

REVIEW

A review of the epidemic-prone enteric diseases in Zambia: cholera, typhoid fever and bacterial dysentery

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Citation style for this article:

Siziya S. A review of the epidemic-prone enteric diseases in Zambia: cholera, typhoid fever and bacterial dysentery. 2017;2(1); pp6-11.

Enteric diseases caused by bacteria that are epidemic prone in Zambia include cholera, typhoid fever and dysentery. Common signs and symptoms of enteric diseases include diarrhoea and vomiting. There is scant information of the occurrence of enteric diseases other than cholera. Cholera is generally pandemic in Zambia with the most recent major outbreaks having occurred in 1990, 1999 and 2004. Cholera outbreaks mainly occurred in peri-urban areas of Lusaka, Luapula, Southern and Copperbelt provinces. Case fatality rates for cholera varied with epidemics indicating different responses to cholera epidemics. Factors that increase the risk factors for cholera include consumption of raw vegetables and contact with cholera cases. Factors that decrease the risk include hand washing with soap, availability of safe drinking water, and sanitation. Addition of oral cholera vaccines to strategies to control epidemics may curtail a seemingly explosive epidemic. More research is required on typhoid fever and dysentery outbreaks to monitor their occurrence and establish their risk factors for the purposes of designing interventions to prevent or curtail the epidemics. Improvement in health information systems to ensure timely, accurate, and complete reporting is needed. Ultimately, outbreaks of bacterial enteric diseases in Zambia can only be controlled once all Zambians have access every day to safe drinking water

Introduction

Enteric diseases caused by bacteria that are epidemic prone in Zambia include cholera, typhoid fever and dysentery [1]. Infections enter the body through the mouth. These diseases are contracted through contaminated food and drink, being in contact with contaminated faeces or vomitus [2]. Common signs and symptoms of enteric diseases in Zambia include diarrhoea and vomiting [3].

Cholera

The World Health Organization has documented the profile of cholera in Zambia from 1978 to 2010 [4]. Cholera was first reported in 1977 with major outbreaks occurring in 1990 and 1999 that lasted for 3 and 4 months, respectively. Another cholera outbreak occurred in 2004 that lasted until 2010 (Figure 1) and spilled over to 2012 (Figure 2), thus becoming pandemic. From 2013 to 2016, no cases of cholera were documented by WHO [5-8], although an outbreak of cholera occurred in Chibombo district between 9 February and 20 March 2016 in which 23 suspected and confirmed cases were seen with no deaths at the district health facility. Eight of the 18 stool cultures were positive for *Vibrio cholerae* [9]. Another outbreak occurred in Lusaka district between 5 February and 24 April 2016 in which 1079 cases and 20 deaths (case fatality rate [CFR] = 1.9%) were recorded. Yet another epidemic was recorded in Kapiri Mposhi district between 11 September and 21 October 2016 with 27 cases and 2 deaths (CFR = 7.4%) [10]. The same epidemic was documented for the period February to 31 May 2016 in which 1054 cases were reported with a CFR of 1.9% [11]. During the same epidemic, 1139 cases and 20 deaths (CFR = 1.8%) were reported during epidemiological weeks 5 to week 24 [12]. The reduction in the number of cases may partly have

