A HARZARD ANALYSIS ON FACTORS ASSOCIATED WITH THE CHOLERA OUTBREAK OF JANUARY TO MARCH 2000 IN BUHERA DISTRICT: MANICALAND PROVINCE, ZIMBABWE

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Abstract

Cholera is an acute diarrhoeal disease caused by bacteria called vibrio cholerae. It has a high case fatality rate. Cholera is endemic in Zimbabwe and the country experiences cholera epidemics during the rainy season. A case control study was conducted following an outbreak of cholera in Buhera District of Manicaland Province in Zimbabwe. Interview schedules, observation methods and laboratory analysis of stool specimens were used to collect data.

A 100% response rate was achieved from 40 cases and 80 controls. Significant risk factors, among others, included lower level education, odds ratio (OR) =4.6, Confidence Interval (CI) =1.83 -12.8 P-value =<0.001; attending gatherings, OR= 2.25,CI=0.97 -5.26,P=0.038; communal hand washing OR=3.86,C I=1.14- 14.37, P=0.015

The epidemic curve indicated a point source infection. The findings indicated a strong association between poor hygiene and sanitation with the spread of cholera.

Cholera was first shown to be water-borne by a proper epidemiological study by John Snow in East London. Traditionally, water was recognised as the primary vehicle for transmission of cholera, but in the past 30 years, outbreaks of cholera associated with eating contaminated food have demonstrated that food also plays an important role. However, vehicles for transmission vary from place to place and this is affected by local customs and practices, and hence, selection of control and preventive measures that are most suitable locally must be implemented.

Keywords: Cholera, Buhera district Zimbabwe

Background

Manicaland province has had 3 cholera outbreaks since 1983, with the worst outbreak being that of 1999 / 2000, where a total of more than 601 cases were reported and about 75 people died.[1] Buhera district is one of Manicaland's seven districts and lies in the south eastern part of the province. It boarders with Mutare District to the north, Mashonaland East to the west, Masvingo Province to the south and Chipinge District to the north east. It has a total population of 257212 as per 1992 census projections, and 53610 households.[2] The district receives minimal rainfall but has two major rivers running through it i.e Save and Devuli rivers. According to the 1998 Manicaland Environmental Department Annual Report, safe water supply coverage for Buhera District is 13.7%, whilst sanitation coverage is 23%.[3] Most residents here resort to the 'bush system' for their toilets, and obtain drinking water from 'mufuku' which are shallow wells made along the river banks, and some unprotected wells out in the country side. The water and sanitary situation might have predisposed the residents of Buhera to the risk of contracting the waterborne disease, cholera.

Cholera is an acute diarrhoeal disease caused by Vibrio cholera, sero group 01 or sero group 0139.[4] Although the infection is often sub-clinical, when symptoms are present , the illness may be mild or fulminant (cholera gravis), the later leading to rapid dehydration and death.[4] Cholera has a potential for rapid spread and is highly seasonal, with epidemics occurring during the rainy season.[4]

Cholera first emerged in an epidemic form in India year 1817. Subsequent pandemics during the 19th century which swept the crowned cities of Asia, Europe, Africa and America had profound impact on the development of public health, stimulating the established of local health departments and systematic infections disease surveillance at local, national and international levels. Although man is the only known animal host of cholera, it has however become clear in recent years that understanding Vibrio cholera's survival in aquatic environment, is central to understanding it's epidemiology which has been dominated by it's tendency to spread throughout the world in pandemics.

Overview of the Cholera Outbreak

The 2000 cholera outbreak in Manicaland was first reported in Buhera district at Birchenough bridge hospital on the 8th of January 2000, and the first reported case came from Jombo village-Zindoga, along the Devuli river. On the 9th of January, the second cholera case reported to the same hospital from Tamanikwa village, 3 km upstream, from Jombo village along Devuli river (Appendix 1- spot map). Stool specimens were collected for laboratory analysis and Vibrio cholera (ogawa) was isolated on both specimens. On the 11th of January 2000 , a team comprising of members from the Provincial Medical Director's office and Buhera district went to carry out a situational analysis at Jombo village where the first case came from. Here, a 13 year old girl was found, who gave a history of having been to a church gathering over the Christmas holidays till the 26th of December 1999, some 20 km north, away from her residential place at a place known as Tonhorai. Nine days later, after the church gathering i.e. on the 4th of January 2000, the girl developed acute, painless, watery diarrhoea and vomiting. She however recovered at home on salt and sugar solution. Rectal swab was negative. On the 8th of January, her aunt who stayed 25 metres away, and used to visit the girl when she was ill, developed similar symptoms. She became the first reported case at Birchenough bridge hospital.

