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Domestic Water Source, Sanitation and High Risk of Bacteriological Diseases in the Urban Slum: Case of Cholera in Makoko, Lagos, Nigeria

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Abstract This study assesses the cholera incidence in urban slum in Lagos State, Nigeria with the emphasis on high risk of unimproved sources of water for domestic use and unsanitary environment. The study uses sets of one hundred and twenty structured guided questionnaires were randomly administered to obtain information on residents' opinions and experiences on the risk and incidence of cholera in the area. Ten water samples were spatially collected from storage containers of the residents for microbial assessment Results of social survey instrument showed there was cholera incidence and the area is still at high risk as revealed from the result of coliform bacilli with high most probable number (MPN) count found in 6 of the 16 sampled water as well as the faecal coliform found virtually in all sampled water. The study concluded that increasing population of urban centres has been a major contributor to the unsanitary environmental, continuous use of unimproved sources of water as well as environmental health problems such as slum cholera risk and incidence. Therefore, for sustainable friendly and free diseases' environment provision of habitable and conducive environment for the slum residents should be the priority of government.

Keywords: *unimproved water, unsanitary, cholera incidence, urban, slum*

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1. Introduction

Globally, poor sanitation is a major contributor to water-borne diseases and contributes to communicable diseases such as cholera which under the age children – less than five every day [1]. Poor hygiene, poor housing, overcrowded living conditions and lack of safe food preparation and handling intensify the situation in developing country particularly the slum environment [2,3,4,5]. Cholera is an intestinal infection caused by the bacterium Vibrio cholerae that affects both children and adults, and where improved water, sanitation, food safety and hygiene practices are inadequate [6,7,8,9,10]. Its symptoms characterized by a sudden onset of severe watery diarrhea with traces of critical dehydration [12,13]. Unlike other communicable diseases, cholera can kill individuals with lower immunity and malnourished children people within an hour by cholera [11]. Its short incubation - between 2hours and 5days enhances cholera spreads very quickly. Eating infected food, vegetables and fruit washed with water contaminated by sewage or drinking water that has been contaminated by the faeces of infected persons makes people or community prone the cholera risk. Today, one of the key indicators of social development is cholera and its occurrences remain a global threat and challenge to countries with minimum hygiene standards and poor access to improved domestic water and inadequate sanitation [12,13]. Cholera epidemics vary in intensity and could last for months to more than a year [14]. This epidemic is functioning amongst Asia, Africa and South America countries [9,15,16,17]. Cholera risk can be lessened by purifying drinking water, preserve food from bacteria contamination and sewage treatment/monitoring as it is being done in the developed [6,18].

In 2010 and 2011, Nigeria recorded 6,400 and 23,366 cases of cholera with 352 and 742 deaths respectively, and almost 3 persons died while 42 others were hospitalized in cholera outbreak in Ede North and South LGAs of Southwestern Nigeria in November, 2012 [1]. The causes of the incidence had been triggered by poor housing, malnutrition, overcrowding among others [2,3,4,5]). It is on the above notes that this study assessed the risk of cholera incidence in slum community of Makoko in Lagos, Nigeria. Makoko is an area of practical urban inequalities and social depreciation, where open defecation is a life style with no social value to toilets, sewage is indiscriminately disposed and virtually no cholera risk awareness. Unless these problems are addressed, not only cholera will continue to thrive but most of slum sensitive communicable diseases.

2. The Study Area

Makoko is a peripheral shanty riverine community located on the eastern part of Lagos metropolis, on the fringes of Lagos lagoon. Makoko with estimated population of about 85,000 in 2009 [19] lies within Longitude 3°12′ and 3°13′, and Latitude 6°28′ and 6°29′. It is administratively located in the Lagos Mainland Local Government Area (Figure 1) and predominantly occupied by different ethnic groups who engage in fishing. The dominant tribes in the community are Egun and Ilaje people with few Yoruba, Igbo, Ijaws and Itsekiris due to their major occupation [20]. The Eguns, Ilajes, Ijaws and Itsekiris rests in structures constructed on stilts above Lagos Lagoon (Figure 2 and Figure 3) while the Yoruba sub-tribe - the Egbas, Ijebus, Ondos and Ibadans as well as Igbos and Hausas dominate the land area.