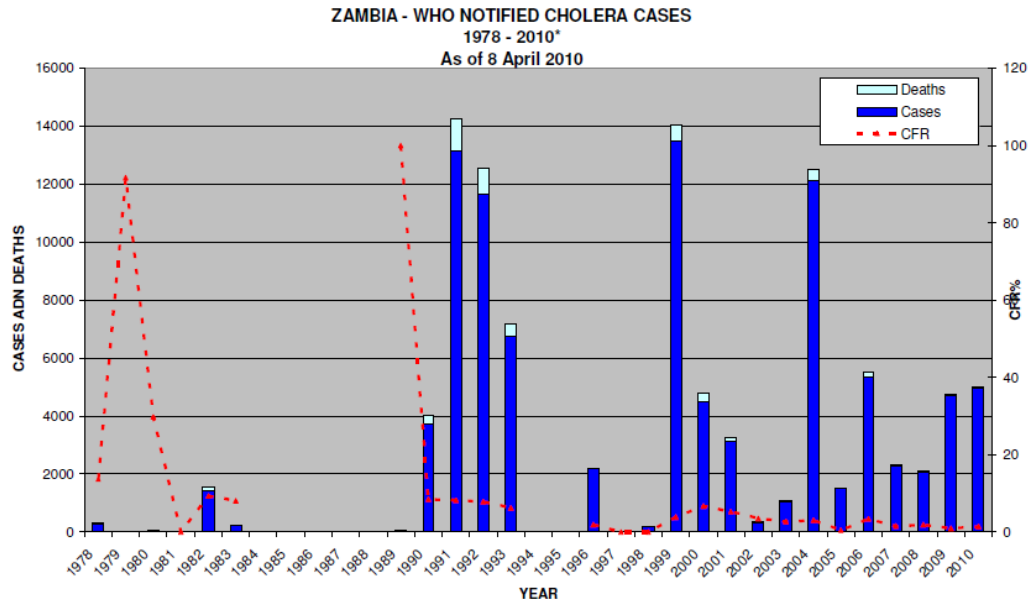


Figure 1 Distributions of number of cholera cases and case fatality rates by year: 1978-2010. Source: WHO. Global Task Force on Cholera Control. Cholera country profile: Zambia. URL: <http://www.who.int/cholera/countries/ZambiaCountryProfile2011.pdf>

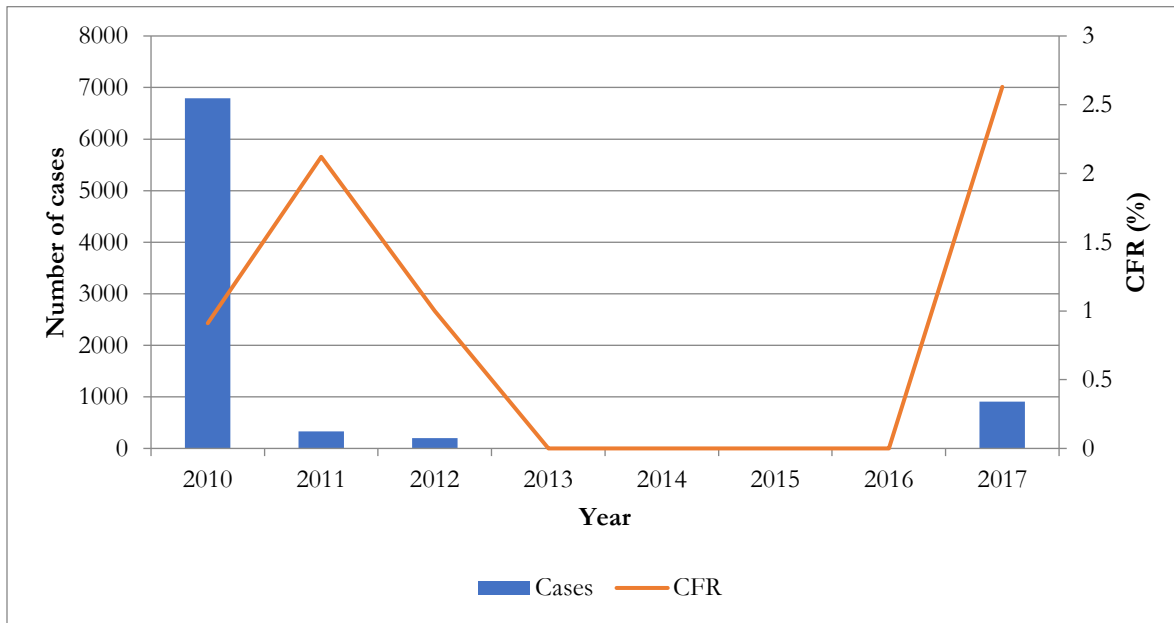


Figure 2 Distributions of number of cholera cases and case fatality rates by year: 2010-2017

