Original Article

CHOLERA OUTBREAK IN ANDONI LOCAL GOVERNMENT AREA, RIVERS STATE, NIGERIA; JANUARY 2015: THE ROLE OF HAND WASHING WITH SOAP

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ABSTRACT

Background: In January 2015, an outbreak of cholera occurred in Andoni, Rivers State. We investigated to identify risk factors for infection and institute control measures.

Methods: An un-matched case-control study with 62 cases and 62 neighborhood controls was conducted. A case was defined as an individual aged 5 years or more with three or more episodes of loose watery stool with or without vomiting residing in Andoni from 11th-18thJanuary 2015. A control was a person without history of loose watery stool and vomiting, but residing in Andoni. A Semi-structured questionnaire was used to collect data on demographic characteristics, clinical information and risk factors. Univariate, bivariate and multivariate analysis was performed using Epi-info version 7. Twenty-one stool samples and 6 water samples from open wells and ponds were analyzed.

Result: Median ages for cases and controls were 8.5 (range; 2– 65) and 18 (2–70) years respectively. Females were 32(51.6%) of cases and 36(56.5%) of controls. The cases and controls did not differ in age and sex. Cases were less likely than controls to wash hands with soap after using the toilet (OR:0.4, CI:0.17–0.96) and to drink from tap water (OR:0.09, 95% CI:0.01–0.69). Hand washing with soap and water remained protective of the disease after controlling for potential confounders. Eleven (52.4%) of the clinical samples and 6 (100%) of the water samples yielded vibrio cholera non O1/O139.

Conclusion: Unhygienic hand washing practices was identified as a risk factor for cholera infection. The source of the outbreak possibly resulted from contaminated wells and ponds. We provided community health education on personal hygiene, with emphasis on hand washing with soap, and recommended super chlorination of wells.

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INTRODUCTION

Cholera is an acute diarrheal infection caused by the bacterium *Vibrio cholera*.[1] Only two serogroups of the bacterium is known to cause epidemics and these are 01 and 0139.[2] Symptoms of cholera are classical and characterized by acute watery diarrhea typically known as rice water stools as a result of its characteristic appearance. Vomiting, abdominal pain and fever may also occur. More than 60% of those infected remain asymptomatic and continue to pass *Vibrio cholera* in faeces. About 80% of symptomatic cases have mild illness while 20% experience acute watery diarrhea with severe dehydration.[3]

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The global burden of cholera remains high, and largely unknown because most cases are unreported. Approximately 1.3 billion people are at risk for cholera in endemic countries with an estimated 2.86 million cholera cases and 95,000 deaths occurring annually in endemic countries.[4] The disease is endemic in developing countries of Africa, Asia, the Middle East, and South and Central America where there is scarcity of portable water and poor environmental hygiene. Sub-Saharan Africa accounts for most of this burden.[5]Cholera is mainly transmitted faeco-orally, by ingestion of food or water contaminated with *vibrio cholera*. Other common vehicles of infection include contaminated fish and shellfish, produce, or leftover cooked grains that have not been reheated properly.[6]Person-to-person transmission of cholera can also occur but

this is extremely rare because a high dose of the bacteria is needed to cause disease in healthy subjects.

Risk factors for cholera appear to vary from one geographical region to another. In Nigeria, risk factors that have been identified include street vended water and not washing of hands with soap before eating food in Kano.[7] Drinking water sold by water vendors was also connected with increased risk of contracting the disease. In Katsina, the outbreak of the disease was linked to faecal contamination of well water from sellers.[8] In 2010, a large outbreak of cholera occurred in Nigeria, and was speculated to be directly related with sanitation and water supply.

The hand dug wells and contaminated ponds being relied on by most of the Northern states as source of drinking water was a major transmission route during the outbreak.[9] Population movement has also been identified to increase risk of transmission. This may be the case in Nigeria where cholera infection is endemic and outbreaks occur commonly. Since the first appearance of epidemic cholera in 1972, intermittent outbreaks have been occurring[10]. In 2010, a severe outbreak which started in northern Nigeria and spread to the other parts of the country affected about 3,000 persons and claimed 781 lives[10].

Sporadic cases have also been reported. In week 35 in 2017, a total of 424 suspected cases of Cholera and one death (CFR, 0.24%) were reported from seven LGAs and three States; Borno – 409, Kaduna - 3 and Kano – 12 in week 35 compared with zero cases reported during the same period in 2016.[11] In January 2015, an outbreak of cholera occurred in Andoni Local Government Area of Rivers State. This was following a report from the Medical Officer of Health in the L.G.A and a confirmation of a case by the State WHO. The outbreak was said to have started in Ukwa community, and spread to neighboring communities. There were 77 cases of fever and acute watery diarrhea and 10 reported deaths within two days. We investigated the outbreak to identify possible risk factors for infection and to institute prevention and control measures.