About 3km upstream at Tamanikwa, a village to the north of Jombo village where the first unreported case came from, another unreported case was found recovering at home, on salt and sugar solution. This was a 45 year old man who gave a history of having profuse painless watery diarrhoea and vomiting from the 8th of January 2000. Rectal swab was negative. About 1km further up from the second unreported case's homestead, was the second reported case's homestead, whose stool specimen was also Vibrio cholera positive. From the history of both the reported and the unreported cases, none of them had visited other areas nor had they received visitors during the previous month, except for the 13 year old girl who had been to a church gathering. All cases however, obtained their drinking water from 'mufuku' along Devuli river.

On the 10th day from the onset of the cholera outbreak, i.e the 14th of January 2000, a community death occurred at the Nechikova village, about 10km north of Zindoga. Relatives and friends convened to the funeral. Vibrio cholera, sero-type ogawa was isolated from rectal swab collected from the deceased. The deceased's family obtained drinking water from 'mufuku' along the Devuli river. The funeral, however was not supervised by health personnel. The deceased belonged to a Zionist church sect, who believe in faith healing. As such, the funeral was not reported and only discovered by the surveillance team who had gone out on a routine surveillance tour.

Six days following the first community death, daily cholera cases started to increase rapidly with the problem extending to areas of about 50 km radius in the district and later to the other districts. From the onset of the cholera outbreak in the district, a team was set up to go out and investigate the outbreak.

Objectives of the outbreak investigation

Major objective

To detect the major cause of the outbreak, treat the affected and combat spread of the infection.

Specific objectives

1. To put up an active cholera surveillance system in place.
2. To characterise the cholera epidemic.
3. To identify risk factors associated with symptomatic infection and disease outcome.
4. To put up control measures in place.

5 To come up with appropriate recommendations on cholera prevention to the district as well as the province.

Case definition

For the purposes of this study, a case of cholera is, any person in whom Vibrio cholera infection has been confirmed by laboratory tests, or person treated for either acute watery diarrhoea with or without blood, or acute watery diarrhoea plus vomiting, with mild, moderate or severe dehydration, during the period from the 4th of January 2000 to the 12th March 2000, the time when the cholera outbreak in Buhera district was declared over.

Literature Review

Cholera, is an acute dehydrating diarrhoeal disease traditionally caused by Vibrio cholerae sero- group 01 and also more recently by Vibrio cholerae sero- group 0139.[4] The disease is a major cause of death worldwide.[6] It is an internationally notifiable condition.[4] Cholera is unlikely to be amenable to world eradication since the existence of environmental reservoirs of Vibrio cholerae means the organism is likely to persist indefinitely.[4] Despite sometimes grim prognosis of untreated cholera, the disease is remarkably easy to treat by fluid and electrolyte replacement orally.[6] Intra-venous infusion could be resorted to in severe cases.[6] the incidence of cholera in a geographic location is determined by the presence of the causative organism, the conditions for its transmission and the immune status of the local population.[4]

Cholera was first shown to be waterborne by a proper epidemiological study by John Snow in East London.[6] Traditionally, water was recognised as the primary vehicle for transmission of cholera, but in the past 30 years, outbreaks of cholera associated with eating contaminated food have demonstrated that food also plays an important role, although in many instances, water is the source of contamination of food.[5] Food borne cholera can be averted by hygienic preparation of food and its consumption.[5] However, vehicles for transmission vary from place to place and this is affected by local customs and practices, and hence, selection of control and preventive measures that are most suitable locally must be implemented.[5]