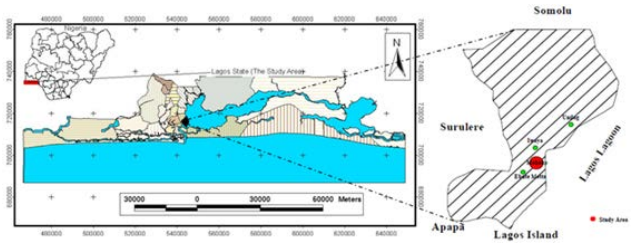

Figure 1. Makoko location in Lagos State

Figure 2. Part of Makoko (Source:http://www.flickr.com/photos/sunday_alamba/4072530164/)

Figure 3. Makoko viewed from 3rd Mainland Bridge (modified from: www.treehugger.com)

3. Methodology

This study which is concerned with urban slum cholera incidence and risk uses both social survey instrument and water quality assessment information to generate results. Well-structured questionnaire and interviews were employed as instrument for data collection. One hundred and twenty questionnaires were administered among the resident of Makoko Community on the subject matter. The questions focus on cholera cases, outbreak, sources of water supply, sanitary environment amongst other. However, the data obtained between November, 2010 and April, 2011 was statistically analyzed descriptively and inferentially using SPSS version 12.

A total of 16 water samples were spatially collected from 15 household storage containers across the community i.e. 10 samples from residents occupying lagoon and 6 from residents occupying land area. The waters were discovered to have collected from unprotected wells and lagoon within the community. Sterilized glass bottles of 250 ml capacity with Ground glass stoppers containing 0.25 ml of fresh 1.8% solution of sodium thiosulfate crystal were used for collection of water. The samples were kept at temperature below 6°C and transported to the laboratory where the services of microbiologist was employed for the samples analyzes within 72 hours from time of collection in accordance with international guidelines and/or standard as recommended by WHO [21]. For this study, Multiple tube test was adopted according to the standard procedure. After inoculation of water samples in different tubes of MacConkey's broth with inverted Durham's tubes, all the tubes were incubated at 37°C. After 18-24 hours of incubation, 0.5-1.0ml was transferred to 10ml of normal strength Alkaline Peptone Water. After incubation for 6 hours, subcultures were made on Thiosulfate Citrate Bile Sucrose (TCBS) agar plates which were incubated at 35-37°C overnight. Suspicious yellow colonies were gram stained and tested for motility and oxidase production. The samples showing characters consistent with Vibrio cholera (V. cholerae) were sub-cultured on Kligler's Iron agar slopes for serological confirmation. All those isolates that gave positive agglutination with V. cholerae O1 antiserum were identified as V. cholerae. The distribution of positive tubes MPN of total coliforms was determined by referring to standard probability table for estimation of MPN of coliforms per 100 ml water sample most probable number (MPN).

Results of the water samples analysis were entered in MS Excel sheet and analyzed accordingly. In the descriptive statistics, table and graph were used to summarize the result of questionnaires. These give visual impression of the results. On the inferential statistics, the Chi-square was used to test for the hypothesis formulated. The hypothesis was tested and the value of Chi-square computed was gotten from the formula below.

$$X^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

Where;
X^2 = Chi-square test
O_i = the observed frequency
E_i = the expected frequency

4. Results and Discussions

Findings shown male and female respondents in Makoko account for 51.7% and 48.3% for respectively.

This indicates that there was no gender bias in the process of questionnaire administration. The respondents responses on years of residency varied as 26.7%, 31.7% and 41.6% claimed to have been residing in the area for less than 5 years, between 6 – 10years and more than 10years respectively. The results reveled that almost 20% of the respondents agreed to have being attacked or diagnosed with cholera symptoms (Figure 4).

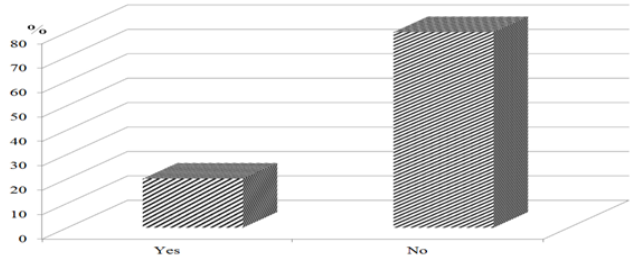

Figure 4. Personal Cholera case attack experience

Only 6.7% of the respondents agreed the area have experienced cholera outbreak. Those who said that the area have experienced cholera outbreak could not give specific date or year of the outbreak but their speculation was between late 80s and mid-90s. The respondents' views on the causes of cholera incidence varied as 33.3%, 25%, 33.3% and 8.3% attributed the causes to environment, food, water and unknown respectively (Figure 5). Their views were expediently based on the understanding of their environment and virtually little knowledge and perceptions of the cholera as a disease.