METHODOLOGY

Study Area

The study was conducted in Andoni Local Government Area in Rivers State. The LGA is a riverine community made up of 12 wards. The major occupations of the people are fishing and trading. Source of drinking water in most towns and villages is rainwater collected into ponds or containers at home during the rainy season, and stream or well water in dry season. It has an area of 233 km² and an estimated population of 211,009 according to the 2006 census.

There are no toilet facilities in most homes in Andoni community and the source of excreta disposal is the overhung community latrine. There are 27 Primary health care centers and one general hospital in the LGA. Private hospital and Patent Medicine Vendors are also present in various towns in the LGA. The suspected Cholera outbreak affected 20 communities in 9 wards including Ngo, Ukwa, Agana, Unyengala, Ayamboko, Okama-Agana, Oronija, Ayama-Agana, EgwedeIlotombi, Oyorokoto, Isiama, Agwutobolo, Okoloile, Ebukuma, Okorolo, Asukama, Unyeada, Ajakajah and Ataba.

Study population: Residents of Andoni LGA who had symptoms of cholera at the time of investigation.

Study Design: The study was an un-matched case-control study

Case definition: We defined a suspected case of cholera as any person aged 5 years or more residing in Andoni LGA with history of three or more episodes of loose watery stools, with or without vomiting from the 8th of January, 2015.

A control was defined as neighbour aged 5 years or more residing on either side of the patient's house about 3 to 5 houses away, with no history of acute watery diarrhoea and vomiting within the 5 days prior to the study.

Inclusion Criteria

1. All persons passing watery diarrhea with vomiting and abdominal cramps irrespective of age and sex
2. Persons who has had history of passage of watery diarrhoea with vomiting and abdominal cramps in the last 5 days

Exclusion Criteria

1. Unconscious patients
2. Patients who are critically ill to respond to the questions
3. Non consenting participants

Case Finding/Subject Recruitment

Six out of 12 towns affected were sampled. Active case search was carried out to find persons having symptoms suggestive of cholera. Data was collected on cases using line-list. A case control study was conducted using persons who met the eligibility criteria.

DATA COLLECTION TECHNIQUE

Structured interviewer administered questionnaire was used to obtain information from both cases and control. The questionnaire contained information on demographic characteristics, clinical symptoms, possible risk factors and general knowledge on cholera. Cases and controls were selected in a ratio of 1:1. Total of 124 questionnaires were administered, comprising of 62 cases and 62 controls.

Data Management

Data was entered into an excel spreadsheet and cleaned, and then exported and analyzed in Epi-info version 7. Descriptive analysis of outbreak data by person, place and time was performed. Univariate analysis was expressed as frequency distribution, percentages, mean, standard deviation and rates (attack rate, case-fatality rate). Bivariate analysis was used to identify potential risk factors using chi-square test at 95% confidence level or alpha level of 5%. An exposure was considered a risk factor if the odds of association with cholera-case status at 95% confidence interval were statistically significant based on a p-value of 0.05.

Laboratory Investigations

A total of 21 clinical samples were collected from in-patients in the Primary Health Centre or Private hospitals and 6 environmental (water) samples were collected at different points (wells and ponds) where inhabitants of the communities patronized as sources of water for domestic use. All the samples were transported in Cary-Blair and Alkaline Peptone water in a reverse cold chain to the testing laboratory for analysis and characterization. Thiosulphate-citrate bile salt-sucrose (TCBS) agar was used to culture *vibrio cholera*e, and polyvalent antisera used to determine serotypes.

Ethical Consideration

Verbal informed consent was obtained from all participants and they were assured of confidentiality of the information they provided.

