International Journal of Community Medicine and Public Health
Owhonda G et al. Int J Community Med Public Health. 2023 Feb;10(2):860-868
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20230248

Review Article

Outbreak investigation of cholera in a rural community, Rivers State Nigeria: an interventional epidemiological study

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Received: 19 November 2022
Revised: 07 January 2023
Accepted: 13 January 2023

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ABSTRACT

Cholera is a potentially life-threatening public health menace caused by a gram-negative rod-shaped bacterium *known as Vibrio cholerae*. This study was an epidemiological investigation of the cholera outbreak in Degema local government area (LGA), Rivers State, Nigeria. An interventional epidemiological study was conducted in a rural community between December 2021 to February 2022. All suspected cases were identified using the World Health Organization (WHO) case definition of acute watery diarrhoea. The standard outbreak investigation procedures (active case search, case management, water sanitation, hygiene) were implemented. The cholera outbreak observed two waves within an at-risk population of 373,071 in the affected LGA. Of the 35 line-listed suspected cases (male-20 versus female-15), the highest frequency was observed among those aged 0-5 years. The index case was reported on the 3rd of December in the 47th week of 2021 and abated by the 49th week, while the 2nd wave began in the 1st week of 2022 and abated by the 6th week. The stool samples result revealed; six positives for RDT, while four samples were positive by microscopy. All patients received home-based treatment except for two cases that were managed at the healthcare facility. The attack and case fatality rates were 0.01, and 8% respectively. The Rivers State public health emergency operation centre deployed standard epidemiological interventions for the containment of acute watery diarrhoea (cholera) aimed at reducing morbidity and mortality; however, vaccines were not part of the response. The deployment of vaccines and provision of potable water will improve response outcomes.

Keywords: Outbreak investigation, Cholera, Rural, Community, Interventional, Epidemiological study

INTRODUCTION

Cholera, an acute gastrointestinal infection is a potentially life-threatening foodborne and waterborne disease caused by *Vibrio cholerae*, a gram-negative rod-shaped bacterium isolated from contaminated food substances and water.[1,2] This pathogen produces toxins known as enterotoxin and has two serotypes (01, 0139) that are faeco-orally transmitted and man is known as the only natural host.[3] The clinical manifestation is characterized by the sudden onset of painless watery diarrhoea with occasional nausea and vomiting occurring within an incubation period of 2 hours to 5 days.[4] Annually, the incidence of cholera infections is greatest among children <5 years of age with approximately 50% occurring within this age group probably because it is climate-driven with seasonal peak patterns.[1,5] It is a major public health threat endemic in low- and middle-income countries (LMIC) with an associated high risk of transmission compared to developed nations in Asia (Bengal, Bangladesh, India), Africa and Haiti. However, new occurrences are possible in other nations in Latin America and Europe in areas with poor food hygiene practices, inadequate portable water supply, unsanitary environmental conditions and poor

healthcare delivery services.[6-8] Communities in countries with a high prevalence of cholera are often associated with poor sanitary conditions and overcrowding; camps with internally displaced persons and refugees, slums due to poverty, disasters, communal clashes and wars.[4,9,10]

Although mild symptoms of cholera can be successfully treated with oral rehydration solution, while severe cases are managed with intravenous fluids and antibiotics.[11] A prompt and good case management indicate adequate access to healthcare services with a case fatality rate of <1%.[4,10] On the other hand, delayed diagnosis and treatment of suspected and confirmed cases of cholera may result in increased mortalities within hours with a case fatality rate between 30-50%.[4,6] To prevent the spread of the disease outbreak in any locality would require early diagnosis, treatment and surveillance through a well-coordinated multisectoral response.[9,12] In the long term, community awareness of preventive measures is the best means of preventing cholera and other diarrhoeal diseases which include; good personal hygiene practices, provision of potable water supply, adequate sanitation, and food safety.[13,14] Additionally, the World Health Organization (WHO) recommends that the use of oral cholera vaccine in endemic areas and humanitarian crises with a high risk of cholera outbreak should be systematically considered as a primary intervention.[15,16]

Outbreak investigation involves swift steps systematically followed, analyzed, and reported by a rapid response team headed by an epidemiologist to contain the spread of an identified communicable disease. The steps include: preparing for fieldwork; establishing the existence of an outbreak; verifying the diagnosis; constructing a working case definition; finding cases systematically and recording information; performing descriptive epidemiology; developing hypotheses; evaluating hypotheses; reconsidering, refining, and re-evaluating hypotheses; compare and reconcile with laboratory and environmental studies; implement control and prevention measures; initiate or maintain surveillance; communicate findings.[17]