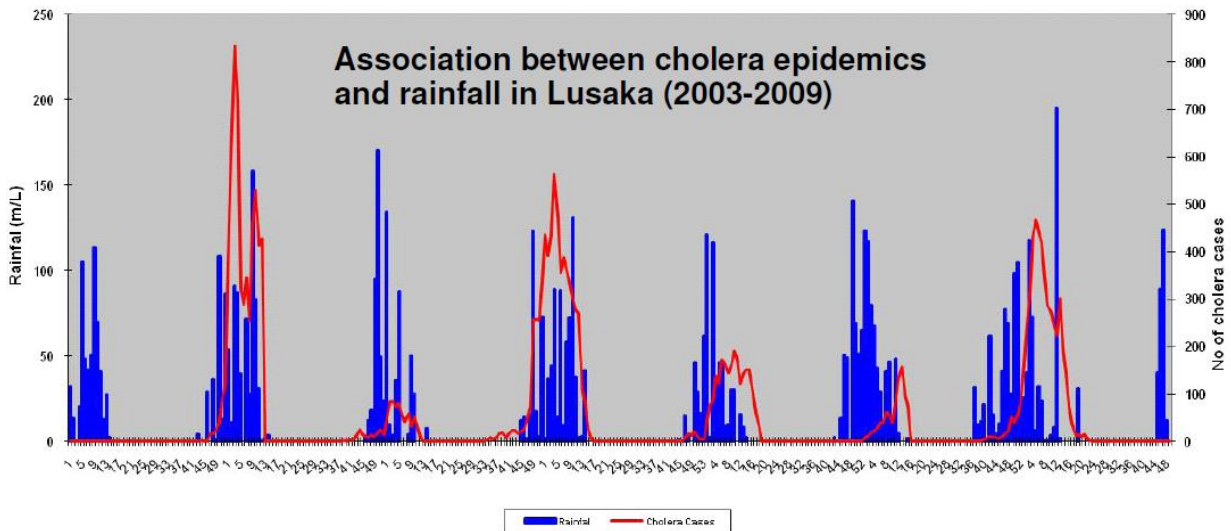


Figure 3 Distributions of number of cholera cases and rainfall patterns: 2003-2009. Source: WHO. Global Task Force on Cholera Control. Cholera country profile: Zambia. URL: <http://www.who.int/cholera/countries/ZambiaCountryProfile2011.pdf>

been due to different t periods. It is surprising that WHO did not document the epidemic that occurred in 2016 given that WHO partly supported provision of cholera vaccine to curb the 2016 epidemic in its early stage in April 2016 [12]. It is likely that although no cholera cases were reported by WHO in the other years (2013-2015), there could have been epidemics in these years as well. In 2011, out of 330 cases, 7 died (CFR = 2.12%) and in 2012, 2 out of 198 cases died (CFR = 1.0%) [13]. Case fatality rate of <1% may indicate good management of cases [14]. Cholera deaths result from severe dehydration and can usually be prevented by administration of large amounts of fluid that can be administered orally. Differences in case fatality rates in Zambia may partly be due to differences in amounts of fluids given to patients and how quickly patients had access to this treatment.

