NFELTP

Report on Cholera Outbreak Investigation in Andoni LGA of Rivers State

Outbreak Investigation

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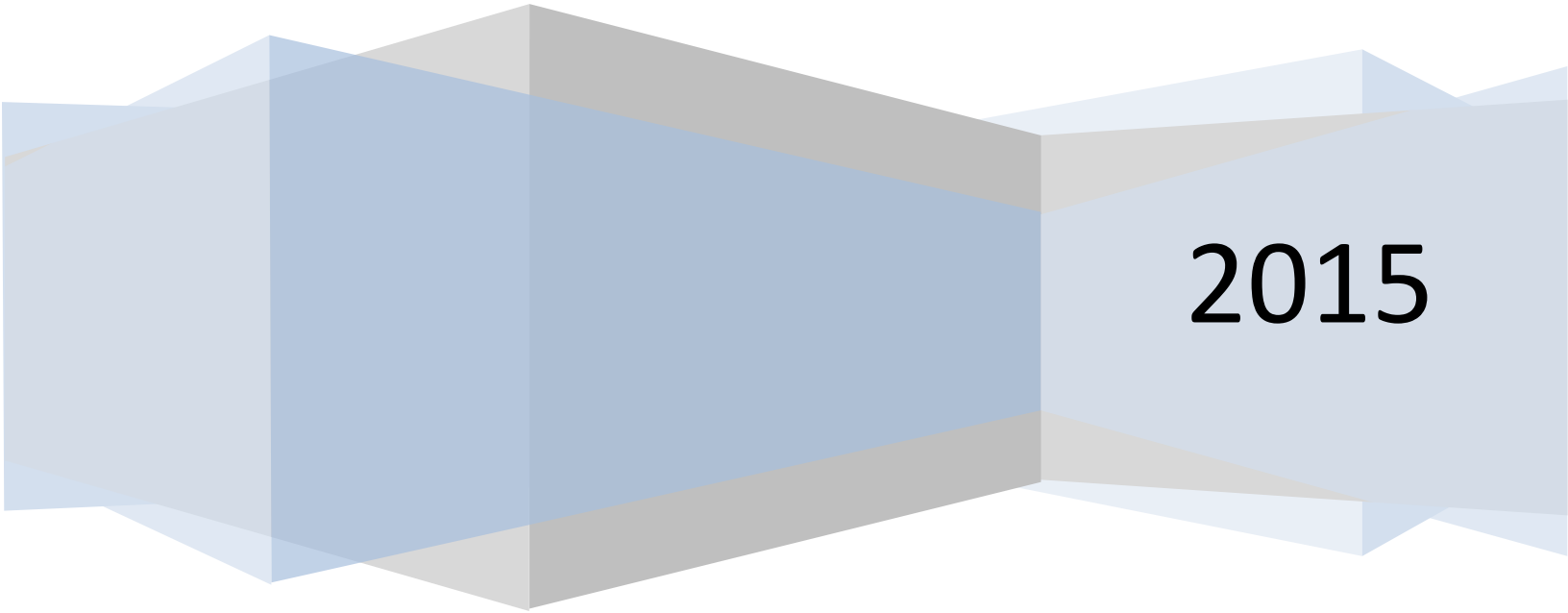