In 2017, to reduce cholera deaths by 90%, a global roadmap to ending cholera by 2030 was launched. The guideline recommended maintaining adequate personal hygiene, improving mass campaigns on vaccination and promoting water, sanitation and hygiene (WASH) activities.[18,19] Although, the provision of basic sanitation and potable water supply are critical measures to control the transmission of cholera and other waterborne diseases; mobile smartphones have been used for real-time reporting of cases and improving vaccination data quality to mitigate the risk and upsurge of cholera outbreaks in developing countries.[20-22] Globally, the spread of cholera may be sporadic, endemic, epidemic, or pandemic with annual morbidities of 1.3-4.0 million and mortalities of 21,000-143,000, of which only 5-10% of cases are reported annually.[23] In 2020, the WHO reported data from 80 countries, of which 27 of them had over 323,369 cases and 857 deaths with a case-fatality rate (CFR) of 0.27%, while no case was reported in 53 nations across the globe. The highest proportion of cholera cases was recorded in Yemen (275,712), though there was a 68% decrease compared to the 2019 report.[24] In descending order, cholera is endemic in Africa especially in the tropics and subtropics with a high Human Poverty Index (HPI), parts of Asia, the Middle East, and South and Central America.[25] Moreover, Africa has experienced recurrent cholera outbreaks, characterized by high morbidity and case-fatality rates, with over 47,256 cases and 741 deaths. These values have decreased over the years with the lowest cases reported in the last 30 years. The highest frequency of cholera outbreaks was recorded in Ethiopia (12,226), Somalia (6414), Mozambique (4000), Uganda (1521), Nigeria (596), Kenya (447), Sudan (7), Malawi (3). South Sudan has been cholera-free for 3 consecutive years and no case has been reported in Djibouti, Eritrea, Zambia and Zimbabwe. These reductions may be due to the implementation of preventive oral cholera vaccine (OCV) campaigns and prompt diagnosis and treatment in response to new outbreaks.[24]

In Nigeria, cholera is an endemic and seasonal disease, occurring annually mostly during the rainy season and more often in areas with poor sanitation.[25,26] In 1971, the first cholera outbreak was reported in the city of Ibadan with 22,931 cases and a case fatality rate (CFR) of 12.8%. Afterwards, only a few cases were reported between 1972 and 1990, though by 1991, the number of cases doubled beyond that of 1972 with a total number of 59,478 cases and a CFR of 12.9%. Other outbreaks occurred in 1999, 2001, 2002, and annually from 2007 and major occurrences in 2010 (cases-45,720; deaths-1,801), 2014 (cases-35,996; deaths-755). The National Centre for Disease Control and Prevention (NCDC), revealed a successive increase in cholera outbreaks with associated rising cases and deaths annually. In 2018, 44,201 cases were reported in 20 States with a CFR of 1.89%. By 2021, over 111,062 suspected cases and 3,604 deaths were recorded, exceeding the values of the previous year.[27-29] However, as of 29 May 2022, a total of 2,339 suspected cases of cholera infections with over 74 deaths were reported in 30 States across the country sparing Abia, Ebonyi, Edo, Enugu, Ogun, Yobe, and FCT. Moreover, approximately 68% of all suspected cases were recorded in only five states; Taraba (651 cases), Cross River (593 cases), Katsina (134 cases), Kano (124 cases) and Benue (100 cases). While, only six LGAs within two states (Cross River and Taraba) in equal proportion, identified over 100 cases. There was a 60% decline from 137 to 342 suspected cases between April (Epi week 13-17) and May (Epi week 18-21). Nevertheless, children aged ≤5 years irrespective of sex were the most affected. This may be due to deterrents such as; poorly equipped laboratories, weak epidemiological surveillance systems, poor political will and existing socio-economic challenges prevailing in these States.[6,30] In Rivers State, various cholera outbreaks have occurred particularly in communities located within some riverine local government areas (LGAs) with poor hygiene and handwashing practices, and a lack of potable water supply.[31] The 2015 outbreak in Andoni LGA recorded over

77 suspected cases of acute watery diarrhoea with 10 reported deaths within two days.[31] It is important to note that in all the outbreaks that occurred within the state, the epidemiology unit of the public health department, Rivers State Ministry of Health (RSMoH) responded swiftly to contain them. The present study focused on investigating an outbreak of cholera in a rural community in Rivers State Nigeria.

