AN OUTBREAK OF DIARRHOEAL DISEASE ATTRIBUTED TO CONTAMINATED DRINKING WATER, NALOLO DISTRICT, ZAMBIA – 2019.

Research Article

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Abstract

On 10th January 2019, the Ministry of Health, through the Zambia National Public Health Institute, received notification from the Provincial Health Office in Western Province of 25 cases, presenting with symptoms of acute diarrhoea; two died. We investigated to describe the epidemiology and identify risk factors.

We reviewed medical records of patients who presented at the health facilities from December 2018 through January 2019. A suspected case was acute onset of watery diarrhoea with or without vomiting, fever, abdominal weakness, and body weakness in resident of Sumi or Situka villages, Nalolo district, from 1st December 2018 to January 2019. We collected stool and water samples for laboratory examination.

Of 30 patients reviewed, eight were confirmed and 13 probable cases. Most (53%) of cases were male, and 83% were aged < 15 years. The median age was 25 years. Fifty-three percent of cases were reported in Situka; 47% in Sumi. Escherichia coli was isolated in eight samples. Two water samples analysed indicated high levels of faecal contamination.

This was most likely a waterborne disease outbreak caused by feacal contamination of drinking water source, an ox-bow lake. Implementation of environmental and sanitary control measures brought the outbreak to an end.

Introduction

Diarrhoeal diseases remain a public health concern, and are the leading cause of child morbidity and mortality in the world1. Despite being preventable, through safe drinking-water and adequate sanitation and hygiene, 780 million individuals lack access to improved drinking-water, and 2.5 billion lack improved sanitation worldwide1. Diarrhoea disease-related outbreaks due to infection, are widespread throughout developing countries where sanitary conditions are relatively poor [1,2.]

In Zambia, sporadic diarrheal disease outbreaks such as cholera, typhoid fever, and dysentery have been reported annually3. Most of the reported diarrheal disease outbreaks are attributed to inadequate access to safe water, unsatisfactory functionality of sanitation systems as well as comprised food safety [4,5.]

Outbreak

On the 10th January 2019, the Ministry of Health (MOH), through the Zambia National Public Health Institute (ZNPHI), received an outbreak notification of non-bloody diarrhoea and vomiting with two deaths in Sumi and Situka villages of Nalolo district in Western Province. By 12th January 2019, the cases increased to 25, which prompted the district health office (DHO) to set up a screening and treatment centre (STC) at Situka village to heighten access to health services among the affected residents. The cases that reported at the STC were commenced on antibiotics. One severe case was referred to Lewanika General Hospital. Further, the DHO, with support from Provincial Health Office (PHO), distributed liquid chlorine for treatment of drinking water and provided health promotions and other environmental activities.

The Ministry of Health, through ZNPHI's Public Health Emergence Operation Centre, in collaboration with the World Health Organisation (WHO) Country Office constituted a national investigation team to support the province and district response to the outbreak. The composition of the national investigation team included a Field Epidemiologist, a Public Health Officer, and a National Surveillance Officer. The team travelled to the province on 16th January 2019 and proceeded to Nalolo district on the 17th January 2019.

We investigated the outbreak to determine the extent of the outbreak; characterise the outbreak by place, person and time; confirm the aetiology of the outbreak, generate hypothesis for the risk factors, and develop and implement a plan to prevent additional infections and future outbreaks.

Methods

Setting

Nalolo is a rural district located in Western Province of Zambia with total catchment population of 55,569. The district has an economy mainly supported by agriculture. The outbreak occurred in two villages located along the Zambezi river bank under the catchment area of the Situnga health facility with the population of 164 people. The two villages are approximately 300 meters apart.

Case definition

A suspected case was defined as acute onset of watery diarrhoea with or without vomiting, fever, abdominal weakness and body weakness in a resident of Sumi or Situka villages in Nalolo district from 1st December 2018 to January 2019. A probable case was defined as a suspected case epidemiologically linked to another clinically compatible case but without labora-

tory confirmation. A confirmed case was a case of diarrhea in person with positive laboratory test indicative of diarrhoea infection caused by bacterial, viral or parasitic organisms - Salmonellae serotype Typhi, Escherichia coli, Shigella, or Vibrio cholerae species.