2015

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ACRONYMNS / ABBREVIATIONS

CFR – Case Fatality Rate

CT – Cholera Toxin

DSNO – Disease Surveillance and Notification Officers

FCT – Federal Capital Territory

FMOH – Federal Ministry of Health

LGA – Local Government Area

MCA – Mac-Conkay Agar

NFELTP – Nigerian Field Epidemiology and Laboratory Training Program

PHC – Primary Health Care

WHO – World Health Organization

RUWASA – Rural Water Supply and Sanitation

SMOH – State Ministry of Health

SSA – Selective Strep Agar

TCBA – Thiosulfate-Citrate-Bile salt-Sucrose Agar

UNICEF – United Nations Children's Fund

ABSTRACT
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Background: On 8th of January 2015, 77 cases of suspected cholera was reported in Andoni Local Government Area of Rivers State, Nigeria. We investigated to identify the source and the agent and to propose recommendations.
Methods: We defined a case as history of three or more episodes of loose watery stool with or without vomiting in any person of any age, residing in Andoni LGA in the last 5 day from the 11th-18th January, 2015. We sent stool specimens and water samples for laboratory testing. We searched for cases using active case search, described the outbreak by time, place and person and conducted a case control study to identify the source of infection. We conducted additional investigations to assess toilet facilities, drinking water sources and refuse disposal methods in affected communities.
Results:A total of 1034 cases and 19 deaths occurred in the LGA within the period of the outbreak, resulting in an attack rate of 375 persons/100,000 population, and a case fatality rate of 1.84%. Twenty-five (69.4%) of 36 samples yielded polymicrobial growth of coliform species and suspected Vibrio cholera non 01/0139 on selective media. The attack rate was highest among under-fives (30.6%). The incidence was highest in Okolo-ile community (255 cases) where contaminated ponds were present. Compared with controls, the 62 cases did not differ in terms of age and sex. However, controls were more likely than cases to drink from tap water (odds ratio: 0.09, 95% confidence interval: 0.01-0.69), and to wash hands after using the toilet (odds ratio: 0.4, Confidence interval 0.17- 0.96). An environmental assessment of drinking water sources confirmed the contamination of ponds and wells.
Conclusions: Contaminated ponds and wells may have been the source of this outbreak of cholera. We recommended super chlorination of wells and ban on drinking from ponds. The Rivers State Ministry of Health implemented these recommendations, which resulted in the control of the outbreak.
Key words: Outbreak of Cholera, Andoni LGA, Contaminated water supplies

INTRODUCTION

On the 8th of January 2015, the state epidemiologist announced the report of suspected cholera outbreak 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 was spreading to neighboring communities.

There were 77 cases of fever and acute watery diarrhea and 10 reported deaths. The NFELTP residents in Rivers state informed the NFELTP programme coordinator in Abuja about the unusual increase in reported cases and deaths from Gastro enteritis in the LGA. In response, four residents of the Nigeria Field Epidemiology and Laboratory Training Programme (NFELTP) were mobilized to investigate the outbreak. The team worked in collaboration with the state WHO and the State Ministry of Health (SMOH) to investigate the outbreak and institute prevention and control measures.

There has always been seasonal outbreaks of cholera in these communities during the dry season. This outbreak was said to have started in early December as people left various fishing ports to return for New Year festivities in the town.

Cholera is an acute diarrhoeal infection caused by ingestion of food or water contaminated with the bacterium Vibrio cholera.[1]It is a gram-negative, rod-shaped waterborne bacterium that carries a single polar flagellum. It grows rapidly in optimum temperature at 37°C, with a range of 10 to 43°C. The organism can be inactivated at pH values less than 4.5 at room temperature and it grows in optimum pH of 7.6, with a range of 5.0 to 9.6[2]. The pathogenesis of *V. cholerae*involves both the colonization of the intestine and the production of cholera toxin (CT) which acts locally to stimulate excessive electrolyte and fluid secretion, primarily from the crypt cells of the small intestine.[3]

More than 200 serogroups of *V. cholerae*are reported but only 2 serogroups, O1 and O139, cause epidemic cholera and pose serious health threats[4].Serogroup O1 consists of 2 biotypes, namely El Tor and classical. Both of these biotypes could be further classified into 3 serotypes (Ogawa, Inaba and rarely Hikojima). Compared with the

classical strains, El Tor strains persist longer in the environment, and are more likely to cause asymptomatic infections and shed in excreta for a longer period of time. The classical strains are thought to be responsible for the first six cholera pandemics, while the El Tor biotype has become predominant in the seventh pandemic which started its course in 1961 to present. [4]

Cholera is transmitted by the faecal-oral route, usually after ingestion of food or water that has been contaminated with infected faeces. Other common vehicles of infection include contaminated fish and shellfish, produce, or leftover cooked grains that have not been reheated properly.[5] Direct person-to-person transmission of cholera is rare, as a high infectious dose of 108 bacteria is necessary to cause the disease in healthy individuals.