METHODS

Study area

The study was conducted in a rural community in Degema LGA in Rivers State, a riverine community made up of different sub-communities. It is a rural area located in the swamps, mangroves, and tropical rainforests southeastern part of Rivers State, south-southern Nigeria. The area has a land mass of 1,011 km^2 with a population of 249,773 as reported by the 2006 census but currently 373,071 residents. It connects other riverine parts of the State's traditional trading centre (fish, cassava, taro, palm produce, plantains, and yams); Abonnema, Bonny, Buguma, and Okrika which led to the growth of fishing and palm oil ports. The LGA constitute eleven Ijaw communities (Bakana, Bille, Bukuma, Consulale, Degema, Ilelema, Ke, Obuama, Ogurama, Tombia, and Usokun) who officially speak *Degema* and *Kalabari* dialects. The residents' main source of livelihood is fishing and trading. Their source drinking water is fetched from wells in all seasons, while streams and rainwater are collected into containers during the rainy season. The common toilet facility is overhung community latrines as well as open defaecation in the jetty. The major religion practised is Christianity. There are nine primary health centres (PHC), one general hospital, and a dental clinic in addition to private hospitals and patent medicine vendors (PMV) located in various towns within the LGA. The cholera outbreak was observed in one of the communities (anonymized) within the Degema LGA.

Study population

All residents in the affected community within Degema LGA presented with acute watery diarrhoea within the period of the outbreak investigation.

Study design

This was an interventional carried out in a rural community in the Degema LGA of Rivers State, Nigeria.

Case definitions

The at-risk population of cholera

This is referred to the total number of susceptible individuals who developed the disease and are at greater risk of becoming ill compared to other contacts.[32,33]

Acute watery diarrhoea (AWD)

The presentation with an acute illness is characterized by the passage of ≥3 loose or watery (non-bloody) stools within 24 hours by any person ≥ 2 years of age.[32,33]

The attack rate of cholera

The proportion of the at-risk population who present with the clinical presentations of acute watery diarrhoea during the period of the epidemic.[33]

Case fatality rate

The proportion of patients with confirmed laboratory isolates by culture or polymerase chain reaction (PCR) of toxigenic strains of Vibrio cholerae who eventually die as a result of the disease. It is expressed as the number of deaths among cases per 100 or 1000 person-years, person-weeks or person-months. It is important to note that a case fatality rate of <1% (low) indicates good case management and prompt access to healthcare services.

While, a case fatality rate of ≥1% (high) connotes delayed response to diagnosis (RDT) and treatment (ORS, intravenous fluids, 24-hour care).[4,10,33]

Cholera outbreak

The occurrence of at least one confirmed case of cholera and evidence of local transmission.[32,33]

Confirmed case of cholera

This is defined as a patient with clinical presentations of acute watery diarrhoea and confirmed laboratory isolates by culture or polymerase chain reaction (PCR) of toxigenic strains of *Vibrio cholerae* (01, 0139) serotypes in a community where it did not previously occur or cholera outbreak has been declared.[32,33]

Signal

These are information on a suspected disease occurrence reported by a health worker(s) who are in contact with key informants that live in the affected community in person or through telephone calls, short message services (SMS) to the LGA disease surveillance and notification officer (DSNO).

Signals are triaged and verified to determine the validity before being reported as a public health event.[34]

A suspected case of cholera

This is the occurrence of acute watery diarrhoea ± vomiting with associated severe dehydration or dying from acute watery diarrhoea in an individual aged ≥2 years residing in a community where it previously did not occur or a cholera outbreak has been declared.[32,33]

Investigation team

The state rapid response team (RRT) comprise programme officers from the epidemiology unit in the public health department and public health emergency operation centre (PHEOC) at Rivers State Ministry of Health (RSMoH), Rivers State primary healthcare management board (RSPHCMB), relevant United Nations; World Health Organization (WHO).The state disease surveillance and notification officer (DSNO), state water sanitation and hygiene (WASH) team in the Ministry of Water Resources as well as the LGA medical team; the Medical Officer of Health (MOH), LGA DSNO, healthcare workers deployed to the model primary health centre (MPHC), within the affected rural community.

Table 1: Tabular presentation of suspected and confirmed cases of cholera during the outbreak.