Data Collection

This was a retrospective descriptive study based on data abstracted from medical records of patients presented at the health centres including STC and those admitted to the Lewanika General Hospital between 30th December 2018 and 16th January 2019. Data on disease surveillance and epidemic preparedness and response were also collected through interviews using a structured questionnaire and checklist administered to staff at the DHO and PHO.

Specimen Collection

Eight stool samples were collected from cases seen at the STC for laboratory examination and sent to Lewanika General Hospital on the 10th January, 2019. Two food (nshima and sour milk from four affected households) and two water samples from an ox-bow lake (the only source for drinking water) were collected for bacteriological analysis. Stool specimens were also shipped to University Teaching Hospital laboratory for quality control on 17th January 2019.

Data Analysis

The data obtained from medical reviews, questionnaires, checklists, and laboratory results were descriptively analysed by using proportions and presented in tables and graphs.

Ethical considerations

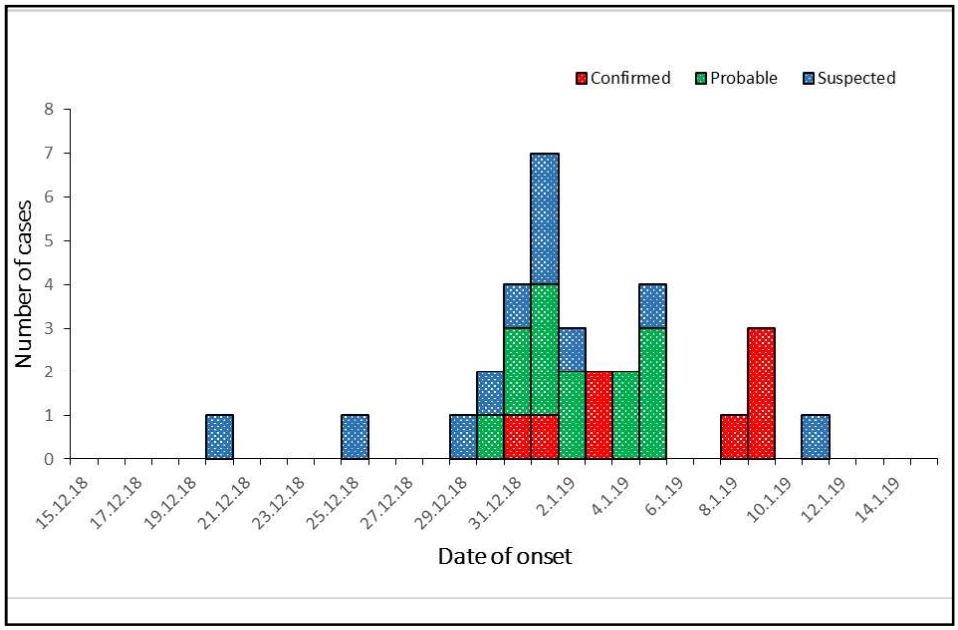
The study was conducted under the public health response authority from Ministry of Health. Therefore, the investigation was coordinated by Epidemic Preparedness and Response cluster at ZNPHI while permission to conduct data collection within the Ministry, was obtained from the Permanent Secretary, Technical Services. . However, verbal permission was sought from the district and hospital management to review medical records.

Results

From 11th December 2018 to 13th January 2019 a total of 30 cases were reported in Nalolo district. We identified eight confirmed cases, and 13 probable cases. Most (53%) of cases reviewed were among male, and 83% were among persons aged <15 years (Table). The median age was 25 years. Most (70%, n=21) of the cases were recorded between the 30th December 2018 and 5th January 2019 (Figure. Fifty-three percent of cases were among residents of Situka village and 47% (n=14) among residents of Sumi both under the catchment of Sunungu Rural Health Centre (Table). The index case was in a female aged 26 years reported on the 11th December 2018 at Itufa health centre of Senanga district.

