Original Article

Cholera outbreaks in Malawi in 1998-2012: social and cultural challenges in prevention and control

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Abstract

Introduction: Cholera still remains a significant cause of morbidity and mortality in developing countries, although comprehensive surveillance data to inform policy and strategies are scarce.

Methodology: A desk review of the national cholera database and zonal and districts reports was conducted. Interviews were conducted with district health management teams, health workers, and participants in communities in six districts affected by cholera in 2011/2012 to obtain data on water, sanitation, and sociocultural issues.

Results: From 1998 to 2012, cholera outbreaks occurred every year in Malawi, with the highest number of cases and deaths reported in 2001/2002 (33,546 cases, 968 deaths; case fatality rate [CFR] 2.3%). In 2011/2012, cholera outbreak was widespread in the southern region, affecting 10 out of 13 districts, where 1,806 cases and 38 deaths (CFR 2.1%) were reported. Unsafe water sources, lack of maintenance of broken boreholes, frequent breakdown of piped water supply, low coverage of pit latrines (range 40%-60%), lack of hand washing facilities (< 5%), salty borehole water, fishermen staying on Lake Chilwa, cross-border Malawi-Mozambique disease spread, and sociocultural issues were some of the causes of the persistent cholera outbreaks in Malawi.

Conclusions: Despite improvements in safe drinking water and sanitation, cholera is still a major public health problem. Introduction of a community-led total sanitation approach, use of social and cultural information in community mobilization strategies, and introduction of an oral cholera vaccine could help to eliminate cholera in Malawi.

Key words: cholera; sub-Saharan Africa; Malawi

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Introduction

Cholera is an acute diarrheal infection caused by ingestion of food or water contaminated with the bacterium *Vibrio cholerae* O1 or O139, which can lead to rapid dehydration and death if left untreated. With the potential to cause many deaths, spread quickly and eventually internationally, and seriously affect travel and trade, cholera is one of the global threats to public health [1]. In 2012, the World Health Organization (WHO) estimated that every year, there are 3–5 million cholera cases and more than 100,000 people die of the disease, with the majority (99%) of the cases and deaths occurring in sub-Saharan Africa and southern Asia [2-4].

Historically, there have been seven cholera pandemics; recent outbreaks in Zimbabwe and Haiti are included in the seventh and ongoing pandemic. Only isolates in serogroup O1 (consisting of two biotypes, classical and El Tor) and the derivative O139 can cause epidemics. It is believed that the first six cholera pandemics were caused by the classical biotype, but El Tor has subsequently spread globally and replaced the classical biotype in the current pandemic. The first cholera pandemic occurred from 1817 to 1823. The seventh and current pandemic started in 1961 in Sulawesi, Indonesia. The pandemic reached sub-Saharan Africa in 1970, where it has remained entrenched. In 1991, the seventh pandemic reached Latin America. In contrast to the persisting situation in Africa, cholera was largely eliminated from Latin America within a decade [4-8].

In Malawi, the first reported cholera cases occurred in 1973 during the pandemic wave that hit most eastern African countries. Every year from 1997 to 2012, there was a cholera outbreak in Malawi, particularly in the southern region [9-10]. This study

highlights the health system and social and cultural challenges in the prevention and control of cholera with the goal of informing efficient and effective public health measures to eliminate cholera in Malawi.

Methodology

Study design

This was a cross-sectional descriptive study. A desk review of the national cholera database, national, zonal, and district cholera supportive supervision reports, and cholera post-mortem meetings reports for the period 1998-2012 was conducted. During the 2011/2012 cholera outbreak, data were collected from cholera outbreak districts and communities using a standard questionnaire from district health management teams (DHMT), health workers in cholera treatment center/sites, guardians of cholera patients at the treatment sites, and people in the cholera-affected communities. A total of six DHMTs (Chikwawa, Nsanje, Blantyre, Zomba, Machinga, and Phalombe), three health workers (clinician, nurse, and health surveillance assistant) and guardians who were available on the day of the survey at each of the 12 cholera treatment sites were interviewed using a standard questionnaire.

Sample size

For community-based interviews, the minimum sample size was calculated using the formula:

$$N = \frac{Z^2 P(1-P)}{e^2}$$

Where: N = sample size, Z = level of confidence, P = baseline level of the selected indicator and e = margin of error, set at P = 0.50, Z = 1.96 (at 95% confidence interval), e = 0.05.