The first reported case of AWD	PHEOC, Rivers State on 03/12/2021
Biological hazard	Cholera (Confirmed) on 10/02/2022
Source of information	Community informant; health facility focal persons; LGA ADSNO, DSNO
Main symptoms	Fever, vomiting, seizure, body weakness
LGA/state affected	Degema, Rivers State
Date of the incident case of AWD	At approximately 02/12/2021
End incident case	At approximately on 10/12/2021
Date of notification	12/10/2022
Status of incident case	Open to investigation at the PHEOC
The date cholera status was verified	Verified on 02/18/2022
The total frequency of persons at risk at the LGA	373,071
Total number of suspected cases	35
Total number of laboratory confirmation	4
Total deaths	2
Health personnel deployed	Case manager, data management expert, LGA DSNO, risk communication expert, state DSNO, laboratory scientist, health educator, other state RRT, WASH team, logistic manager, security team, local United Nations Agency Representation
Chain of command	Led by the state PHEOC incident manager
Public health action taken	Outbreak investigation
Public communication	Community engagement and risk communication

Interventions instituted by the state rapid response team

Rapid diagnostic test (RDT) was made available to healthcare personnel for investigating all suspected cases by the 2nd phase of the outbreak. The RRT also embarked on case search, treatment and referral. The Rivers State public health emergency operation centre (PHEOC) immediately activated the "cholera outbreak response mode" and "the incident management system for cholera." The State RRT visited the affected community for further investigation of the outbreak and the activities carried out included: advocacy visits to the community stakeholders (chiefs, elders, market women, religious and youth leaders); all required commodities to investigate the outbreak were prepositioned to all communities within the LGA with priority given; Ringers lactate, oral rehydration salts (ORS), intravenous (IV) canular, IV metronidazole, drip giving sets, chlorine powder, hand gloves, face masks, hand sanitiser, Veronica buckets, water cans, cups, spoons, scrub suits, sample collection materials, and RDT; risk communication messages were targeted at promoting early health (treatment) seeking behaviour for diarrhoea [health sensitization programmes on cholera (symptoms, source/route of infection, mode of spread, and preventive measures) were conducted to limit the spread, and reduce morbidity and mortality within the community; safe food preparation methods, household water treatment, and proper faecal and waste management methods were emphasized; and handwashing techniques (soap and water) were demonstrated and the hand-washing moments were emphasized to promote hygienic conditions in the community); a retroactive case search was done at the healthcare facilities situated within the affected community and its sub-communities; preliminary screening of stool samples was done using rapid diagnostic test kits (RDT); the State RRT collected water samples from selected boreholes and wells for testing; the PHEOC on cholera was activated sequel to the positive RDT samples; the health centre in the area was designated as the cholera treatment unit (CTU) and satellite oral rehydration points (ORPs) were set up; detailed line-listing of suspected, and confirmed cases and mortalities was done; an active case search was commenced by State and LGA RRT teams; representatives of the WASH team enlightened the residents in the affected community on water filtration and purification (boiling, and use of chlorine tablets); representatives of the WASH team also barricaded and prohibited the residents within the affected

community from fetching water from the unsanitary wells pending water treatment; provision of bottled potable water for household use; representatives of the WASH team also demonstrated the use of chlorine tablets to purify water drawn from sources, after which the treated water was drunk by the WASH team and a community influencer who is also a political leader (legislator) in the Degema LGA; information education and communication (IEC) materials were distributed; posters, handbills, and standard operation procedure (SOP) on the management of cholera; collected water samples were transported in the reverse cold chain to the reference laboratory for analysis; the PHOEC met daily during the period of the outbreak to review coordination and response; SITREP was shared daily with all stakeholders and SITAWARE as necessary; security agencies embedded in the PHEOC were involved in the response; data was entered into the SORMAS platform and transmitted to the national data repository; and the academic unit of the PHEOC was involved in the analysis and interpretation of data.

FINDINGS

Person distribution

The sociodemographic characteristics findings from the LGA RRT investigations revealed the following: The sex distribution of all suspected cases was greater among the males (20) compared to the females (15) (Figure 2). Of all suspected cases of cholera, patients aged 0-5 years (15) had the highest frequency compared to other age groups. Whereas the following age group had the lowest frequency; 16-20 years (1), 21-25 years (1), 31-35 years (1), 36-40 years (1), and 55-60 years (1), no case was observed among those aged ≥60 years (Figure 1). However, with an at-risk population of 373,071 persons in the affected LGA, a line list of 35 patients presented with symptoms of acute watery diarrhoea, ±vomiting, and generalised body weakness.