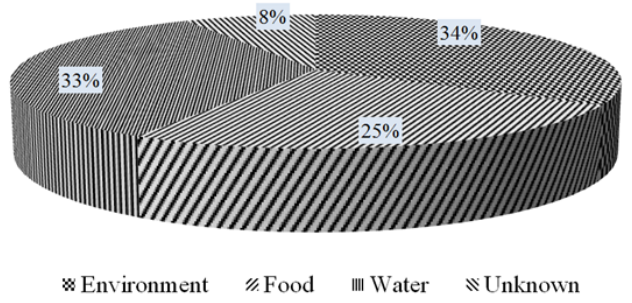

Figure 5. Causes of Cholera attack experience

The respondents' perceptions on the how cholera can be transmitted or spread agents revealed that flies and unsanitary environment are the major conveyors of cholera disease while only 2% attributed the spread to unknown agent (Figure 6).

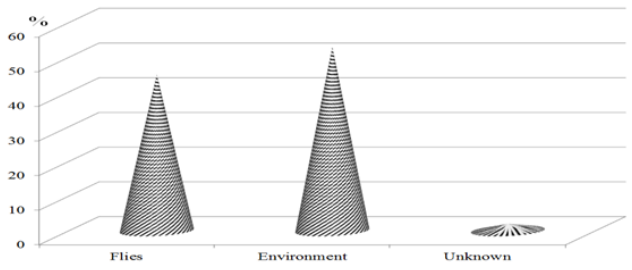

Figure 6. Spread agents of Cholera

On preventive measures, 8%, 72% and 20.0% of the respondents respectively argued that health campaign, consistence environmental sanitation and effective drug Administration would be their best option. On total eradication of cholera, 28.3%, 41.7% and 30.0% of the respondents rested their argument perceptions on Government, Communities and Individuals respectively.

The Chi square analysis carried out on the relationship between households' socio-demographic and cholera risk in Makoko revealed a significant relationship. This gives an indication that the household population, housing congestion, socio-economics status residents (mainly low income earners) and educational level are factors that contribute mainly to unhygienic environment and the use of unimproved water for domestic purposes.

4.1. Water Samples Analysis

The results of sampled water assessment revealed that 40% positivity rate of the 10 water samples collected from the stilt houses on Lagoon and 33.3% positivity rate of the of the 6 water samples collected from over-land residents were confirmed bacterium vibrio cholera presence. The presence of faecal coliform in the sampled water also suggests high contamination of sewage and animal waste. The values of total coliforms range between 0.00 and 2.10 x 106 while total bacterial counts range between 1.140 x 108 and 2.10 x 109 from point to point. Low level of personal and domestic hygiene could lead to extensive environmental of water sources in the area. It appeared that most probable incidence was caused by unimproved drinking water sources. Based on WHO recommended standards of MPN index of less than 10 for total coliforms with total absence of faecal coliforms was deemed to be satisfactory for human consumption and presence of faecal coliforms in any number rendered the water sample unsatisfactory. Therefore, this finding supports the high risk of cholera incidence in the area if appropriate measures are not introduced in due time.

5. Conclusion and Recommendations

The large and increasing population of urban centres is a major contributor to the environmental health problems. Government cannot single handed address the problem but, it also requires the collaboration of citizens either through participation in government-backed campaigns. Such participation depends on community members understanding of the causes and controls measures of any diseases incidence in the urban slum community such as Makoko in Lagos. Community members require a positive attitude towards taking responsibility for the environment and their social ways of life to encourage safe and friendly environment. It will be a great assistance for the community if government and all public stakeholders can come together to re-structure and update the pattern of healthcare facilities distribution and management that will really address cholera incidence in the not only in Makoko but all other areas at high risks of cholera and other communicable diseases in Lagos State and Nigeria at Large. It is quite imperative to provide safe drinking water, adequate sanitary facilities in the communities with high risk of communicable diseases. Residents of such communities should be motivated to use the provided sanitary facilities proper personal hygiene.

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