The sample size was adjusted for 1.5 (multiply) design effect for multiple sites and 10% (divide by 0.9) refusal rate. The minimum required sample size after adjusting for the above factors was therefore 640 people to be interviewed from cholera outbreak communities.

Selection of communities and participants

In the six districts with cholera outbreaks during the 2011/2012 season, there were a total of 18 communities that were affected, including the fisherman community around Lake Chilwa. At least 36 (640/18) people were therefore interviewed from each community affected by cholera. In each community, 36 households were randomly selected using a systematic sampling method. The sampling interval was calculated by dividing the total number of households in the community by 36 (the number of households to be selected). At the household level, only one eligible participant was selected using the simple random method. All adults 15 years of age or older were eligible to participate in the study.

Data management

Data were entered in Epi Info 2004 version 3.2.2 (Center for Disease Control, Atlanta, GA, USA) and exported to SPPS for Windows version 11.0.0 (Chicago, IL) for analysis. Confidence intervals (CI) for proportion were calculated using the formula $p = p \pm C\sqrt{p(1-p)/n}$ where p is the given proportion whose CI needs to be calculated, C is the coefficient, at 95% CI, C = 1.96, n = number of participants. The results were statistically significant if there was no overlap between two CIs of comparing groups.

Ethical statement

Ethical approval was granted by the Malawi National Health Sciences Research and Ethics

Committee. Written informed consent was obtained before participants were enrolled in the study. Consent to review cholera treatment registers, line lists, and patient files was obtained from the official in charge of the health facility.

Results

Trends in cholera outbreaks in Malawi: 1998-2012

Since 1998, there was a cholera outbreak every year in Malawi, with the highest number of cases and deaths reported in 2001/2002 (33,546 cases, 968 deaths; attack rate 0.29%, CFR 2.3%), 1998/99 (25,000 cases, 860 deaths; attack rate 0.25%, CFR 3.4%) and 2008/09 (5,751 cases, 125 deaths; attack rate 0.04%, CFR 2.2%) (Figures 1-3).

Cholera outbreak 2011/2012

From 1 November 2011 to 31 October 2012 (cholera reporting season), a cholera outbreak was widespread in the southern region, affecting 10 out of 13 districts in that region. The outbreak occurred almost throughout the entire year; it started in October 2011 in Chikwawa and persisted to September 2012 in districts around Lake Chilwa (Zomba, Phalombe, and Machinga). No cholera outbreak occurred in the central and northern regions. A total of 1,806 cases and 38 deaths (attack rate 0.01%, CFR 2.1%) were reported, and 27 treatment centers/sites were established.