Environmental Assessment

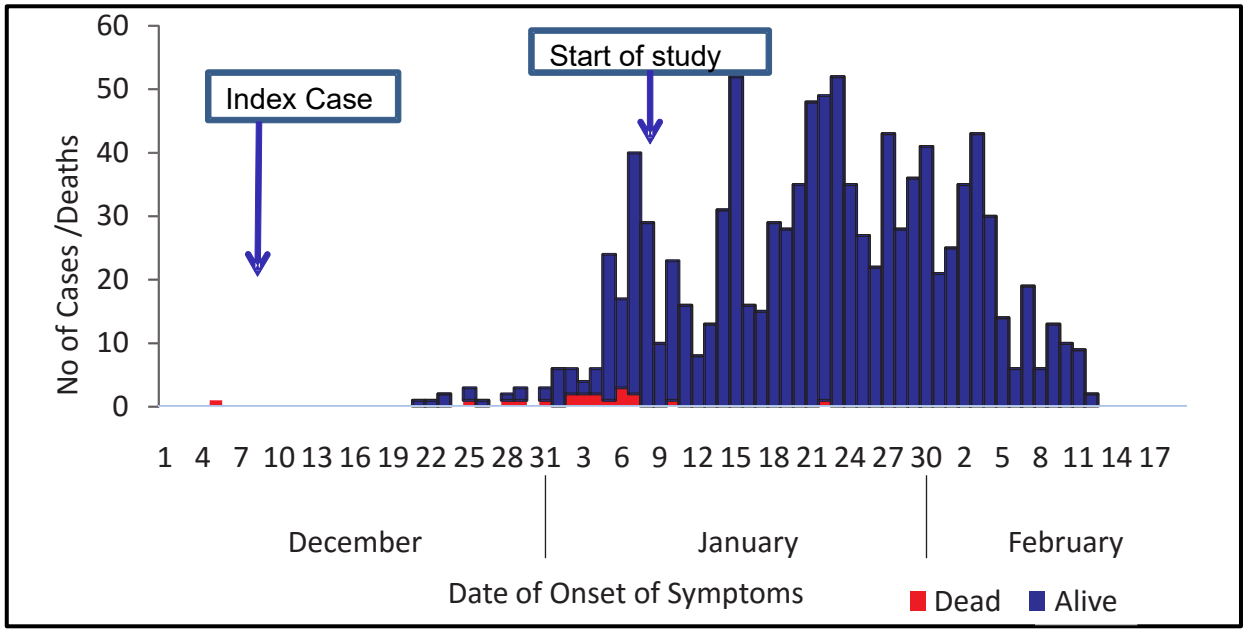
A walk through survey and assessment of the surroundings of the affected communities was conducted. Physical assessment of the toilet facilities, drinking water storage and refuse disposal facilities were also conducted in the selected affected communities.

RESULTS

Overall, a total of 1034 cases and 19 deaths occurred in the LGA, with an estimated total population of 211,009 resulting in an attack rate of 375 persons/100,000 population, and a case fatality rate of 1.84%. Majority of cases, 412(39.8) were under-fives, while the elderly age group (6.3%) constituted the least

proportion of cases. Median age of cases was 7.5 years with a range of 5 years to 85 years. Females constituted 576(55.7%) of affected cases.

Figure 1: Epicurve of Cholera Outbreak in Andoni LGA, Rivers State, February 2015



The shape of the epicurve was suggestive of a common source propagated epidemic [Figure 1]. The index case was reported on the 5th of December with multiple peaks over the three months period. The last reported case was reported on the 12th of February.

Univariate Analysis

We recruited 62 frequency-matched case-control pairs from six randomly selected communities, for the case-control study. The median age of cases from the case-control study was 8.5 years (range of 5-70years) while that of the control was 18 years (range 5-70years). Female were 32 (51.6%) of the cases and 36 (56.5%) of controls. Of the 62 cases, 60 (96.8%) had diarrhea, 29 (46.8%) had vomiting and 30 (48.4%) had abdominal cramp. The major sources of water are well water for both cases and controls and sachet water for the cases.

Seventeen (27.4%) of the cases wash hands before eating and 10 (16.1%) of the cases wash hands after use of toilet. None of the cases and controls boil their water before drinking and only 1.61% of cases has ever chlorinated drinking water while two (3.2%) cases store drinking water in a container without cover.

All (100%) of the cases and almost all controls, 61(98.39%) did not have toilet facilities in their households. Most of the respondents (72.6% of cases and 69.35% of controls) defecate into the stream/community latrines. Only 5(8.06%) cases had contact with a suspected/confirmed diarrhea case. Seven (11.29%) of the cases had attended a gathering in the one week preceding illness as compared to 10 (16.13%) of controls.