Of all the stool samples investigated, only six (6) tested positive by RDT, sent to the reference laboratory for *Vibro cholerae* by culture test and only four (4) were confirmed positive (Figure 3). Out of the thirty-five (35) patients who presented with acute watery diarrhoea, thirty-three (33) were mild cases and thus received home-based treatment, while the remaining two were managed at the nearest healthcare facility due to severe dehydration. Two (2) deaths were observed among two (2) children aged 5 years and 11 years old with a case fatality rate of 8%.

$$\text{Attack rate} = \frac{\text{Number of patients with acute watery diarrhoea} \times 100\%}{\textit{Total population at risk to AWD outbreak}}$$

$$= 3500/373{,}071 = 0.009 \approx 0.01\%$$

$$\text{Case fatality rate} = \frac{\text{Number of notified deaths from AWD} \times 100\%}{\textit{Number of notified cases of AWD}}$$

$$= 200/35 = 8\%$$

Time distribution

The PHEOC received a SIGNAL on the 03 of December, 2022 of a suspected case of cholera which was reported by the DSNO in Degema LGA to the epidemiology unit of the public health department, Rivers State Ministry of Health. A multi-sectorial RRT was constituted and deployed to commence an active case search in the affected community as well as line-listing all individuals that met the case definition from the day the index case was reported. Concomitantly, a line list of thirty-five (35) suspected cases was made within three (3) months as the majority who presented with mild symptoms was managed at home, while only two cases were managed at the MPHC due to their severity in presentation. Two (2) epidemic waves were observed throughout the three (3) months of the cholera outbreak between the 03 of December, 2021 to the 28 of February, 2022. The prodromal symptoms of the first suspected case in the first (1st) wave started on the 02 December which eventually became the index case of the cholera outbreak and was reported on the 03 December of 2021 (at week 47 of the year 2021) in an 11-year-old male who presented with passage of loose/watery stools of >3 episodes in 1-day duration associated with fever and vomiting at the MPHC within the LGA. During this period, four other children and an adult female presented with gastroenteritis (passage of watery stools, vomiting) with associated generalized body weakness. A total of six (6) suspected cases were observed, which sharply increased, peaked in the 48th week, and gradually declined from the 50th week of the year 2021 with no case found till the 52nd week of the same year and no deaths were recorded. By the 10 December, all cases of acute watery diarrhoea abated, while the RRT continued coordination of risk communication engagement and referral for treatment. All stool samples were characteristically rice-water, loose, profuse, and odourless and were sent to the reference laboratory for investigations, but no case was confirmed.

The 2nd wave began in the 1st week of the year 2022 (04 January) when more cases of gastroenteritis were identified within the community, peaked in the 6th week and steeply declined after interventions were instituted by the LGA and State RRT. During this phase, a total of nineteen (29) suspected cases were reported with two (2) recorded deaths. No cases were observed from the 8th week and there were two deaths.

Place distribution

All the patients with acute watery diarrhoea fetched their drinking water from at least one of the three common hand-dug well water sources in the community which we found to be unsanitary and potentially contaminated. These water samples were collected and sent to the laboratory for

analysis. However, some of the well water samples showed the presence of coliforms which denotes faecal matter contamination. Concerning the waste management system, refuse was dumped into the surrounding water bodies, while the jetty toilet utilized by residents of the community was <200 metres from the source of drinking water. The observations made following the assessment of the source of water supply and sewage system by the RRT were: the distance between each assessed well to the closest potential source of contamination (sewage site) was <200 metres; the surrounding environment around each well was unsanitary due to the absence of drains; the absence of covering for the well; the absence of parapet in most of the wells; each assessed well had multiple buckets used to fetch water; the floor of all the wells was uncemented; the regurgitation of water drawn from the wells; the depth of each well was <100 metres; and access to all the wells was unrestricted.

The State RRT conducted training to build the capacity of some healthcare workers deployed to a 10-bed primary health centre in the affected community on treatment protocols and this facility was designated and served as the CTU. The healthcare staff were provided with sufficient ORS to enable them also set up contingency ORPs strategically within the community, especially at the town hall.

