying Anopheles mosquito [18,20]. The prevalence of mosquito breeding habitats throughout the year in Onitsha may explain

why there was no significant difference in occurrence of malaria in the area between wet and dry season.

The slightly progressive decrease in occurrence of malaria over the four years (Fig. 1) is obviously not a function of improved environmental hygiene but a possible improvement in level of use of mosquito bite preventive measures (e.g. mosquito nets, repellants and insecticides) and possible increase in number of drug/chemist/pharmacy stores within the city which provide immediate across-the-counter anti-malaria drugs to people hence reducing the number of malaria patients that go to the hospital.

The relatively higher occurrence of malaria among females (Table 2) may be explained by possible higher exposure of females involved in trading beside mosquito breeding habitats to mosquito sites. During the on-the-spot-check for level of environmental hygiene in terms of sanitation/presence of human feces in open places and mosquito breeding habitats in the city, it was observed that mainly female traders sell their items of trade comprising mainly food condiments, vegetables and local food stuff beside heaps of refuse dumps and stagnated pools of dirty water. However, similar higher prevalence of malaria in women than men has been reported in Amaigbo, Imo state, Nigeria [17].

The high occurrence of malaria across all the age groups (Table 1) tends to support the view of Acholonu (1984) that malaria occurs irrespective of age, as mosquitoes do not discriminate on individual ages for their blood meals. The result however showed that the disease occurred comparatively higher in age group 15-44 and 5-14 respectively.

A surprising observation in this study was the complete absence of cholera in the records of the four hospitals used for this study, considering that typhoid fever and diarrhea (which are examples of fecal-oral-route transmitted diseases like cholera), recorded occurrences as high as 6,459 and 5,194 in 2011, 4,865 and 7,240 in 2012, 5,010 and 5,164 in 2013, 5,061 and 6,376 in 2014 respectively (Table 1) and there was evidence that cholera cases were not recorded as diarrhea in those hospitals. Responses from questionnaire administered corroborated the observation, confirming the absence of cholera epidemic in the city over the study periods.

Typhoid fever and diarrhea did not show marked progressive increase or decrease over the study period (Fig. 1) and statistical analysis showed no significant difference in their occurrence with respect to season. The observation is however not surprising because the bad environmental hygiene and sanitation practices

coupled with poor state of potable water supply series in the city prevailed over the study period. No significant difference was observed in the study area over the study period (data not shown).

Diarrhea has been observed to occur more in age group 0-1 and 2-4, and it was also noted that diarrheal diseases remain a major cause of childhood mortality and morbidity in developing countries [21]. The occurrence of diarrheal diseases in children more than adults have also been reported by several other authors [5,7].

Dysentery had a lower occurrence than the rest of the diseases. This may be a consequence of the ease with which the disease is treated at the counter at the drug pharmacy stores, and so fewer cases get to the hospitals.

Typhoid fever like malaria showed relatively high occurrence across all the age groups with slightly higher occurrence in age group 15-44 and 5-14. The disease is known to be spread through consumption of food or water contaminated with *Salmonella typhi* [22,23]. Food and water are contaminated by *Salmonella typhi* through human and animal feces containing the organism [10,24]. It is therefore not surprising that the disease showed high occurrence across all the age groups in the study area since the possibility of contamination of food and water by *Salmonella typhi* through human feces commonly found in some open spaces within the city was obvious.

It is possible that the occurrence of the four diseases as obtained from the records of the four designated hospitals may be lower than the actual prevalence of the diseases in the study area over the study period. This is because record of the four diseases in other hospitals and the numerous drug/pharmacy store that give over-the-counter medical treatment to people in the city could not be considered. However, since there are possibilities that some patients who came from towns outside Onitsha and who were not resident at Onitsha were treated in the hospitals used for this study, it may be said that the number of such patients balances up the number of patients in other hospitals and drug stores not captured in the study. The result of this survey may therefore justifiably represent a close estimate of the occurrence of dysentery, diarrhea, typhoid fever and malaria in Onitsha within the period 2011-2014.