Symptoms of cholera are characterized by acute onset of profuse watery diarrhoea (described as "rice-water" stools) and often vomiting. The incubation period is short, and usually lasts from two hours to five days and therefore the number of cases can rise very quickly with explosive pattern of outbreaks[6]. In severe cases, continuous fluid loss may quickly lead to extreme dehydration and shock that could be fatal, and the mortality can reach up to 50%.[7] Among the people with symptoms, 80% have mild illness and around 20% develop acute watery diarrhoea with severe dehydration. About two-third of the cholera patients do not develop any symptoms, the bacteria are present in their faeces for 7–14 days after infection and shed back into the environment that may potentially pass the infection to others.[1]

For the past decade, cholera has been largely confined to developing countries in the tropics and subtropics, especially in parts of Asia, Africa, and South and Central America where clean water and sanitation measures are lacking. The global incidence of cholera has been on steady increase in recent years. In 2009, a total of 45 countries reported 221,226 cases to the WHO, an increase by 16% compared with 190,130 cases in 2008. There was a slight decline in the overall case fatality rate from 2.7% in 2008 to 2.24% in 2009.[8] Africa alone accounted for 98% of the cholera cases and 99% of the deaths worldwide, while 0.86% cases were reported from Asia. In recent years, massive and prolonged outbreaks have occurred in countries that have been free of cholera for

decades. One of the large outbreaks took place in Zimbabwe. More recently, an outbreak of cholera broke out in Haiti following an earthquake that struck in early January 2010.[9]

In Nigeria, as of 31 January 2014, 855 cholera cases (17 lab confirmed) and 20 deaths (Case Fatality Rate 3.3%) were reported from 28 Local Government Areas (LGAs) in 9 States. During the same period in 2013, no cases or deaths were reported. In the last three weeks an upward trend of cases has been observed compared to the same period in 2012 and 2013. Between January to November 2013, a total of 4,220 cases and 145 deaths (CFR 3.4%) were reported. In week 43, 459 cases and 30 deaths were reported in Gwandu LGA, Kebbi State, 73 cases and 5 deaths reported in week 45 in FCT, Kano, Lagos and Sokoto.[10]

In the on-going dry season, water sources have been stretched, contributing to the already low access to water and sanitation. Only 58% of Nigeria's population have access to water and sanitation. This poses a high risk for the spread of cholera cases to states which have not previously reported any cases.In Nigeria,

Objectives of the outbreak investigation

1. To describe the outbreak in terms of time, place and person
2. To confirm diagnosis using laboratory methods and identify the source of infection
3. To determine the risk factors for cholera infection in the affected areas
4. To support the State Ministry of Health 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 and settlements with the wards. The major occupation of the people is Fishing and trading. Source of drinking water in most towns and villages is rain water 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 km^2 and an estimated population of 211,009 according to the 2006 census.

There are no toilet facilities in the homes of most of the people of Andoni 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, AganaUnyengalaAyambokoOkama-Agana, Oronija, AyamaAgana, EgwedeIlotombi, Oyorokoto, Isiama, Agwutobolo, Okoloile, Ebukuma, Okorolo, Asukama, Unyeada, Ajakajah and Ataba.

Study population

The person living in Andoni LGA and currently having symptom of Cholera regardless of age were the cases and controls were chosen from the community.

Study Design

The study was an un-matched case-control study

Case definition

We defined a suspected case of cholera as any person of any age residing in Andoni LGA with history of three or more episodes of loose watery stool in the last 5 day with or without vomiting from the 11th January, 2015.

A control was defined as neighbour 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 5days

Exclusion Criteria

1. Unconscious patients
2. Patients who are too ill to respond to the questions
3. Persons who are not willing to participate in the study

Case Finding/Subject Recruitment

We sampled 6 out of 12 towns affected. Active case search was carried out to find persons having symptoms suggestive of Cholera and line listed, a case control study was done 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. Data was collected from the subject by administering the same structured questionnaire to the cases (including cases on admission) and the controls.

All cases reported by the DSNOs from health facilities and the affected communities were line listed. Five health workers from the State Ministry of Health were trained by the NFELTP residents on how to administer the questionnaire designed for the investigations. The questionnaires were administered by NFELTP residents and trained volunteer health workers. Cases and controls were matched in 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. Data was then exported and analyzed in Epi-info version 7.We performed descriptive analysis of outbreak data by person, place and time. Univariate analysis was expressed as frequency distribution, percentages, mean, standard deviation and rates (attack rate, case-fatality rate etc. as appropriate). For the inferential analysis, 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

In each of the affected communities, clinical samples were collected from in-patients in either PHC or Private hospitals while environmental (water) samples were also 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 transport media (Carry-Blair and Alkaline Peptone water) in a reversed cold chain to the testing laboratory for analysis and characterization.

