

## Original Research Article

# Outbreak of cholera at Dutsen-Abba Ward Zaria local government area, Kaduna State Nigeria 2015: the importance of hygienic practices

Baffa S. Ibrahim<sup>1\*</sup>, Yahaya Mohammed<sup>2</sup>, Rabi Usman<sup>3</sup>, Ubong A. Okon<sup>3</sup>, Uche I. Katchy<sup>3</sup>, Abayomi A. Olufemi<sup>3</sup>, Mercy Niyang<sup>1</sup>, Bola Gobir<sup>1</sup>

<sup>1</sup>Department of Epidemiology, University of Maryland Global Initiative Corporation, Abuja, Nigeria

<sup>2</sup>Department of Medical Microbiology, Usman Danfodio University Sokoto, Nigeria

<sup>3</sup>Nigeria Field Epidemiology and Laboratory Training Program, Abuja, Nigeria

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### \*Correspondence:

Dr. Baffa S. Ibrahim,

E-mail: [baffasule@gmail.com](mailto:baffasule@gmail.com)

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## ABSTRACT

**Background:** Cholera is an infection caused by *Vibrio cholerae*, which may lead to severe dehydration and death if not treated promptly. On August 31, 2015, the Kaduna Ministry of Health received a notification of increase cases of vomiting and diarrhoea at Dutsen-Abba in Zaria. A response Team was sent to confirm the outbreak, describe the socio-demographic characteristics and identify possible risk factors for the outbreak.

**Methods:** We defined cases according to the world health organization (WHO) criteria. We conducted an unmatched case-control study and descriptive study. We retrieved line-listed cases at the ward facility. We interviewed cases at the facility and recruited controls from the community, and administered questionnaires to both cases and controls. We analysed data using Epi-Info7 and Microsoft Excel 2016.

**Results:** A total of 50 cases were recorded, with a median age of 20 years and age range of 1 – 50 years. There were more females (68%) than males. Majority of cases (52%) were under 20 years, while all cases are below 50 years. Seven (7) deaths were recorded giving a Case Fatality Rate (CFR) of 14%. The CFR was higher in females (14.7%) than in males (12.5%). Index case was seen on August 29, 2015. The outbreak lasted five days. Last cases were seen on September 2, 2015. Highest number of cases seen in a day (23) was on third day of the outbreak. Only two cases (4%) had their samples tested using cholera RDT, and both tested positive. Drinking un-boiled water (OR: 12.67, 95% CI: 2.33–68.93), regular hand washing (OR: 0.22, 95% CI: 0.06–0.90) and proper waste disposal practices (OR: 0.07, 95% CI: 0.02–0.36) are factors we found to affect cholera infection during the outbreak.

**Conclusions:** Our investigation confirmed a cholera outbreak with a high CFR, especially among females. Poor hygienic practices among the populace seem to be the drivers for this outbreak.

**Keywords:** Cholera, Outbreak, Hygienic practices, Kaduna

## INTRODUCTION

Cholera is an acute gastro-intestinal infection caused by *Vibrio cholerae* which are curved aerobic gram negative bacteria that are highly motile with the aid of a polar flagellum. *Vibrio cholerae* serogroups O1 and O139 cause cholera in humans and are implicated in most

outbreaks of cholera.<sup>1</sup> Most common symptoms of cholera are profuse diarrhoea and vomiting. These symptoms are usually acute, after an incubation period of 2 hours to 5 days. The diarrhoea, described as "rice water" has a fishy odour. A person with cholera may pass as much as 10 to 20 litres of diarrhoea a day. When not treated, severe cholera kills about half of affected

individuals. Fever is rare and should raise suspicion for secondary infection when present.<sup>2,3</sup> Cholera is transmitted to humans by either contaminated food or water. The source of the contamination is usually other cholera sufferers when their untreated diarrheal discharge is allowed to get into waterways, groundwater or drinking water supplies.<sup>2</sup>

*Vibrio cholera* can easily be identified in a stool sample by a rapid dipstick test especially in outbreak situations. Stool samples that test positive using a RDT test, will further require culture and sensitivity testing in the laboratory to determine antibiotic resistance of the organism. In epidemic situations, patient's clinical history and a brief clinical examination may suffice for diagnosis of cholera.<sup>4</sup> Treatment is usually started without or before laboratory confirmation. Stool and swab samples collected in the acute stage of the disease, before antibiotics have been administered, are the preferred specimens for laboratory diagnosis of cholera. If an epidemic of cholera is suspected, the most common causative agent is *Vibrio cholerae* O1, but if *Vibrio cholerae* serogroup O1 is not isolated, the laboratory should test for *Vibrio cholerae* O139. However, if neither of these organisms are isolated, it is necessary to send stool specimens to a reference laboratory for further processing.<sup>5,6</sup>

Cholera is a preventable and easily treatable infection, but may be life threatening if neglected or left untreated. The World Health Organization recommends focusing on prevention, preparedness, and response to combat the spread of cholera.<sup>4</sup> They also stress the importance of an effective surveillance system for early detection of potential outbreaks.<sup>4</sup> 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 the administration of intravenous fluids. Mass administration of antibiotics is not recommended, as it has no effect on the spread of cholera and contributes to increasing antimicrobial resistance.