REFERENCES

- [1]. WHO. Water and Sanitation. World Health Organization 1996; Fact Sheet No. 112.
- [2]. Prüss-Ustün A, Bartram J, Clasen T, Colford JM, Cumming O, Curtis V, Bonjour S, Dangour AD, De France J, Fewtrell L, Freeman MC, Gordon B, Hunter PR, Johnston RB, Mathers C, Mäusezahl D, Medlicott K, Neira M, Stocks M, Wolf J, Cairncross S. Burden of disease from inadequate water, sanitation and hygiene in low- and middle-income settings: a retrospective analysis of data from 145 countries. *Tropical Medicine and International Health* 2014;19(8):894-905.
- [3]. Bompangue D, Giraudoux P, Plisnier PD, Mutombo Tinda A, Piarroux M, Sudre B, Horion S, Tamfum J, Ilunga BK, Piarroux R. Dynamics of cholera outbreaks in great lakes region of Africa, 1978–2008. *Emerging Infectious Diseases* 2011;17(11):2026-2034.
- [4]. Caincross G, Cliff JI. Water use and health in Mireda, Mozambique. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 1987;81:51-54.
- [5]. Adkins HJ, Escamilla J, Santiago L, Ranoa C, Echeverria P, et al. Two- year survey of etiologic agents of diarrheal disease at San Lazaro Hospital, Manila, Republic of the Philippines. *Journal of Clinical Microbiology* 1987;25:1143-1145.
- [6]. Germani Y, Morillon M, Begaud E, Dubourdieu H, Costa R, et al. Two-year study of endemic enteric pathogens associated with acute diarrhea in New Caledonia. *Journal of Clinical Microbiology* 1994;32:1532-1536.
- [7]. Okeke IN, Ojo O, Lamikanra A, Kaper JB. Etiology of acute diarrhoea in adults in southwestern Nigeria. *Journal of Clinical Microbiology* 2003;41:4525-4530.
- [8]. Liu L, Johnson HL, Cousens S, Perin J, Scott S, Lawn JE, Rudan I, Campbell H, Cibulskis R, Li M, Mathers C, Black RE. Child Health Epidemiology Reference Group of WHO and UNICEF. Global, regional, and national causes of child mortality: an updated systematic analysis for 2010 with time trends since 2000. *Lancet* 2012;379(9832):2151-2161.
- [9]. Melloul A, Hassani L. Salmonella infection in children from the wastewater-spreading zone of Marrakesh city (Morocco). *Journal of Applied Microbiology* 1999;87:536-539.
- [10]. Orji MU, Onuigbo HC, Mbata TI. Isolation of Salmonella from poultry droppings and other environmental sources in Awka, Nigeria. *International Journal of Infectious Disease* 2005;9:86-89.
- [11]. Buckle GC1, Walker CL, Black RE. Typhoid fever and paratyphoid fever: Systematic review to estimate global morbidity and mortality for 2010. *J Glob Health* 2012;2(1): 010401, doi: 10.7189/jogh.02.010401.
- [12]. Arndt MB, Mosites EM, Tian M, Forouzanfar MH, Mokhdad AH, Meller M, Ochiai RL, Walson JL. Estimating the burden of paratyphoid a in Asia and Africa. *PLoS Negl Trop Dis* 2014;8(6):e2925. doi: 10.1371/journal.pntd.0002925.
- [13]. Velasco AC, Mateos ML, Mas G, Pedraza A, Diez M, et al. Three-year prospectivestudy of intestinal pathogens in Madrid, Spain. *Journal of Clinical Microbiology* 1984;20:290-292.
- [14]. Zhao C, Ge B, De Villena J, Sudler R, Yeh E, et al. Prevalence of Campylobacter spp., Escherichia coli, and Salmonella serovars in retail chicken, turkey, pork, and beef from the Greater Washington, D.C., area. *Applied and Environmental Microbiology* 2001;67:5431-5436.
- [15]. Mbata T, Orji M, Oguoma V. The Prevalence Of Urinary Schistosomiasis In Ogbadibo Local Government Area Of Benue State, Nigeria. *The Internet Journal of Infectious Diseases* 2008;7(1).
- [16]. Franca-Botelho AC, Lopes RP, Franca JL, Gomes MA. Advances in Amoebiasis Research Emphasizing Immunological and Oxidative Aspects. *Research Journal of Parasitology* 2011;6:1-17.
- [17]. Acholonu ADW. Malaria in Amaigbo, Imo State, Nigeria. *Nigerian Journal of Microbiology* 1984;4:80-88.
- [18]. Alnwick D. Meeting the malaria challenge. *Africa Health* 2001;23:18-19.
- [19]. FME. Study and design of Integrated waste management facility in Onitsha, Anambra State. Federal Ministry of Environment (FME), Nigeria. Final Report 2002;1:1-145.
- [20]. WHO. Intestinal parasites. In: Basic Laboratory Methods in Medical Parasitology. World Health Organization, Geneva 1991;67-73.
- [21]. Valentiner-Branth P, Steinsland H, Fischer TK, Perch M, Scheutz F, et al. Cohort study of Guinean children: incidence, pathogenicity, conferred protection, and attributable risk for enteropathogens during the first 2 years of life. *Journal of Clinical Microbiology* 2003;41:4238-4245.
- [22]. Baird-Parker AC. Foodborne salmonellosis. *Lancet* 1990;336:1231-1235.
- [23]. Waage AS, Vardund T, Lund V, Kapperud G. Detection of low numbers of Salmonella in environmental water, sewage and food samples by a nested polymerase chain reaction assay. *Journal of Applied Microbiology* 1999;87:418-428.
- [24]. Ogunbiyi JAJ, Onabowale BO. Typhoid enteritis in Lagos, Nigeria. *Nigerian Medical Journal* 1976;6:505-511.

