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Cholera Outbreak Investigation in Sokoto State – Nigeria, 2013

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Abstract
Cholera remains a global threat to public health and a key indicator of lack of social development. According to the World Health Organization, the burden of cholera is estimated to be 3–5 million cases and 100 000–120 000 deaths annually. In November, 2013, suspected cases of cholera were reported in Kebbe, Shagari and Tambuwal Local Government Areas (LGAs), Sokoto State, Nigeria. We investigated to confirm and characterize the outbreak. Suspected cholera case was defined as any resident of Kebbe, Shagari and Tambuwal LGAs with acute watery stool with or without vomiting from 6th October and 9th November, 2013. A cross-sectional descriptive study design was used. Stool specimens were collected and tested using rapid test kit. The outbreak was described in terms of person, place and time. We identified 170 cases with 24 deaths among 10,282 persons (Attack rate: 1.7%, case fatality rate: 14.1%). The attack rate was highest among 15 – 29 years age group (2.3%). The median age of the cases was 22 years. All four specimens tested positive to *Vibrio cholera* serogroup O1. Of the 170 cases, 108 (63.5%) occurred in Kebbe LGA. Environmental assessment revealed widespread refuse, animal dung, uncovered wells and unsafe drinking water from streams. This study revealed that the outbreak was caused by *Vibrio cholera* serogroup O1. We strengthened case management and conducted health education focussing on personal hygiene and environmental sanitation. It was recommended that local authorities should intensify health education messages and provide potable water supply to affected communities.

Introduction

Cholera caused by *Vibrio cholera* continues to be a global threat to public health and a key indicator of lack of social development. Cholera is an acute diarrhoeal infection caused by ingestion of food or water contaminated with the bacterium, *Vibrio cholera* strains belonging to O1 and O139 serogroups are agents of endemic and pandemic cholera, a potentially life-threatening diarrhea that produces characteristic rice-water stool. It is a major problem in the developing countries and has been linked to poverty and poor

sanitation (Ajoke *et. al.,* 2012 & Alyson, 2011). 20% of those who are infected develop acute, watery diarrhea, 10–20% of these individuals develop severe watery diarrhea with vomiting. The diarrhoeal illness is a result of secretion of the cholera toxin by the bacterium. Cholera toxin is an 86 kDa ADP ribosylating exotoxin that is highly immunogenic. Cholera toxin has been shown to bind GM1 ganglioside leading to profoundly increased levels of cyclic (cAMP). This high cAMP level causes a decrease in active absorption of sodium and chloride by villous cells and an increase in active secretion of chloride by crypt cells that clinically manifests as diarrhea and electrolyte imbalance (Glenn *et. al.,*2009).

If these patients are not promptly and adequately treated, the loss of such large amounts of fluid and salts can lead to severe dehydration and death within hours. The case-fatality rate in untreated cases may reach 30–50%.Treatment is straightforward (basically rehydration) and, if applied appropriately, should keep case-fatality rate below 1%.

Contaminated water and food are the most common routes of cholera transmission during outbreaks (Bhunia *et. al.,* 2009 & Colombara *et al.,* 2013). Further risk factors include rainfall, seasonality, poor sanitation, travel, conflict, population displacement, health facilities with poor infection control and living near contaminated water sources. Funerals are often implicated in cholera transmission (Sack *et al.,* 2004 & Glenn *et. al.,* 2009). Epidemiologically, cholera most often occurs in-explosive outbreaks throughout several regions simultaneously. Pandemics of cholera have followed progressive patterns, affecting many countries across the continent and over many years (Griffith *et. al,* 2006 & Gunnlaugsson *et al,* 1998). The number of cholera cases reported to WHO continues to rise. For 2011 alone, a total of 589 854 cases were notified from 58 countries, including 7816 deaths. Many more cases were unaccounted for due to limitations in surveillance systems and fear of trade and travel sanctions. The true burden of the disease is estimated to be 3–5 million cases and 100 000–120 000 deaths annually (WHO,2012).

In developing countries, cholera often occurs as rapidly progressive, large-scale outbreaks. These large-scale outbreaks cause a high burden of disease and rapidly overwhelm curative health care services, particularly during complex humanitarian emergencies or in settings where public health systems have broken down UNICEF (2010). In Nigeria, the infection is endemic and outbreaks are not unusual. In the last quarter of 2009, it was speculated that more than 260 people died of cholera in four Northern states with over 96 people in Maidugari, Biu, Gwoza, Dikwa and Jere council areas of Bauchi state. In 2010 an outbreak of cholera affected many states in all the 6 geopolitical regions of the country with 26, 240 cases and case fatality ranging from 2 to 23% (Tauxe *et al*.,1995).