Ethical Consideration

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

Environmental assessment

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

RESULT

Descriptive Epidemiology

i. Description of outbreak in person

Overall, a total of 1034 cases and 19 deaths occurred in the LGA within the period of the outbreak, resulting in an attack rate of 375 persons/100,000 population, and a case fatality rate of 1.84%.

Table 1: Age group distribution of line-listed cases

Age group	Frequency (%) n=1034
0-4	412 (39.8)
5-9	147 (14.2)
10 -19	132 (12.8)
20-39	180 (17.4)
40-59	98 (9.5)
>= 60	65 (6.3)
Total	1034 (100)

Majority of cases, 412 (39.8) are under-fives, while the elderly age group (6.3%) constitute the minority of cases. Median age of case was 7.5 years with a range of 3 months to 85 years. Females were 576 (55.7%) of affected cases.

ii. Description of outbreak in time

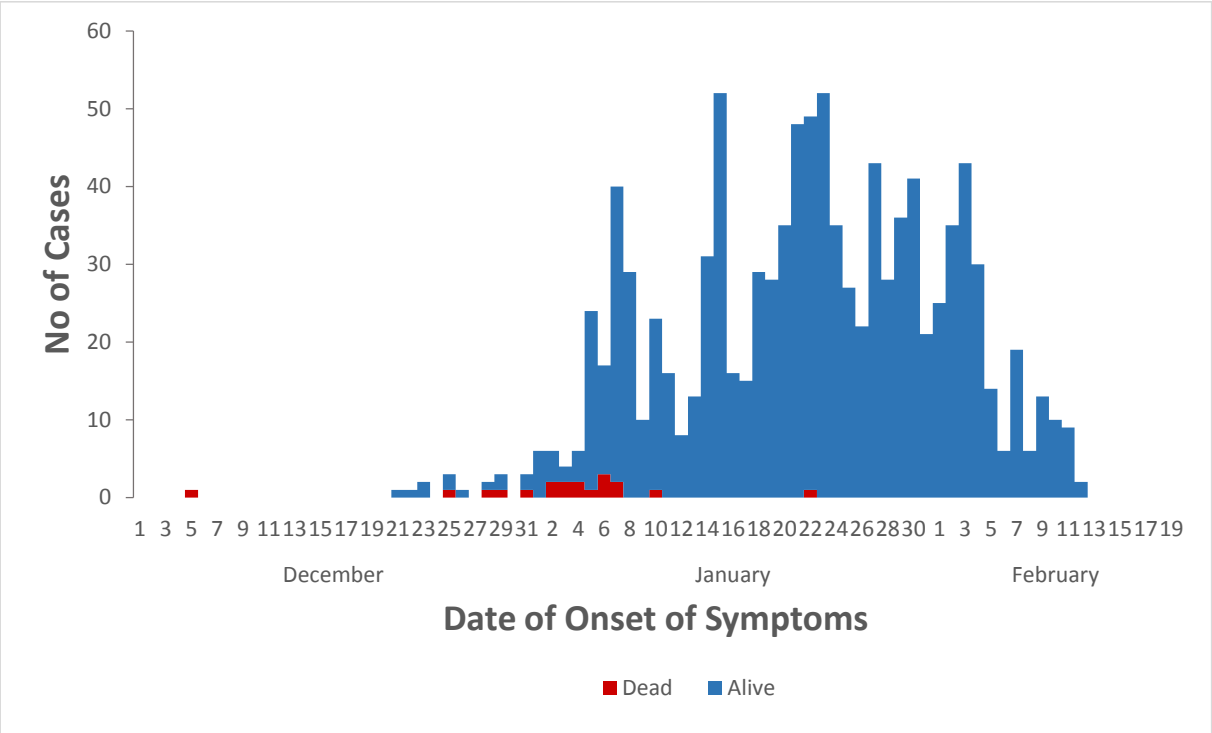

Figure 1: Epicurve of Cholera Outbreak in Andoni LGA, Rivers Stae, February 2015

The shape of the curve is suggestive of a common source propagated epidemic. 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.