List of Figures

Figure 1 The occurrence of dysentery, diarrhea, typhoid fever and malaria in Onitsha for the period 2011-2014

List of Tables

- Table 1 Age distribution of dysentery, diarrhea, typhoid fever and malaria in Onitsha 2011-2014
- Table 2 Sex distribution of dysentery, diarrhea, typhoid fever and malaria in Onitsha 2011-2014
- Table 3 Monthly occurrence of dysentery, diarrhea, typhoid fever and malaria in Onitsha 2011-2014

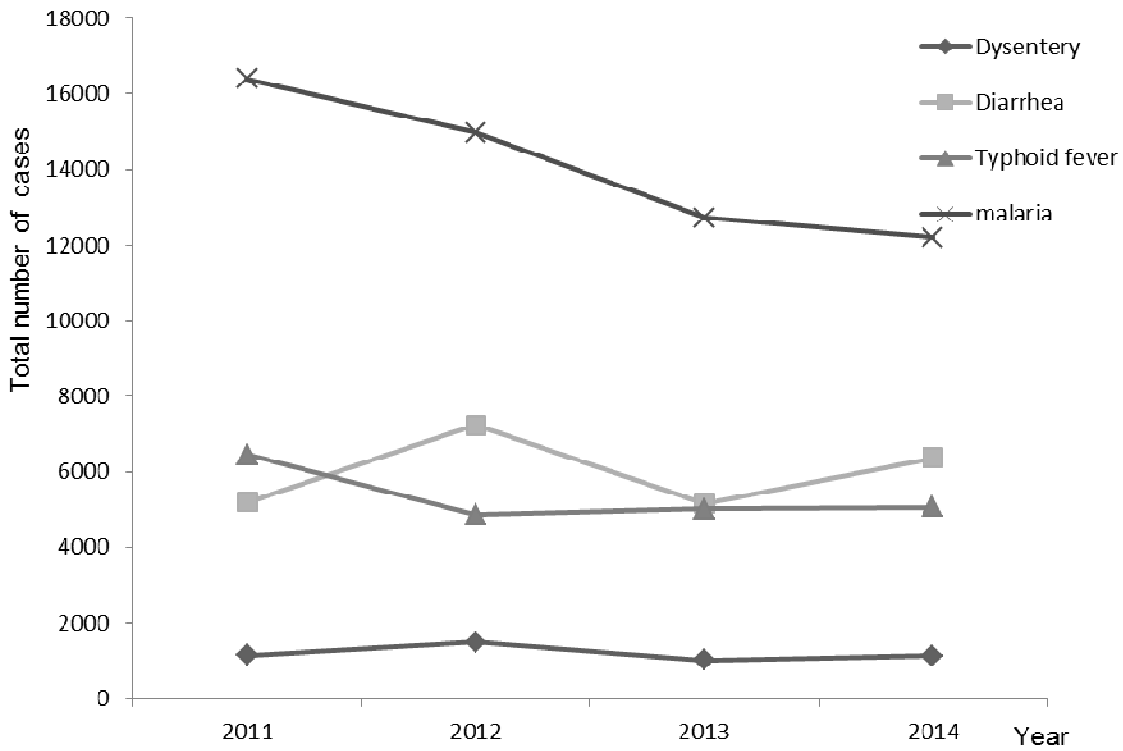


Figure 1: The occurrence of dysentery, diarrhea, typhoid fever and malaria in Onitsha for the period 2011-2014

Table 1. Age distribution of dysentery, diarrhea, typhoid fever and malaria in Onitsha 2011-2014

Year	Disease	Age Group (Years)						Total
		0-1	2-4	5-14	15-44	45-64	65-above	
2011	Dysentery	34	240	272	253	215	129	1143
	Diarrhea	1712	1502	1056	345	303	276	5194
	Typhoid fever	711	1259	1209	1690	947	643	6459
	Malaria	1740	2933	3626	5412	1698	984	16393
2012	Dysentery	32	320	328	302	291	215	1488
	Diarrhea	2253	2157	1332	672	498	328	7240
	Typhoid fever	596	984	1090	1106	705	375	4865
	Malaria	1627	2500	2990	5002	1792	1063	14974
2013	Dysentery	30	185	198	219	215	164	1011
	Diarrhea	1879	1072	1040	542	415	216	5164
	Typhoid fever	775	1018	1058	1199	469	491	5010
	Malaria	1381	2008	2236	4309	1443	1343	12720
2014	Dysentery	27	178	243	169	299	207	1123
	Diarrhea	1840	1595	1125	756	687	373	6376
	Typhoid fever	697	1000	1050	1100	623	591	5061
	Malaria	1716	1649	2441	4238	1272	877	12192