The current outbreak in Lusaka district was reported on 6 October 2017 to the WHO [15]. Initially, between 28 September and 7 December 2017, 547 cases including 15 deaths (CFR = 1.8%) were reported. By 18 December 2017, a total of 908 cases were reported with a CFR of 2.6%

[16]. This rise in number of cases and CFR, prompted the Ministry of Health to institute a quick response to contain the outbreak at an early stage by forming a response coordination team comprising senior members of staff in line ministries (political will and leadership), Lusaka Water and Sewerage Company, Lusaka City Council, Disaster Management and Mitigation Unit, Defence Forces, WASH and health promotion teams, National Epidemic Preparedness, Prevention, Control and Management committee and the Zambia National Public Health Institute; resource mobilisation through partners and private organizations, surveillance and case management; strengthening laboratory facilities; health promotion and communication and instituting an oral cholera vaccine campaign. This action is in line with the three strategic axes for The Global Roadmap to 2030 which are Axis 1: Early detection and quick response to contain outbreaks at an early stage; Axis 2: A multisectoral approach to prevent cholera in hotspots in endemic countries; and, Axis 3: An effective mechanism of coordination for technical support, resource mobilisation, and partnership at the local and

global level [17]. To reduce CFR by maximizing supplies, equipment and human resource, the Heroes National Stadium was converted into a cholera treatment hospital with 500 bed capacity with room for expansion. Case fatality rates seen in Figure 1 of as high as 100% were based on small numbers of reported cases. Yearly case fatality rates since 2010 have been around 1%, except in 2011 when a CFR of 2.1% was reported (Figure 2). Between 1996 and 2004, 69 strains of *V. cholerae* serogroup O1 were isolated in Zambia [18]. These different strains may respond differently to treatment. Mwansa et al [19] reported *V. cholerae* serogroup O1 to have had a low level of resistance to tetracycline during 1990–1991 (2-3%) that increased to 95% in subsequent epidemics in which resistance patterns of over 70% were reported for chloramphenicol (78%), doxycycline (70%) and trimethoprim–sulphamethoxazole (co-trimoxazole) (97%). Geographically, outbreaks occurred in peri-urban areas of Lusaka, Luapula, Southern and Copperbelt provinces between epidemiological weeks 40-45 of the year and weeks 20-25 of the following year [20]. WHO observed a very strong association between rainfall and cholera cases [4] as shown in Figure 3 and also noted that outbreaks usually started during the month of October and ended between mid-May/beginning of June of the following year. Luque Fernández et al [21] found that an increase in temperature 6 weeks prior to the beginning of the rain season followed by an increase in rainfall 3 weeks later beyond expected levels, led to an increase in the number of cases of cholera within the following 3 weeks. Phiri et al [22] also reported an association between cholera cases and rainfall patterns. Factors that increase the risk of getting cholera included consumption of raw vegetables [23], contact with cholera case [24], absence of latrine [25], unsafe main source of drinking water [22] and increased number of people in a household [22]. Protective factors for cholera were consumption of kapenta [23], presence of drainage systems

surrounding houses [25], treatment of drinking water [24-26] and hand washing with soap [3,24-26].

A new vaccine produced by (Shantha Biotechnics, Hyderabad, India) as a single dose rather than a two-dose was administered to 576,043 people over the age of 1 year living in 9 townships of Lusaka at greatest risk for cholera in April 2016. Epidemics call for desperate measure and as such, although the vaccine was not registered in Zambia, the Ministry of Health approved its emergency use. The administrative coverage was 73.4%. After the vaccination campaign, few cholera cases were reported and there was no evidence of the disease spreading within the vaccinated areas [12]. However, the outcomes of the intervention were unclear.

In response to the current epidemic of 2017-2018, a cholera vaccination campaign using Euvichol (EuBiologics Co., Ltd, South Korea) oral cholera vaccine was launched on 10 January 2018 in the hot spots of Lusaka, namely: Chipata and Kanyama sub-divisions [27]. Although the vaccine is supposed to be given as two doses two weeks apart, only one dose was given. It remains to be seen what impact this vaccination campaign will have on the epidemic. However, in a modelling study, the single dose was found to avert more cases and deaths than a standard two-dose campaign in Zimbabwe, Haiti and Guinea [28].