Figure 1. Trends in cholera cases in Malawi 1998-2012

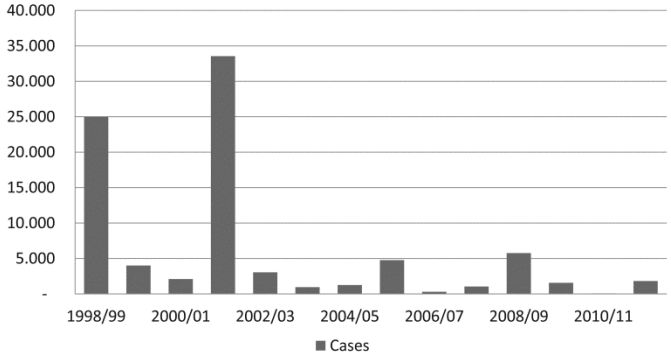

Figure 2. Trends in cholera deaths in Malawi 1998-2012

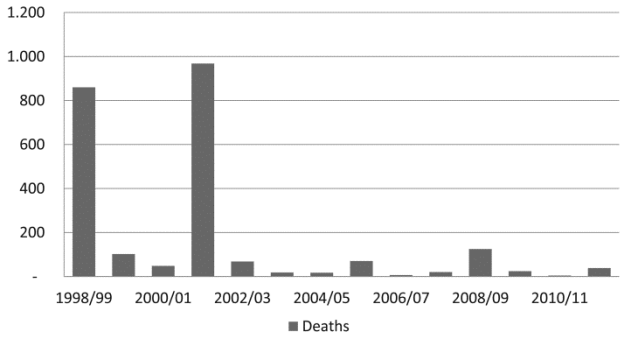

Figure 3. Trends in cholera case fatality rate in Malawi 1998-2012

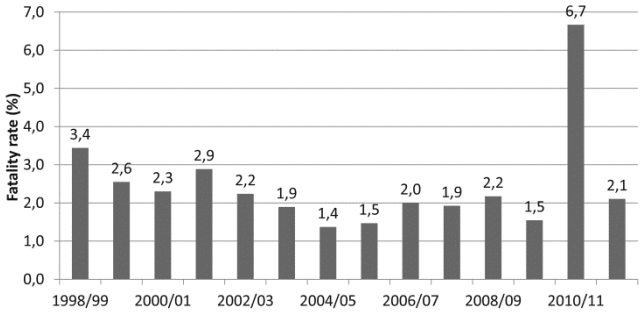

Table 1. Cholera cases and deaths during the 2011/2012 outbreak in Malawi

District	Cholera cases						Cholera deaths						CFR (%)
	Tot	Gender		Age (years)			Total	Gender		Age (years)			
		M	F	0-4	5-14	≥15		M	F	0-4	5-14	≥15	
		n (%)	n (%)	n (%)	n (%)	n (%)		n (%)	n (%)	n (%)	n (%)	n (%)	
Nsanje	463	226 (48.8)	37 (51.2)	69 (14.9)	133 (28.7)	261 (56.4)	8	5 (2.2)	3 (1.3)	1 (1.5)	0	7 (2.7)	1.7
Chikwawa	182	85 (46.7)	97 (53.3)	19 (10.4)	51 (28.0)	112 (61.6)	3	2 (2.3)	1 (1.0)	1 (5.3)	0	2 (1.8)	1.7
Blantyre	370	180 (48.7)	190 (51.3)	27 (7.3)	93 (25.1)	250 (67.6)	15	6 (3.5)	9 (4.7)	0	9 (9.7)	6 (2.4)	4.1
Machinga	124	103 (83.1)	21 (16.9)	1 (0.8)	11 (8.9)	112 (90.3)	4	4 (3.8)	0	0	1 (9.1)	3 (2.7)	3.2
Phalombe	204	101 (49.5)	103 (50.5)	39 (19.1)	44 (21.6)	121 (59.3)	2	1 (1.0)	1 (2.6)	1 (2.6)	0	1 (0.8)	1.0
Zomba	234	201 (85.9)	33 (14.1)	3 (1.3)	17 (7.2)	214 (91.5)	3	3 (1.5)	0	0	0	3 (1.4)	1.5
Thyolo	45	26 (57.8)	19 (42.2)	1 (2.2)	8 (17.8)	36 (80.0)	2	2 (7.7)	0	0	0	2 (5.6)	4.4
All districts	**1,622**	**922 (56.8)**	**700 (43.2)**	**159 (9.8)**	**357 (22.0)**	**1,106 (68.2)**	**37**	**23 (2.5)**	**14 (2.0)**	**3 (1.9)**	**10 (2.8)**	**24 (2.2)**	**2.3**

CFR: case fatality rate; n: number of cases and deaths by gender and age

The highest number of cholera cases and deaths were reported from Blantyre (406 cases, 17 deaths; attack rate 0.05%, CFR 4.2%). Of the 1,622 cases with known gender and age, 56.8% were males, 9.8% were children under 5 years of age, 31.8% were children under 15 years of age, and about two-thirds (68.2%) were adults 15 years of age or older. Of the 38 deaths, 23 (62.2%) were males. Among cholera cases of 922 males, 700 females, 159 children under 5 years of age, 357 children between 5 and 14 years of age, and 1106 adults 15 years of age or older, case fatality rates were 2.5%, 2.0%, 1.9%, 2.8%, and 2.2%, respectively (Table 1).

Social and cultural risk factors

A review of risk factors from the 2011/2012 cholera line list and interviews with 640 participants (36 participants in each of the 18 affected communities) revealed the following as the sociocultural risk factors for cholera: unsafe water sources in both urban and rural areas due to lack of boreholes or piped water; lack of maintenance of broken boreholes; frequent breakdown of piped water supply, particularly in Chikwawa and Blantyre City; low coverage of pit latrines (range of 40%-60% in the cholera-affected communities visited); lack of hand washing facilities (< 5% of the households had hand washing facilities); saltiness of borehole water from some boreholes, particularly in Nsanje and Chikwawa districts and hence people were not using it for drinking; fishermen staying in floating shelters – *zimbowera* – on Lake Chilwa where people defecated in the same water (lake) they used for domestic purposes; poor sanitation in public markets in both rural town centers and cities; rapid uncontrolled urbanization in townships such as Ndirande and Chilomoni in Blantyre, where households had no space to build a pit latrine; and cross-border disease spread as was the case for Nsanje district, where health authorities and the community claimed that almost every cholera was brought in by people from Mozambique or by Malawians who went to farm in Mozambique. Some non-biomedical sociocultural perceived causes of cholera included statements such as "Cholera is like a wind, it will pass hence do not bother", "Witchcraft, why me?", and "Chlorine-treated water smells and tastes bad"; these reasons were commonly indicated by interviewed participants in all the six districts.