Table 2. Sex distribution of dysentery, diarrhea, typhoid fever and malaria in Onitsha 2011-2014

Year	Dysentery		Diarrhea		Typhoid fever		Malaria	
	Male	Female	Male	Female	Male	Female	Male	Fema
2011	554	589	2596	2598	3119	3340	7839	8554
2012	735	753	3610	3630	2391	2474	7212	7762
2013	513	498	2568	2596	2496	512	6028	6692
2014	567	556	3200	3176	2525	2546	5746	6447

Table 3. Monthly occurrence of dysentery, diarrhea, typhoid fever and malaria in Onitsha 2011-2014

Year	Disease	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	Dysentery	86	107	84	84	92	97	96	95	108	106	93	95
	Diarrhea	427	425	459	451	430	437	425	406	388	434	452	460
	Typhoid	454	464	465	459	598	619	628	594	631	621	473	453
	Malaria	1376	1363	1372	1342	1320	1371	1354	1364	1343	1396	1388	1404
2012	Dysentery	136	125	135	120	122	134	125	114	115	122	119	121
	Diarrhea	632	622	614	587	600	600	614	582	597	600	590	602
	Typhoid	388	417	392	407	388	394	409	412	400	407	410	441
	Malaria	1281	1252	1269	1243	1257	1269	1224	1246	1212	1284	1218	1217
2013	Dysentery	75	84	80	72	72	75	71	105	88	89	103	97
	Diarrhea	432	436	437	435	433	430	456	428	419	401	425	432
	Typhoid	410	399	407	405	399	433	434	413	422	413	442	433
	Malaria	1073	1085	1059	1070	1067	1052	1048	1068	1066	1066	1047	1019
2014	Dysentery	97	99	96	95	94	95	77	107	108	91	81	83
	Diarrhea	536	534	539	539	543	551	560	532	523	505	502	510
	Typhoid	437	428	427	413	409	420	435	414	43	414	411	430
	Malaria	971	1003	984	1044	1050	1040	999	1019	1017	1017	1025	1024

10/8/2022