DISCUSSION

The socio-demographic findings of this present study reported a higher proportion of suspected and confirmed cases of cholera among patients within the younger age group, particularly in early childhood. The affected age group were largely susceptible to acute watery diarrhoea perhaps due to their comparative low-level immunity in addition to the poor hygiene practices of their caregivers as opposed to those in older age bands known to have higher immunity and better personal hygiene. This is in concordance with studies conducted in Nigeria, Ethiopia, Bangladesh, and India where the majority of cases were found among patients who were under the age of ten years.[6,31,35,36] Contrarily, studies carried out in Nigeria, Ethiopia, Bangladesh, and Malta revealed that cases of acute watery diarrhoea were observed more among patients in their middle adolescence, early adulthood and older age groups as opposed to younger children.[25,28,37-41] Additionally, a greater proportion of all line-listed patients were slightly more males than females. This is in agreement with the previous studies done in Nigeria, South Africa, Ethiopia, and India.[6,38,39] However, the reverse was the case in earlier studies carried out in Nigeria, some other West African countries (Benin, Burkina Faso, Cameroon, Mali, Niger, Togo), Pakistan and Malta.[25,28,29,31,37,41,44]

The cases of acute watery diarrhoea can be classified into two distinct waves; with a greater frequency of cases and deaths occurring in the second wave following the diagnosis of cholera as opposed to a less eventful first wave with a low attack rate but a high case fatality rate than most of the previous studies. This is in line with studies reported in earlier studies done in Nigeria, Ghana, and some other West African countries (Benin, Cameroun, Togo, Niger, Mali).[25,28,42,44,45] On the flip side, a global review reported lower case fatality rates in countries within Africa (Nigeria, Burkina Faso, Democratic Republic of Congo, Ethiopia, Kenya, Mozambique, Somalia, South Sudan, Tanzania) and Asia (Afghanistan, Bangladesh, Iraq, Pakistan, Philippines, Syria) and Europe.[31,38,46] Although, in a country like India one of the cholera epidemics experienced a zero fatality rate.[6] The findings observed in countries with lower case fatality rates (0 to <1%) as compared to those with higher rates were most probably due to the prompt institution of intervention measures to curb the epidemics, especially regarding cholera vaccination.

The epidemic curve revealed that the cholera outbreak was a result of a common-source continuous exposure as members of the affected community fetched their water from contaminated boreholes and unsanitary wells unfit for drinking.[47] Also, the unsanitary waste disposal system practiced by residents of the affected community may have facilitated the spread of pathogens to their food and water sources. These observations agree with previous studies conducted in Nigeria, Ethiopia, India.[6,25,48] Even though many cholera outbreak investigations in Nigeria do not identify risk factors for the illness, it is important to note that; shortage of potable water supply during the dry season, poor handwashing hygiene practices, poor sewage disposal system, and faeco-oral transmission of foodborne diseases are commonly identified risk factors, especially in low socio-economic settings.[13,48] This is in agreement with studies carried out in Nigeria, and Bangladesh.[31,40] However, the key strategies in the management and control of cholera outbreak as documented in the present study include; case definition, active case finding, deployment of rapid response team with prepositioning of commodities, prompt diagnosis, home/facility-based treatment of suspected and confirmed cases, immediate provision of alternative potable drinking water and treatment of water sources. These are in line with preventive measures adopted in cholera outbreak management in previous studies done in Nigeria, Ethiopia, Bangladesh, India.[6,25,31,35,40,48]

Limitations

Even though all requisitions were made by the LGA DSNO from the Rivers State PHOEC, the major existing challenges encountered during the period of the outbreak while deploying resources required for the management of patients were the logistics and insecurity issues predominant in the riverine locality. Although, the unavailability of cholera vaccines and poor sewage disposal habits were also contributory factors to the high case fatality rate recorded.

CONCLUSION

The PHEOC deployed standard protocol and prompt interventions to reduce the morbidities and mortalities associated with this outbreak through active case search, epi-intelligence and management of all identified cases of acute watery diarrhoea. However, the cholera outbreak experienced a high case fatality rate. This perhaps was due to the unavailability of vaccines for susceptible age groups and the issues of insecurity associated with the effective deployment of resources to the affected rural community.

Recommendations

Continuous surveillance in the affected area, capacity building for healthcare workers, provision of sanitary wells/boreholes, sanitary sewage and refuse disposal methods, as well as procurements and preposition of cholera commodities and vaccines; will help enhance better outbreak response.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Owhonda G, Luke A, Ogbondah BO, Nwadiuto I, Abikor V, Owhondah E. Outbreak investigation of cholera in a rural community, Rivers State Nigeria: an interventional epidemiological study. Int J Community Med Public Health 2023;10:860-8.