Risk factors for high (> 1.0%) cholera case fatality rate during the 2011/12 outbreak

The review of case notes of cholera patients who died and interviews with participants in communities where cholera deaths occurred revealed the following about cholera-related deaths: of the 38 cholera deaths that occurred during the 2011/2012 outbreak, 18 (47.4%) died because of poor case management due to shortage of supplies or lack of knowledge among health workers, 10 (26.3%) were community deaths (failure to seek medical help), and 10 (26.3%) of the Lake Chilwa cases died en route to or soon after arriving at the health facility or treatment camp because of the long distance they had to travel.

Discussion

Cholera outbreaks in the southern region of Malawi occurred during the rainy season (sometimes throughout the year) every year since 1998. The outbreaks have been caused by *Vibro cholerae*, serogroup 01, biotype El Tor, serotype Ogawa and Inaba [10]. Nsanje, Chikwawa, and Blantyre districts are the major hotspots. According to the 2008 population, housing, and census data from the National Statistics Office, about three in four (74.2%) households in Malawi have access to safe drinking water (piped water, boreholes, and protected wells); boreholes are the main water source of 48.3% of the households. Household access to safe drinking water in Nsanje, Chikwawa, and Blantyre were among the highest at 81.1%, 74.9%, and 94.6%, respectively. However, water from some of the boreholes in Nsanje and Chikwawa was salty and households did not use it for drinking. Drinking water was drawn from unsafe sources (rivers, unprotected wells, and the lake). Furthermore, it is estimated that about one in three (32%) of safe water sources in Malawi are not functioning at any given point in time due to breakdown and lack of maintenance [11].

Although nationally, 85.6% of households have a toilet facility – traditional pit latrines are the commonest type, available in 81.1% of the households – Nsanje and Chikwawa were the two districts with the lowest household coverage of toilet facilities. Over one in three households in Nsanje and Chikwawa (37.9% and 35.9%, respectively) had no toilet [11]. Low coverage of toilet and hand washing facilities increases the risk of water and food contamination. Household accessibility to both safe drinking water and toilet facilities were high in Blantyre (94.6% and 99.2%, respectively), but there were frequent breakdown in water supply from the Blantyre Water

Board. Some townships, such as Bangwe and Chigumula, went for more than three weeks without water. Households were therefore forced by the situation to draw water from unsafe sources. A similar situation occurred at Chikwawa *Boma* (district headquarters), where cholera started during 2011/2012 rainy season. This illustrated that, despite the gains in the provision of safe drinking water, poor sanitation, salty borehole water, and frequent breakdown of piped water supply and boreholes contributed to the persistence of cholera outbreaks in Nsanje, Chikwawa, and Blantyre. In agreement with other studies, rapid, informal, and uncontrolled urban settlements in Ndirande, Bangwe, and Chiromoni townships in Blantyre contributed to poor sanitation [12]. This underscores the importance of improving and sustaining supplies of safe water, adequate sanitation, and planned and controlled settlements in urban areas. It was reported that 100% of shallow wells in Malawi were contaminated with fecal matter, particularly in the rainy season [13]. Introduction of community-led total sanitation (CLTS), an innovative participatory approach for mobilizing communities to completely eliminate open defecation, could improve sanitation coverage and use. Communities are helped to conduct their own appraisal and analysis of open defecation and take their own action to become free from open defecation [14-15].

The stay of fishermen on Lake Chilwa (the second largest lake after Lake Malawi) in floating homes (*zimbowela*) with no access to safe water and toilets was another root cause of the persistent cholera outbreak. Approximately 6,000 fishermen stay on the lake in clusters of 10 to 16 people for up to three months without coming ashore. It generally takes at least one hour to get to a *zimbowela* by motorized boat and three hours by canoe. Due to their distance from land, fishermen living on the lake had no access to water disinfectants and health facilities, leading to a prolonged cholera outbreak and high case fatality rate [16]. At the port of entry, as the fishermen were going into the lake, they were given five liters of 1% stock solution for the treatment of drinking water. However, because of their prolonged stay on the lake, this was not enough; the 1% stock solution can be used for only two weeks after it has been prepared. To ban fishermen from staying on the lake has been politically and socially difficult to implement over the years. Weekly visits to *zimbowelas* for surveillance and provision of cholera prevention messages, materials, and 1% stock solution, though resource-demanding, could be an option to stop cholera on Lake Chilwa.