Cholera first emerged in an epidemic form in India in 1817.[4] Subsequent pandemics during the 19th century which swept the crowded cities of Asia, Europe, Africa and the Americas, had profound impact on the development of public health, stimulating the establishment of local health departments and systematic infectious disease surveillance at local, national and international levels.[4] Although man is the only known animal host of

cholera, it has however become increasingly clearer in recent years that understanding Vibrio cholera's survival in aquatic environment is central to understanding its epidemiology which has been dominated by its tendency to spread throughout the world in pandemics. [6] (see Figure 1)

Figure 1. The cholera pandemics. Adapted from Cowcroft (1994)

Pandemic	Organism	Origin	Period	Affected Regions
First	01-Classical	Bangladesh	1817 -1823	India, SE Asia, Middle East, East Africa
Second	01-Classical	Bangladesh	1826-1851	India, SE Asia, Middle East, East Africa, Europe, Americas
Third	01-Classical	Bangladesh	1852-1859	India ,SE Asia,Middle East, East Africa, Europe, Americas
Fourth	01-Classical	Bangladesh	1863-1879	India, SE Asia, Middle East, East Africa,Europe, Americas
Fifth	01-Classical	Bangladesh	1881-1896	India, SE Asia, Middle East, East Africa, Europe, Americas
Sixth	01-Classical	Bangladesh	1899-1923	India, SE Asia, Middle East, East Africa, Europe, Americas
Seventh	01-El Tor	Indonesia	1961-	India, SE Asia, Middle East, East Africa, Europe, Americas
Eighth	0139	India	1991-	India, SE Asia

Singh et al, New Delhi revealed that cholera affected women more than men.[7]

In the same study, all cholera cases occurred in those who were illiterate or educated up to primary level.[7] Although cholera rarely occurs in children under 2 years, a four day neonate was found to be infected with Vibrio cholerae 0139 in Bangladesh.[8] It was however successfully treated. Important risk factors were found to be contact with affected persons,. storage of water in wide- mouthed containers, use of mugs to draw water from containers and non use of soap when hand washing after toilet use, before cooking and eating food.[7] These findings suggested that the hygienic practices were more important than contaminated water sources for transmission of cholera in Delhi during the 1992 cholera outbreak.[7]

Gunnlaugson 1997, in their study in Biombo - Guinea Bissau, West Africa, mentioned that cholera outbreaks occurred in several villages following funerals in the region.[9] Cholera was strongly associated with eating at a funeral where the corpse was not disinfected, and with touching of the body.[9] Following this study, the authors recommended that, during cholera epidemics , in addition to other cholera prevention activities, health workers should inform community leaders about the risk of cholera transmission during funerals, meals should not be served and bodies should be disinfected.[9]

Rodrigues, 1997 in Guinea- Bissau, echoed similar sentiments that using soap for hand washing was a protective factor.[10] He also reiterated that using limes in the main meals, not eating with fingers and using water from a public stand pipe were protective.[10] For his recommendations, he emphasised on the importance of hygiene and use of acidifiers in food preparation, for cholera control programmes in Africa.[10]

A study done by Birmingham et al, 1997 revealed that bathing in contaminated surface water was a major risk factor for cholera in Sub- Saharan Africa.[11] Similar studies by Swerdlowet et al, 1997 in Malawi indicated that significant risk factors for illness included drinking river water, placing hands into stored household water and eating left over food.[12] The authors also revealed that improved access to treatment and increased use of oral rehydration therapy could decrease mortality.[12] Preventing future cholera outbreaks in Africa was therefore dependent on interrupting both waterborne and food borne transmission of the pathogen.[12] The use of antibiotics in the treatment of cholera was found to be beneficial by their reduction of stool volume.[13]

In an anthropological study done by Nations and Monte 1996, it was revealed that 'non compliance' with recommended regimens, is more of a revolt against accusatory attitudes and actions of the elite than as an out right rejection of care by the poor.[14] They further highlighted that controlling cholera requires eliminating 'blaming the victim' rhetoric while attacking the social roots of cholera namely, poverty, low earning power, female illiteracy, sexism, lack of basic sanitation and clean water.[14]