Most of the Northern states of Nigeria rely on hand dug wells and contaminated ponds as source of drinking water. Usually, the source of the contamination is other cholera patients when their untreated diarrhoea discharge is allowed to get into water supplies (Colombara *et al.*, 2013). In addition to this health-related toll, large-scale cholera outbreaks cause great economic loss as inappropriate external restrictions may lead to disruptions in trade and travel. Thus, identifying interventions that would be effective in preventing or limiting the spread of these outbreaks would have substantial public health and economic impact. Effective prevention measures against cholera outbreaks require the identification of the predominant sources of infections and implementation of targeted interventions. However, two problems limit the feasibility of this approach. First, many cholera outbreaks are not investigated using epidemiological methods that allow identification of risk factors for illness (Tauxe *et al.,* 1995). Second, during many outbreaks, the *Vibrio cholerae* is transmitted through many routes that cannot all be identified. The high concentration of pathogens in the stools of infected individuals and the high faecal output cause high levels of environmental contamination that exposes other persons to infection. These outbreaks are often not caused by a single common source but rather by the ingestion of various types of food and beverages that become contaminated through various unidentified breaks in hygienic practices (Tauxe *et al.,* 1995).

The cholera outbreak in Sokoto State started on 6th October, 2013 with the index case from Barkeji in Tambuwal LGA. The outbreak spread to

Kebbe and Shagari LGAs where several cases were recorded. This year 2013, Notification of acute gastroenteritis was sent from the Sokoto state Ministry of Health to the Federal Ministry of Health, which was received by the Epidemiology unit of the Nigerian Centre for Disease Control (NCDC). The notification stated that 3 out of the 23 LGAs in the state had reported outbreak of acute gastroenteritis. Following which, NFELTP residents were deployed to the field to investigate the outbreak. The investigation and control were performed in collaboration with the local health authorities. On 6th of November, 2013 we initiated an investigation of the outbreak specifically to confirm the outbreak, characterize the outbreak in terms of time, place and person and implement targeted interventions.

Methods

We defined a suspected cholera case as any person with acute watery stool with or without vomiting living in Kebbe, Shagari and Tambuwal LGAs from 6th October to 9th November, 2013.We searched actively for cases in the communities, we also reviewed hospital records and for each case patient, we collected information on age, sex, residence and time of onset. A physical assessment of the sanitary condition of the environment was done. We calculated incidences by age and sex, drew an epidemic curve and prepared a map representing the incidence by area in view of the distribution of potential exposures in Kebbe, Shagari and Tambuwal LGAs.

Laboratory Investigations

We selected a random sample of case-patients, collected 4 specimens of stool and tested for *cholera* using rapid diagnostic test kit.

Environmental investigation

We performed a walk through environmental assessment in the communities.

Results

We identified 170 cases that met the case definition among the 10,282 residents of the affected settlements. (Overall attack rate: 1.7%). There were 24 deaths (Case fatality ratio: 14.1%.The attack rate (Table 1) was highest among persons 15 to 29 years of age (2.3%) followed by the 30 and above years of age (1.9%). The lowest attack rate was among 0 – 4years (1.0%). Females were less affected than males (46% versus 54%).The first case-patient developed an illness during the first week of October (Figure 1). The outbreak has a multiple peaks (7th, 18th of October and on 4th November). The shape of the curve suggested a person-to-person transmission.

Table 1: Age Distribution of Cases and Age Specific Rates (n= 170)

Age-group (years)	No. of cases	No. of deaths	Estimated people	Attack rate (%)	CFR (%)
0 - 4	21	4	2,056	1.0	19.0
5 - 14	38	4	2,838	1.3	10.5
15 - 29	51	5	2,200	2.3	9.8
= 30	60	11	3,187	1.9	18.3
Total	**170**	**24**	**10,282**	**1.7**	**14.1**