iii. Description of outbreak in place

Table 2: Distribution of line-listed cases by Wards andSettlements

S/N	Ward	Settlement	No of Cases	No of deaths	Case Fatality Rate (%)
1	Ward 1	Ngo	80	1	1.25
		Ukwa	15	3	20
2	Ward 2	Agana	30	0	
		Unyengala	6	0	
		AyambokoOkamaAgana	7	0	
		Oronija	4	0	
		AyamaAgana	1	0	
		Egwede	14	2	
			83	0	
					14.29
3	Ward 3	Agwutobolo	125	0	
		Ilotombi	9	0	
		Isiama	16	2	12.5
		Oyorokoto	75	0	
4	Ward 4	Okolo-Ile	255	7	3.11
		Ebukuma	191	2	1.05
		Okorolo	15	0	
5	Ward 5	Asukama	5	0	
6	Ward 6	Unyeada	36	0	
5	Ward 8	Ajakajak	37	1	2.70
6	Ward 10/11	Ataba	30	1	3.33
Total			1034	19	1.84

A total of 1034 cases were identified among the residents of the affected communities, with an estimated total population of 211,009 giving an attack rate of 490/100,000 populations.

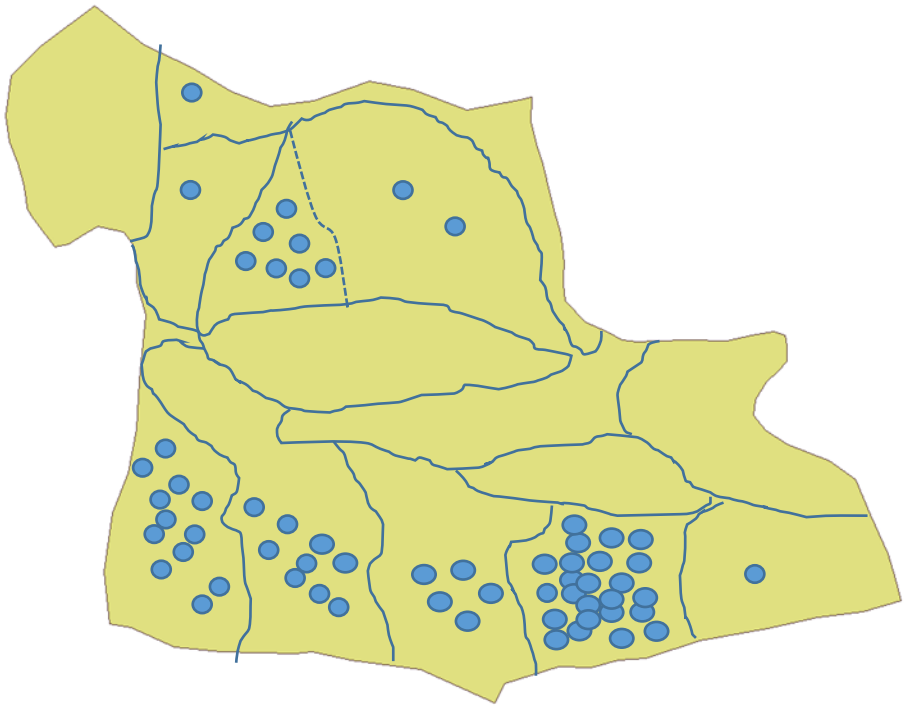

Figure 2: Spot map of suspected cholera outbreak in Andoni LGA, Rivers state, Feb 2015

The map shows a clustering of cases in ward 4 (Okolo-ile and Ebukuma communities), which is proximal to the index community (Ukwa) in ward 1. There's a scanty occurrence of cases in wards 5, 6, and 8 compared to other wards.

Analytic Epidemiology

Univariate Analysis

We recruited 62 frequency-matched case-control pairs from six randomly selected communities, for the case-control study. The median age of case was 8.5 years (range of 1-70years) while that of the control was 18 years (range 2-70years). Female were 32 (51.6%) of the cases and 36 (56.5%) of controls

Table 3: Age group distribution of cases

Age group	Frequency (%)
Under 5	19 (30.65)
5 - 9	15 (24.19)
10 - 19	6 (9.68)
20 - 44	13 (20.97)
45 - 54	3 (4.84)
55+	6 (9.68)
Total	62 (100)

Table 4: Respondents' Level of Education

Educational Level	Case (%)	Control (%)
None	23 (37.10)	18 (29.03)
Primary	25 (40.23)	18 (29.03)
Secondary	10 (16.13)	22 (35.48)
Tertiary	2 (3.23)	2 (3.23)
Others	2 (3.23)	2 (3.23)
Total	62 (100)	62 (100)

Majority of the cases (40.23%) had primary education and No formal education (37.10%), while majority of controls (35.48%) had secondary education.