Cholera tends to be more severe in persons with low gastric acidity due to malnutrition, gastritis, surgery, or drugs such as antacids.[4] The problem also tends to be more severe in persons with blood group 'O,' hence the high prevalence of blood group O among populations in Latin America may have intensified the cholera epidemic there.[4] According to Chidavaenzi, the Herald, February 11, 1999, commonly practised methods of domestic water collection, transportation, storage and distribution in the home, often exposed water to further contamination.[15] He recommended the use of water urns in the home, to reduce bacterial load in domestic water. Cholera will ultimately be brought under control, only when water supplies, sanitation, personal hygiene and food handling practices are safe enough to prevent the transmission of Vibrio cholerae.[14]

Methodology

A case control study was carried out in Buhera district with a total of 40 cases and 80 controls. An epidemiological investigation using interview schedule (appendix 2), to carry out a hazard analysis in the affected areas, observations as well as laboratory test were used to obtain data.

Epidemiological Investigations

A hazard analysis to try and establish the likely origin of the infection and factors predisposing residents to the infection was done through interviewing cases and controls. A 'case' was any person who met the definition of a case, as described above, and a 'control' was any persons who lived within the same community and had equal chances of being exposed to the risk of contracting cholera. Controls were taken from neighbours and were not matched in any way with the cases. Taking controls from the same family was avoided to counter the problem of over matching.

The hazard analysis involved assessing the knowledge, attitudes, practices and beliefs with regards cholera, environmental assessment with regards water and sanitation , recent visits, gatherings, food consumed as well as assessing self efficacy in terms of ability to take own decisions and prevent contracting cholera.

Laboratory investigations

During the peak of the outbreak, a temporary laboratory was set up at Birchenough Bridge hospital in order to cope with the large numbers of stool specimens. A total of 76 stool specimens were collected and cultured during the outbreak, using thiosulphate citrate bile salt sucrose (TCBS) agar whose efficiency was enhanced by use of alkaline peptone water. Vibrio cholera appeared as yellow colonies.

Results

A total of 78 residents in wards 26 to 30 of Buhera district were affected by cholera during the outbreak. Out of the 76 specimens, 44 were positive, 18 were negative and 14 results were missing. Fresh stool specimens were collected and tested within 3 hours of collection as per recommendations by the Mutare Provincial Laboratory. Rectal swabs were only collected in cases where stool was not readily available e.g, the deceased. Eight water samples from different water points were sent for laboratory testing and five of the samples

from different water points along Devuli and from shallow wells in the communal area, yielded Vibrio cholera (ogawa). Stool and water samples were later sent to the National Quality Control laboratory in Harare for further analysis and verification.

The age range for cases was 7 to 70 years with a median of 29, and mode of 32. Female to male ratio for cases was 25 to 15 respectively (Appendix 1). Table 1 gives a summary of the total number of cholera cases in Buhera district, deaths, and the case fatality rate.

From statistical analysis, it appears there was an association between the disease and drinking water from an unprotected well with OR= 0.48, 95% CI =0.16 - 1.43 and a P-value of 0.14. This meant that persons who drank water from unprotected water sources had 0.48 chances of developing cholera than those who drank water from a protected water source. Eating food at a gathering (funeral) was associated with contracting cholera with an OR =30.00, P=0.0002, and 95% CI= 2.91- 7.4 and this meant that persons who ate food at a gathering had about 30 times the risk of contracting cholera than those who did not. Individuals who washed hands from a communal bowl prior to eating had 15 times the risk of contracting cholera than those who used the 'run to waste method' with a P value of 0.000001. Having toilet facilities at home was found to be a protective factor with a P value of 0.0000008, OR=0.08, 95% CI=0.02- 0.26. Higher level of education and being male were also found to be protective factors.

Preventive and control measures

These were outlined as indicated below, at the onset of the outbreak, and were reviewed and updated throughout the outbreak period.

- Treatment of the affected at identified treatment centres and infection control.
- Follow up of cases and contact tracing.
- Inter- sectoral meetings with members of other ministries in a collaborative effort to try and control the epidemic.
- Use of boiled water and water chlorination in the homes and in wells.
- Inspection of food outlets and monitoring of vendors.
- Supervision of funerals, discourage huge and long time gatherings as well as avoid serving of food where possible.
- Encourage stringent hygienic practices amongst communities at all times.
- Information dissemination to commuters, bus operators, schools, churches, community leaders etc.
- Construction of temporary toilets using locally available resources.