The outbreak was initially detected by the Senanga DHO on 7th January 2019, which later notified Nalolo DHO that one of its rural health centers, Itufa, had been receiving cases of non-bloody diarrhea, suspected to have been typhoid fever. Although the two affected villages are in Sinungu Health Centre catchment area on the west bank of Zambezi river, the communities prefer accessing health services from Itufa Health Centre located on the east-bank of the Zambezi because it takes less time to reach Itufa Health Centre than Sinungu despite the need to cross river

Figure 1: Cases of Diarrheal Disease by date onset, Nalolo, December 2018 – January 2019 (N=30).



The clinical characteristics for the cases included diarrhoea, vomiting, intermittent fever, abdominal pains, and body weakness. Nine cases were treated as in-patients while 21 were treated as out-patients (Table). Of the eight stool samples collected from patients microscopy, culture and sensitivity, none was positive for S.Typhi or Shigella, however, E. coli was isolated in eight samples and Enterobacter agglomeran was isolated in one sample. We did not perform further tests to determine the toxigenicity of the E. coli and Enterobacter agglomerans isolates. The only blood specimen tested for serology, was sero-negative. None of the food analysed had microorganisms isolated. All the water samples analysed indicated high levels of faecal contamination (i.e. >5000 colonies/100ml).

Data from checklist revealed that all the health workers in Nalolo district had not been trained in Integrated Disease Surveillance and Response (IDSR); only one person was reported to have been trained at Lewanika General Hospital. In addition, Emergency Preparedness and Response Committee meetings were rarely held either at the district offices or the hospital.

Table: Demographic and clinical characteristic of diarrheal disease, Nalolo, 2019 (N=30)

Characteristics	Number (%)
Gender (Male)	16(53)
Age group (years)	
≤5	1 (3)
6-10	1 (3)
11-14	3 (10)
15+	25 (83)
Residence	
Situka	16 (53)
Sumi	14 (47)
Signs and Symptoms	
Diarrhoeal	30 (100)
Vomiting	25 (83)
Fever (>38 °C)	30 (100)
Abdominal pains	30 (100)
Body weakness	30 (100)
Constipation	11(36)
Laboratory (Positive – *E.Coli*)	
Stool	8 (100)
Water	2 (100)
Food	0 (0)
Hospitalization	
In-patient	9 (30)
Outcome	
Alive	28 (93)
Dead	2 (7)

Discussion

Our investigation revealed that there was an outbreak of diarrheal disease associated with exposure to contaminated drinking water, caused by E.coli infection, which mostly affected residents above 15 years. All the cases reported from the two villages in which the outbreak occurred relied on untreated water from a nearby ox-bow lake. Prevention of diarrhoeal diseases is an important public health strategy for reducing morbidity and mortality not only in children but also in older age groups. In enteric disease outbreaks, sources of infection have been traced to a variety of origins such as surface water, household water containers, foods and drinks, and poor sanitary conditions1,6. The local municipal council and cooperating partners, responsible for management of water and sanitation can effectively prevent such outbreaks by providing safe water to the community. Provision of safe water is vital to protecting public health in Zambia; most of the reported waterborne disease outbreaks during the period 2017–2018 were associated with drinking contaminated water, accounting for at least 5,097 cases of illness, 1006 hospitalizations, and 99 deaths[3].

Almost all the patients presented with abdominal pains, diarrhea, vomiting, fever and malaise suggestive of exposure to E. coli high toxigenic strains. Although we could not perform further tests to determine the toxigenicity of the E. coli and Enterobacter agglomerans isolates, our results reveal very high faecal contamination of water from the ox-bow lake. Studies have documented the potential human health risk associated with the exposure to water contamination from shallow wells, due to the very high level of human faecal indicator bacteria isolated strains such as E. coli and Enterococcus from water and surface sediment [7].