Table 1: Result of Bivariate Analysis for Risk factors for Cholera infection in Andoni LGA, Rivers State, February 2015

S/N	Exposure Variable	Case n= 62 (%)	Control n= 62 (%)	Odds Ratio	95% CI
1	Drinking from borehole	4 (6.45)	6 (9.68)	0.64	0.17- 2.40
2	Drinking tap water	1 (9.09)	10 (90.91)	**0.09**	**0.01- 0.69**
3	Drinking Sachet Water	20 (32.26)	12 (19.35)	1.98	0.87- 4.63
4	Drinking stream water	6 (9.68)	22 (35.48)	0.19	0.07- 0.52
5	Drinking well water	25 (40.32)	31 (50)	0.68	0.33- 0.38
6	Drinking pond water	17 (27.42)	12 (19.35)	1.57	0.67- 3.65
7	Ate Sea food	53 (85.5)	42 (67.7)	2.80	1.16- 6.79
8	Store water in container with cover	60 (96.97)	61 (98.39)	0.49	0.04 -5.56
9	Wash hands before eating	17 (27.42)	15 (24.19)	1.18	0.53 -2.65
10	Wash hands with soap and water after defecation	10 (16.13)	20 (32.26)	**0.40**	**0.17 - 0.96**
11	Defecate in Community Latrine	45 (72.58)	43 (69.35)	1.17	0.54 -2.54
12	Contact with diarrhea case	5 (8.06)	3 (4.92)	1.70	0.39 -7.43
13	Age less than 5years	19 (30.65)	10 (16.13)	2.29	0.97 -5.46

Result of bi-variate analysis for risk factors for cholera revealed that drinking tap water was protective of the disease with an odds ratio of 0.1 and Confidence Interval 0.0-0.7. Also, people who washed their hands with soap and water after defecation were less likely to contact cholera (OR; 0.4,CI:0.2-0.9) than those who did not [Table1].

Table 2: Multivariate Logistic Regression for Risk/Protective Factors to cholera outbreak in Andoni LGA

Exposure	B	Odds Ratio	Confidence Interval
Drinking Tap water	-2.105	0.122	0.14 – 1.03
Wash hands with soap and water after defecation	**-1.222**	**0.326**	**0.13 – 0.81**

Unconditional logistic regression revealed that hand washing with soap and water after defecation was protective of the disease after controlling for possible confounding variables. [Table 2]

Laboratory Results

Eleven out of 21 clinical (stool) samples and 6 water samples yielded polymicrobial growth of coliform species and *Vibrio cholerae* on selective media (MCA, SSA and TCBS) used. The recovered coliform species were biochemically confirmed to be *Salmonellae typhi* while the *Vibrio cholerae* isolates were serologically confirmed as non 01/0139.

DISCUSSION

The outbreak in Andoni was caused by more than one micro-organism. Bacteriological examination revealed *Salmonellae typhi* and *Vibrio cholerae* isolates non 01/0139 as the causative organism. This implies that not everyone line listed suffered from cholera. The non O1/O139 has been reported to cause a milder form of gastroenteritis and less fever than the O1 and O139 and are normally associated with sporadic cases and small outbreaks.[10,12] The shape of the epi-curve suggests that certain amount of person-to-person transmission may have occurred. This is consistent with studies outside Nigeria were person to person contact was seen as a major source of transmission.[13] The burial of those killed by cholera was not fully highlighted in the study but corpse of cholera patients are highly infectious through body fluid contact[13]and could be another source of person to person transmission of the disease

in this outbreak. There was increase in the population size of the communities affected during the end of year festivities. This may have led to a strain on the community water sources, which became contaminated. Studies in the Kenya[14] and Nigeria[10] have also found contaminated water supplies to be major sources of cholera outbreak.

A physical assessment of the affected communities revealed very poor drinking water sources, inadequate refuse and sewage disposal methods. The community latrine where majority of the inhabitants defecate was an overhung toilet which empties directly into the stream. The residents defecate, fish from and eat of the various sea foods from the same water body. Studies carried out in Germany,[13] France,[15] and Calabar Nigeria[16] showed that sea foods have been implicated in the risk factors for cholera. In this study however, people who ate sea foods were not significantly more at risk than those who did not.

Our investigations therefore suggests that the outbreak was likely caused by drinking from pond/stream and well water, which were visibly polluted and contaminated with *vibrio cholera*. This is consistent with studies done in Papua New Guinea[17], India[18] and Nigeria[10] among others.

Our study also showed that drinking from tap water was protective of the disease, this in agreement with the study in Papua New Guinea where piped water was protective of cholera[17]. Hand washing with soap after defecation was protective against infection. This has been emphasized by previous researchers as a simple, cheap and effective measure to reduce spread of infectious diseases in many environment.[17-19]

CONCLUSION

The investigation of cholera outbreak in Andoni LGA, Rivers state revealed attack rate 0.375% and a CFR of 1.84%. Hand washing with soap after defecation was identified as being protective of the disease. Contaminated wells and ponds were the likely sources of infection. The State Ministry of Health was supported by partners to institute prevention and control measures by provision of technical support, supply of medical kits and community sensitization. There is need for continuous community health education on the critical times of hand washing, especially after defecation. Alternate sources of portable drinking water should be provided in affected communities of Andoni LGA of Rivers State.

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