Case management

Oral rehydration therapy was the primary mode of treatment and, severe cases received either Doxycycline 300mg stat, cotrimoxazole or erythromycin. The use of cotrimoxazole was later abandoned when the organism showed some resistance. Prophylactic chemotherapy was given to very close contacts, who were defined as persons residing in the same house as the case.

Discussion

Although the first unreported case gave a history of having been to a church gathering at Tonhorai, on tracing back, no other persons from the same gathering seemed to have developed diarrhoea. The first unreported case and the first reported case could be linked as they were related and stayed 25 metres apart and shared a common water source. The first reported case visited the 13 year old when she was ill.

There was however, no link between the Jombo village cases and the cases from Tamanikwa village. The only common link between them was their source of water, which was the Devuli river. The epi-curve indicated a point source infection during the initial stages of the epidemic (appendix 2) The upsurge of cholera cases was observed following a community death, and the pattern on the epi- curve is indicative of a propagated infection . These findings concur with findings by Gunnlaugsson et al 1994 in Guinea Bissau, where cholera cases continued to increase as more people were dying and relatives and friends attended funerals.

Use of participatory methods rather than coercion was found to be more beneficial as communities were given the chance to take charge and be responsible for their own health.

In an anthropological study done by Nations and Monte 1996,[14] non compliance resulted as a revolt against accusatory attitude by the elite who always resolved to' blaming the victim'

The church members of the Zionist and the Apostolic sectors exhibited this behaviour during the initial stages of campaigns against cholera in Buhera. Cooperation was only after the health teams improved their campaign strategies and involved the communities.

This was evidenced by their willingness to report cholera cases to the health team, cooperation in the construction of temporary toilets and participation in the water chlorination exercise.

In this case control study, there was a significant association between drinking water from unprotected water source and risk of disease. Eating food at funerals, coupled with washing hands in a communal bowl were high risk factor. Having a toilet and protected water source was protective. Belonging to the Zionist or Apostolic church sectors, employment status and level of education, was not of statistical significance. This could be due to the fact that most people in the area belonged to the same church sects, were unemployed and had lower level education.

Limitations

- There was non compliance by members of the Zionist and Apostolic church sects during the initial stages of the epidemic, who believed in faith healing. However, compliance improved following the deaths of two prominent church leaders.
- Inadequate transport, coupled with incessant rains, tended to slow down efforts by health personnel to quickly contain the epidemic.
- Sparsely distributed health facilities made it difficult for cases to quickly get assistance.
- There was generally low staff morale due to lack of incentives.
- Poor sanitation in the district and inadequate safe water supply in the district were factors that may have contributed to the onset of the epidemic.

Recommendations

1. Provision of safe water to the communities and construction of toilets should be treated as an urgent mater. Plans for bore-hole construction are already underway and water chlorination as well as water boiling are being done by members of the community.

2.Health education campaigns utilising community participatory methods, against cholera should be continuous and intensified prior to the rainy season.

3.The province should sustain the cholera surveillance.

4.There is need to have transport set aside for disease control purposes and outbreak management.

5. As a long term measure, Buhera district needs to have more health facilities in order to improve accessibility. Currently the district has 25 health facilities.

Conclusion

Cholera is preventable and curable. The causes of cholera spread are multi - faceted, and these mainly relate to the knowledge, attitudes, practices and beliefs. Morbidity and mortality rates due to cholera could be greatly reduced if communities are empowered to be masters of their own health through participatory health education. It is also hoped that the cholera control measures instituted aim at controlling and preventing waterborne and food borne diseases. These would assist to alleviate the problem in Buhera district and the province as a whole. For the purposes of disseminating information, persons were identified at district, province and national levels to communicate information about the cholera out break in Buhera. An Environmental Health Officer from the district was tasked with the collection of information about cholera around the district and pass it on to the principal investigating officer i.e. the MPH Officer in the Province. The principal investigating officer would then give information to the health executive, and liaise with the link person in the department of Epidemiology and Disease Control / Ministry of Health and Child Welfare. The Provincial Medical Director (PMD) disseminated information to other districts and neighbouring provinces. Any other persons needing information about the cholera situation in Manicaland, would be referred to the PMD. Information to neighbouring countries was communicated at national level.

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