Among the enteric diseases (cholera, dysentery and typhoid fever), cholera has been well documented. It is important that interventions to prevent cholera should be evidence based. The new Zambia National Public Health Institute (ZNPHI) should have a strong research team to provide such evidence and an effective information system to provide information timely to stakeholders for prevention purposes. ZNPHI should coordinate research on cholera during epidemics. However, some important, country-relevant information has been obtained from uncoordinated research that could be used in controlling or preventing cholera. Given limited resources, targeted interventions to prevent cholera epidemics should consider

these factors that have been shown to be associated with cholera in Zambia, in particular covering peri-urban areas of Lusaka, Luapula, Southern and Copperbelt provinces and fishing camps. These findings suggest that cholera may be effectively controlled using a multidisciplinary integrated approach that may include provision of clean water, adequate sanitation, health promotion covering personal and environmental hygiene, passive and active surveillance of cholera cases, and the treatment of cases. Provision of clean water and sanitation are vital in the prevention of cholera which could be done by partly avoiding contamination of drinking water by laying the drinking water and waste water systems far apart and partly by avoiding sinking of boreholes in an area with many septic tanks. Provision of piped water from a source far away from the septic tanks is a cheaper option to providing safe drinking water in the long run than treating water at household level

Bacteria dysentery

There is little documentation of dysentery epidemics in Zambia. In June 1990, an outbreak of *Shigella dysenteriae* Type 1 dysentery was reported in a prison in western Zambia and by December 1991 a total of 24,774 cases had been recorded with a case fatality rate of 10.2% [29]. There are no other documented epidemics.

Factors associated with dysentery included: recent contact with a person with dysentery, a family member with preceding dysentery, households sharing their latrine with other households, obtaining drinking water only by hand-dipping and eating cooked relish (a cooked meat or vegetable dish) purchased from a vendor [30].

Among the *Shigella* species, *S. flexneri* was resistant to ampicillin and co-trimoxazole (both 100%), followed by chloramphenicol and streptomycin (both 83.8%). *S. dysenteriae* was resistant (100%) to both ampicillin and co-trimoxazole. *S. boydii* was 100% resistant to ampicillin, co-trimoxazole and chloramphenicol [31]. The importance of

monitoring antibiotic sensitivity patterns cannot be overemphasised for better management of cases.

Clearly, there is scanty information on dysentery. Outbreaks of dysentery can only be efficiently prevented or curtailed if information to design interventions is available. As a notifiable disease, it must be correctly and timely reported.

Typhoid fever

Few typhoid fever epidemics have been documented in Zambia. Bisseru [32] reported an outbreak of typhoid fever in a girls' camp in Zambia. A more recent outbreak of typhoid fever was reported in 2010-2012 that affected 2,040 patients, with a fatality rate of 0.5% [33].

Piped water supply was associated with a reduction in the incidence of typhoid fever in Lusaka, Zambia [34]. Provision of safe piped water is critical in the prevention of typhoid fever as well as curtailing the epidemic.

Regular monitoring of antibiotic sensitivity patterns is vital in good management of cases. Hendriksen et al [33] reported that most (83.0%) isolates were multidrug resistant (MDR). In another study conducted by Kalonda et al [35], all the fifty *Salmonella* Typhi were resistant to sulphamethoxazole, ampicillin, trimethoprim and co-trimoxazole, and concluded that multidrug resistant *Salmonella* Typhi was emerging in Lusaka.

Tracking typhoid fever epidemics would provide information on its prevention and further studies should be conducted on risk factors for typhoid fever to guide targeted interventions in Zambia.

Conclusion and recommendation

Tracking of cholera epidemics and establishment of its risk factors have been satisfactory. At the national level, the health information system should be improved to document typhoid fever and dysentery epidemics. ZNPHI should establish a strong research department to determine risk factors for typhoid fever and dysentery that can be used

in designing interventions to prevent or curtail typhoid fever and dysentery epidemics

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