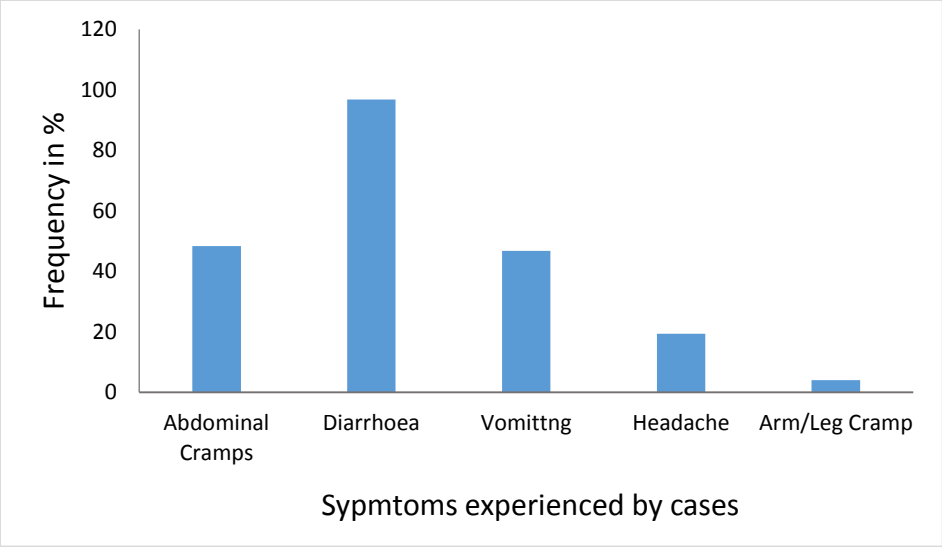

Figure 3: Distribution of symptoms experienced by Cases

Of the 62 cases, 60 (96.8%) had diarrhoea, 29 (46.8%) had vomiting and 30 (48.4%) had abdominal cramp.

Table 5: Major sources of drinking water for cases and controls

Drinking Water Source	Cases (%)	Controls (%)
Well	25 (40.32)	31 (50%)
Stream	6 (9.68)	22 (35.48)
Tap	1 (1.61)	10 (16.13)
Pond	17 (27.42)	12 (19.35)
Sachet water	20 (32.26)	12 (19.35)
Borehole	4 (6.45)	6 (9.68)
Rain water	3 (4.84)	2 (3.22)

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.

Table 6: Methods of Refuse disposal by cases and controls

Refuse Disposal Methods	Cases	Control
Burning	2 (3.2)	1 (1.6)
Bush	12 (19.35)	13 (20.97)
Backyard	12 (19.35)	20 (32.26)
Stream	39 (62.9)	33 (53.23)

Majority of the cases and controls dispose refuse into the stream, followed by the backyard and bush.

Table 7:Toilet facilities by cases and controls

	Cases	Control
Backyard	2 (3.23)	1 (1.61)
Bush	4 (6.45)	7 (11.29)
Community Latrine	45 (72.58)	43 (69.35)
Stream	11(17.74)	13 (20.97)

All (100%) of the cases and 61 (98.39%) controls do 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.

Bivariate Analysis- Risk Factors for Cholera

Table 8: 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 (%o)	Odd's Ratio	95% Confidence Interval	P-Value
1	Drinking from borehole	4 (6.45)	6 (9.68)	0.64	0.17 - 2.40	0.509
2	**Drinking tap water**	**1 (9.09)**	**10 (90.91)**	**0.085**	**0.01 - 0.69**	**0.004**
3	Drinking Sachet Water	20(32.26)	12 (19.35)	1.98	0.87 - 4.63	0.100
4	**Drinking stream water**	**6 (9.68)**	**22 (35.48)**	**0.19**	**0.07 - 0.52**	**0.0005**
5	Drinking well water	25 (40.32)	31(50)	0.68	0.33 – 1.38	0.279
6	Drinking pond water	17(27.42)	12(19.35)	1.57	0.67 - 3.65	0.289
7	Store water in container with cover	60(96.97)	61(98.39)	0.49	0.04 -5.56	0.559
8	Wash hands before eating	17(27.42)	15(24.19)	1.18	0.53 -2.65	0.289
9	Wash hands after toilet	10(16.13)	20(32.26)	0.4	0.17 - 0.96	0.036
10	Defecate in Community Latrine	45(72.58)	43(69.35)	1.17	0.54 -2.54	0.692
11	Contact with diarrhoea case	5 (8.06)	3(4.92)	1.70	0.39 -7.43	0.48
12	Age less than 5years	19 (30.65)	10 (16.13)	2.29	0.97 -5.46	0.056