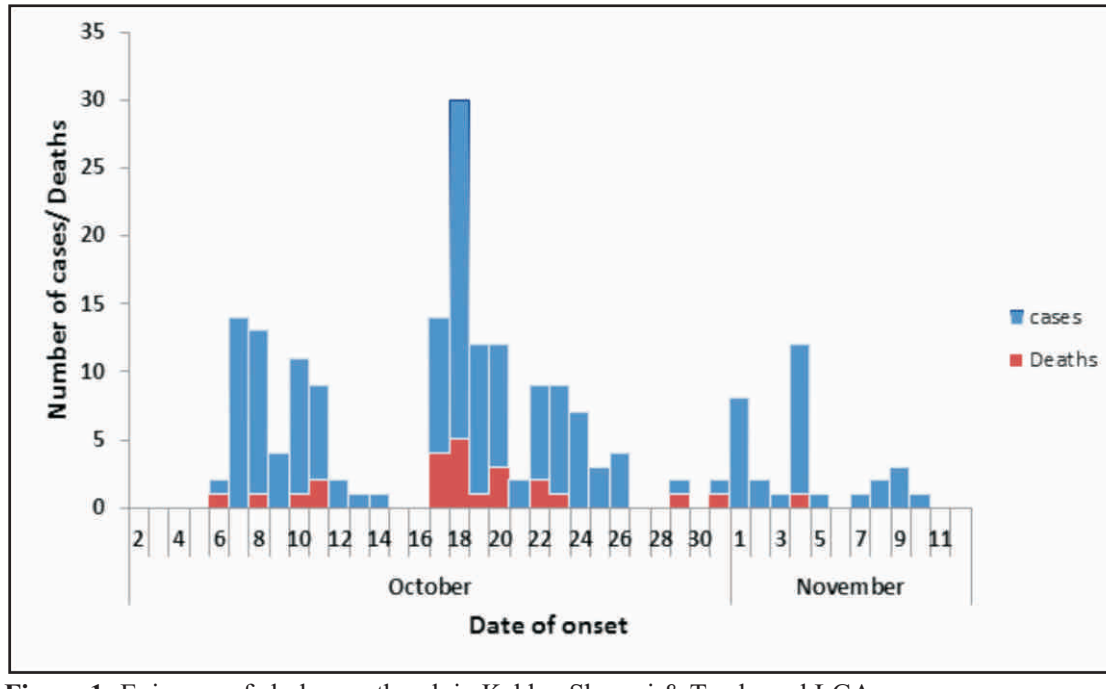

Figure 1: Epicurve of cholera outbreak in Kebbe, Shagari & Tambuwal LGAs, October- November, 2013

Laboratory Investigations

Of the four specimens from case-patients tested for cholera (100%) were positive for cholera serogroup 01using rapid diagnostic kit.

Environmental Investigations

An environmental assessment revealed unsanitary conditions and unsafe water supply. Wells were uncovered and some of the settlements in Kebbe LGA have river as one of their sources of drinking water.

Discussion

The cholera outbreak investigation in Sokoto State affected three LGAs with a total of 170 cases with 24 deaths (CFR: 14.1%) and overall attack rate of 1.65%. Attack rate was highest among persons 15 to 29 years of age (2.3%) and lowest among 0 – 4 years of age (1.0%). Females were less affected than males (46% versus 54%).Kebbe LGA recorded the highest number of cases (63.5%), with 14 deaths; while Shagari and Tambuwal LGAs had 36.5% of the cases each.

This cholera outbreak caused substantial deaths, disease and economic loss. Due to inadequate disease notification system in the country, it is believed that most cases of cholera are not reported due to poor surveillance systems. Fatality rates are 5% of total cases in Africa and less than 1% elsewhere (WHO,1997). The age-group 15 – 29 years has the highest attack rate(2.3%), this inconsistent with the findings of a study conducted in Kano (Hutin *et al.,* 2003), where age-group 0 – 4 years had the highest attack rate (40.9%). The outbreak of cholera was speculated to be directly related with sanitation and water supply.

The hand dug wells and contaminated ponds being relied on by most of the communities as source of drinking water was a major transmission route during the outbreak. Perhaps, these wells were shallow; uncovered and diarrhea discharge from cholera patients could easily contaminate water supplies (Colombara *et al.,* 2013). Another factor that may greatly contribute to risk of cholera transmission is population movement which enhances the spread of the infectious agent to others and to different sites. Also lack of safe water and poor sanitation are important risk factors. All these

features have contributed greatly to cholera infections in the affected communities. As is the case in a lot of outbreaks in Nigeria, there was late detection and reporting of the outbreak to relevant authorities hence the investigation team responded only after over a 100 cases had occurred.

The findings in this report are subject to limitations. First, not all cholera cases, especially during confirmed outbreaks were reported through the surveillance system; therefore, our results may not be representative of all cholera cases and were biased toward areas and populations with access to care and adequate reporting efficiency, However, effort was made to actively search for cases in the neighboring communities.

Secondly, a very limited number of stool samples were tested and no confirmatory test was carried out as there were no appropriate media for confirmatory test.

Conclusion

The outbreak was probably caused by cholera serogroup 01 and spread due to unsafe water supply and poor sanitation with high mortality among adults. We strengthened case management and conducted health education focussing on personal hygiene and environmental sanitation. We recommended to the local authorities that health education massages should be imparted to the community concerning the risk factors, importance of the personal hygiene, environmental sanitation as well as food safety/ handling. We also recommended the provision of portable water supply to the affected communities.

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