The diagnoses of diarrheal diseases caused by specific pathogens may be challenging because they are usually clinically diagnosed as common salmonella gastroenteritis or enteric fevers (including typhoid fever), or often misclassified as malaria. Studies have documented that people in endemic areas are at a risk of contracting both (typhoid fever and malaria) infections concurrently 8–10. There is a considerable overlap of signs and symptoms of malaria and typhoid fever; the similarity of clinical features of both diseases leads to misdiagnosis and mistreatment of the febrile patients thus the initial suspicion of typhoid fever by clinicians in affected villages. Most of the cases suspected to have typhoid fever were treated with oral rehydration therapy and antibiotics which included ciprofloxacin and metronidazole, despite both the stool and blood serological tests being negative. Therefore, a reliable diagnostic method is important for effective management of cases to avoid misuse and wastage of drugs1,8,11. Further, strengthening surveillance at all levels may play an important role in early detection of notifiable diseases.

There was inadequate coordination and feedback among the key public health players (health centre, districts and referral hospital) during reporting, detection and confirmation. Although the health centre notified the hospital on the 7th January 2019, Senanga district DHO informed Nalolo DHO days later, contrary to standard reporting guidelines for immediately reportable diseases12. Additionally, the two DHO did not provide follow-up or feedback regarding the outbreak. Ideally, suspected outbreaks of epidemic-prone diseases are required to be reported to the next level within 48 hours of surpassing the epidemic threshold 13. However, this was not case as the national level was notified 10 days later. The DHO's public health departments have a primary responsibility of detecting and investigating outbreaks.

Our investigation evaluation indicated deficiencies to timely notify, detect and respond to the outbreak. The heightened challenges could arise from the fact that none of staff in the district were trained in IDSR 13–15. Since the district has some hard-to-reach areas within its catchment attributed to distance and impassable terrains, training of staff in community based surveillance could improve notification, detection and response to outbreaks 16. Regular supportive supervision could also have enhanced surveillance data validation. Delayed response to the outbreak was compounded by the fact that the district did not have the capacity to confirm any outbreaks because it had no laborato-

ry and all the samples were sent to a level II referral hospital located over 40 kilometers away. Although Nalolo district is a new district, there is need to have a laboratory which can at least perform basic analyses such as bacteriological testing to improve timely confirmation of diarrhea diseases.

Our investigation suggests poor health-seeking behavior among residents in the two affected villages. The positive change in health seeking behaviour could be enhanced by regular health education programs especially on good handwashing and other hygiene practices 17,18. Residents of Sumi and Situka villages had no access to a safe drinking water and basic sanitary facilities[7]. The community was accessing water for both human consumption and domestic use from an oxbow lake with stagnant water without any form of water treatment. Equally, the lack of secure pit latrines in the area could have propagated the infection as the communities prefer open defecation to toilet use. There could be increased contamination of water source due to rain water and human/animal waste interaction4. The lack of access to safe drinking water was partly attributable to the fact that the villages are inhabited by the nomadic Mubyane families of the Lozi tribe, who migrate seasonally from flooded plain to highlands along the Zambezi river. Therefore, sinking of some permanent protected boreholes on the safe highlands could improve access to safe drinking water and reduce contamination of the water used in the community.

To contain the outbreak, the DHO with support from PHO erected a tent for an onsite treatment centre at Situka village; distributed sodium hypochlorite solution for treatment of drinking water; and provided health education on personal hygiene including use of appropriate sanitary facilities such as pit latrines. Further, follow-up visits were conducted to further assess and collect information on the outbreak, and the national team provided technical support to DHO. The stool samples were subjected to further examination, while screening and active surveillance was continued.

Limitations

Our study was based on the descriptive secondary data analysis; we could not establish other risk factors accountable for increased diarrheal disease susceptibility in the study population. We could not perform further tests to determine the toxigenicity of the E. coli and Enterobacter agglomerans isolates.

Conclusion

Our investigation shows a waterborne disease outbreak caused by feacal contamination of drinking water source. Delayed confirmation and response by the local health could have contributed to spread of the outbreak among residents. Continued implementation of health education on water treatment (chlorination and boiling), use of toilets and good handwashing practices are highly recommended. Prompt confirmatory test should also be prioritised by clinicians as diarrheal patients may be misdiagnosed, e.g., presumed to have malaria. There is a need to provide training and capacity building for health personnel in disease surveillance to improve detection, response and coordination at all levels.

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Competing interests

The authors declare no competing interests.

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