Laboratory Results

A total of 36 samples, made up of 20 clinical (stool samples) and 16 environmental samples were collected. Twenty-five (69.4%) of the samples yielded polymicrobial growth of Coliform species and suspected *Vibrio cholerae* respectively 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 suspected cholera 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 gastroenteritis due cholera. The result could equally be as a result of isolation failure[11]. The non 01/0139 has been seen to cause a milder form of gastroenteritis than the 01 and 0135 and are normally associated with sporadic cases and small outbreaks[12], this seen in this outbreak.The shape of the epi-curvesuggests 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 due to end of year festivities, which lead to a strain on the water sources and probably became contaminated. This is consistent with studies in the UK[13], Nigeria[11].

The main source of the outbreak is difficult to establish by analytical studies, however a physical assessment of the affected communities reveal very poor drinking water sources, inadequate refuse and sewage disposal methods. The community latrine where majority of the inhabitants defecate is an overhung toilet which empties directly into the stream. The residents defecate in the salt water creeks, fish in the same creek/rivers and eat of the various sea foods from the same water body. Studies showed that sea foods has been implicated in the risk factors for cholera, but it is a less common problem than raw and undercooked foods.[13]

Our investigations therefore suggests that the outbreak might have been caused by consumption of pond/stream and well water, which are the commonest sources of drinking water by the communities, and which were visibly polluted. This is consistent with studies done in Papua New Guinea[11], United Kingdom,[13] and Nigeria[12] 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.[11] Hand washing with soap after going to toilet 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[12-14].

LIMITATION

Due to limited number of field workers and the short time frame, we could not increase our sample size to 1case: 2controls as we planned. This would have increased the power of our study. Secondly, the controls may have had some sub-clinical infection at the time of the study, thus there may have been some differential misclassification of disease status.

CONCLUSION

The investigation of suspected cholera outbreak in Andoni LGA, Rivers state revealed attack rate 0.375% and a CFR of 1.84%. The diagnosis was confirmed at Braithwait Memorial Hospital, Port-Harcourt. Contaminated wells and ponds were identified as the main sources of the infection. The State Ministry of Health was supported by the Federal Ministry of Health to institute prevention and control measures by provision of technical support and supply of medical kits.

RECOMMENDATION

Community

The Social Mobilization Unit of the LGA/ State should provide continuous community health education on personal and food hygiene, including environmental sanitation, to the affected community members. Education should also include drinking water treatment practices, proper cooking of sea-foods, hand washing and proper waste and sewage disposal. There should be provision of alternative source of portable drinking water for the affected communities.

Health facilities

Health workers should be trained on the recognition and management of cholera, including infection control practices in the health facility and in the community. Case definition of cholera should be displayed in all health facilities within the state.

Local Government

The LGA authority should carry out hyper chlorination of all the wells in Andoni LGA. The LG Environmental Health Officers should continuously inspect the LGA and ensure that a high quality environmental hygiene is maintained in the affected communities.

State Ministry of Health

The State Ministry of Health should support the LGA health team to intensify surveillance for early detection of cases of gastro-enteritis. Water samples from wells in the LGA should be chlorinated and tested regularly. Public enlightenment campaign should be intensified. SMOH should train LGA DSNOs on outbreak investigation and response.

Federal Ministry of Health

The FMOH should provide cholera drugs, test kits, supplies and consumables as requested by SMOH.

FMOH should support the State to establish and equip a Public Health laboratory for prompt diagnosis of laboratory specimen of public health concern.

PUBLIC HEALTH ACTION TAKEN

Supply of drugs and consumables to health facilities in affected communities.

Additional nine treatment centres were set up in the LGA and equipped with doctors and health workers, including supply of medical equipment to support case management.

SMOH provided water tankers and portable sachet water to most affected communities

UNICEF donated water purifiers to the communities through Rural Water Supply and Sanitation (RUWASA).

Social Mobilization Unit of the Rivers State Primary Health Care Management Board embarked on Health/ community education & enlightenment campaigns with the use of posters and hand bills, radio and TV jingles.

One bore-hole was sunk in the most affected (okolo-ile) community.

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