In addition to biomedical risk factors of cholera outbreak (poor sanitation, lack of access to safe water, and poor food hygiene), this study demonstrated the existence of social and cultural risk factors. Demonstrating the social cultural factors were statements such as "Chlorine-treated water smells and tests bad", "Cholera is like a wind, it will pass; hence, do not bother", and "Witchcraft, why me?" Before this study, these sociocultural factors were not well documented in Malawi and hence no consideration was made in the development of cholera prevention messages and community mobilization strategies. It is true that water treated with chlorine smells like chlorine and the taste may not be good if taken before the recommended time. This fact must be recognized and tackled during community mobilization and health promotion. Witchcraft and God's will as perceived causes of cholera were also reported by other studies. This study highlights the need to incorporate social and cultural issues related to cholera in health promotion messages and materials in addition to messages addressing traditional biomedical risk factors [17-19].

Cholera is an easily treatable disease, provided the cases are detected and treated early. Up to 80% of people can be treated successfully through prompt administration of oral rehydration salts (WHO/UNICEF ORS standard sachet). Very severely dehydrated patients require administration of intravenous fluids and appropriate antibiotics to diminish the duration of diarrhea, reduce the volume of rehydration fluids needed, and shorten the duration of *V. cholerae* excretion. With prompt proper treatment, the case fatality rate should remain below 1% [2]. However, in Malawi, the cholera case fatality rate had been over 1% for the past 14 years (1998-2012), with a range from 1.4% to 6.7%. Risk factors for high (> 1%) case fatality rates revealed by this study were similar to those identified by other studies conducted in sub-Saharan Africa [1-2]. The risk factors included failure to seek medical help (community death); late presentation to health facilities because of long distances, particularly those staying on Lake Chilwa; poor case management; shortage of supplies; early discharge of patients from the cholera treatment site, leading to the condition getting worse at home; and other underlying medical conditions or infections such as HIV and malaria. In some cholera treatment sites, management of cholera cases was left to semi-trained community-based health workers, health surveillance assistants (HSAs). This, coupled with lack of supervision by trained medical

and nursing personnel, also contributed to poor case management and outcomes. Promotion of community awareness about symptoms and signs of cholera, training of health workers, and establishment of cholera treatment centers in the affected communities may improve early detection and prompt proper treatment of cases, thereby reducing the number of people dying from cholera.

In endemic areas and areas at risk of outbreaks, WHO recommends the use of the new generation of oral cholera vaccine in conjunction with improving water supply and sanitation. The oral cholera vaccine has been shown to provide short-term protection of 85%-90% against *V. cholerae* O1 in all age groups at four to six months following immunization, with minimal side effects [2,20-22]. Malawi could therefore consider introducing the oral cholera vaccine in high-risk districts and communities such as Nsanje, Chikwawa, Blantyre, and the fisherman community at and around Lake Chilwa.

Limitations of the study

This study made use of the available health facility data and reports on cholera. The use of health facility data has its own limitations, such as incompleteness and bias in the sense that the information is obtained only from people who came to health facilities. These limitations affected this study just as they would any other study that uses this type of data. The other limitation of this study was that the community-based data collection, because of limited resources, was confined to communities that had a cholera outbreak. Nevertheless, the comprehensive review of the available cholera data provided local evidence that could be used to inform policies, information, education and communication (IEC) strategies and interventions for the elimination of cholera in Malawi and in the eastern and southern regions of Africa. The limitations of health facility-based data (registers, patient files, and line lists) were minimized by the additional data collected from health workers, district health management teams, and communities, using structured questionnaires.

Conclusion

Despite improvement in safe drinking water and sanitation, cholera is still a major public health problem in Malawi; outbreaks occurred every year from 1998 to 2012. Frequent disruptions in water supply, poor sanitation in some districts, salty borehole water, social and cultural issues, fishermen staying on the lake in makeshift floating houses, and cross-border spread were some of the causes of the persistent cholera outbreaks. Introducing a community-led total sanitation approach and promoting hygiene in high-risk districts, taking into account social and cultural issues into community mobilization strategies, introducing oral cholera vaccine to high-risk groups, and improving surveillance could help eliminate cholera in Malawi.

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