Cholera has continued to be a global public health problem and a key indicator of lack of social development. The global burden of cholera remains largely unknown because none reporting of cases in majority of endemic countries. World health organization (WHO) maintains a repository of reported cases and deaths, which it publishes annually in the Weekly Epidemiological Record. However, the WHO estimates that only 5–10% of the cases occurring annually are officially reported.<sup>7,8</sup> This low reporting can be attributed to limited capacity of epidemiological surveillance and laboratories, as well as social, political, and economic disincentives.<sup>8</sup> Recent estimate puts cholera burden to be 2.9 million of cases and 95,000 deaths in 69 endemic countries, with the majority of the burden in Sub-Saharan

Africa.<sup>8</sup> However, the WHO put the CFR for cholera to be less than 1% with early and proper treatment. This may be high in an outbreak setting.<sup>4</sup>

Cholera is endemic in most of Africa, parts of Asia, the Middle East, and South/Central America. Factors that may lead to outbreaks in endemic areas include, wars and civil unrests, flooding, earthquakes, landslide, poor sanitation and improper refuse dumping, open defecation, and slumps.<sup>4,9,10</sup> In West Africa, when compared to 2012, the number of cases reported in 2013 showed an important decrease of 80% (from 50,663 to 9765). Only Nigeria and Togo reported more cases than in 2012.<sup>9,10</sup>

In Nigeria, outbreaks of cholera are common both in urban rural settlements.<sup>6,11</sup> An upsurge of cholera cases was reported in September, 2013 by the Federal Ministry of Health and continued throughout December, 2013. A total of 6600 cholera cases including 229 deaths (CFR 3.47%) were reported from 94 LGAs in 20 states (Kaduna state inclusive).<sup>6,12,13</sup>

Kaduna state is endemic for cholera with recurrent outbreaks occurring at irregular intervals. On Monday August 31, 2015, the Kaduna state Disease Surveillance and Notification Officer (DSNO) received a notification of increased cases of diarrhoea and vomiting at Dutsen-Abba ward, Zaria local Government Area of Kaduna state. A state response team and residents of the Nigeria field epidemiology and laboratory training program (NFELTP) was drafted to verify the outbreak, describe the socio-demographic characteristics and management outcome of the cases, identify risk factors associated with outbreak, and initiate preventive and control measures. We report on their investigation.

## METHODS

### Study setting

Kaduna State lies in the North-West zone of Nigeria. It is home to more than 59 ethnicities with diverse social, cultural and religious inclinations. Its current population is estimated at 7.8 million (projected from Nigeria 2006 census).<sup>14</sup> Kaduna State consists of 23 LGAs and three senatorial districts (North, Central and South). Routine cholera surveillance in the state is through the Integrated Disease Surveillance and Response (IDSR) platform. Cholera outbreaks are usually reported through the LGAs DSNOs to the state's DSNO.

Zaria local government area (LGA) is located in the Northern Senatorial district of Kaduna State. It has a population of more than half a million inhabitants. Dutsen Abba is a Ward in Zaria LGA locates along Kaduna-Zaria high-way. The main source of drinking water in the ward is well water, and open refuse disposal is a common practice among the inhabitants.

### **Study population**

All settlements within Dutsen-Abba Ward of Zaria LGA are within the scope of this outbreak investigation.

### **Study design**

We conducted a cross-sectional descriptive study and an unmatched case-control analytical study.

### **Case definitions**

We defined cases according to the world health organization (WHO) criteria as follows.

### **Suspected case**

All persons more than 1years of age, living in any community within Dutsen-Abba ward, Zaria LGA, who present with any of acute watery diarrhoea or vomiting or both within the period of August 20, to September 10, 2015.

### **Confirmed case**

Any suspected case that tested positive to cholera RDT on the field or confirmed by laboratory isolation of *V. cholerae* 01 and 0139 from stool sample.

We actively searched for cases across all settlements within the ward and health facility. We retrieved all line-listed cases from the health facility and from the LGA DSNO. For each suspected case, we collected information on age, sex, residence and time of onset of illness. We also ask questions related to drinking water sources and hygiene practices. For each suspected case, we selected one unmatched control from the same settlement, which fits into our inclusion criteria for analysis. We administered a semi-structured questionnaire to patients and controls in all affected settlements. We analysed data for the outbreak using Microsoft Excel 2013, Epi-info version 7, and health mapper.

### **Inclusion criteria**

**Cases:** Any persons more than 1years of age, living in any community within Dutsen-Abba ward, Zaria LGA, who present with any of acute watery diarrhoea or vomiting or both within the period of August 20, to September 10, 2015.

**Controls:** Any resident from affected communities who was a neighbour to a case, and who did not develop signs and symptoms suggestive of cholera during the same period who agreed to participate in the study.

**Sample size estimation:** The sample size for the case-control study was calculated using Epi-Info version 7 for Two-by-two software, with; 95% confident interval (CI),

power of 80 per cent and odds ratio (OR) of 4. Frequency of exposure among controls of 30% and case to control ratio of 1:2. A total sample size of 42 was calculated (14 cases and 28 controls).

### **Ethical consideration and informed consent**

We got the permission of the State Ministry of Health to conduct the study after the review and adaptation of the study instrument (questionnaires). The settlements were informed of the study by the LGA DSNO. We used staff of the health facilities as guides into the settlements. We obtained informed verbal consent from all study participants before we administered questionnaires to subjects. Confidentiality was assured throughout the study. We did not use names or address of participants in our study. We treated participants with respect and all participants willingly participated in the study without being paid money or coerced.

### **Data management**

All the line-listed data we collected from the LGA DSNO were entered into excel sheet, cleaned and used for descriptive analysis. We entered questionnaire data into Epi-info version 7 software for analysis. We conducted univariate and bivariate analysis using Epi-info version 7 and Microsoft Excel 2013.

### **Laboratory investigations**

Stool samples were collected on the field for cholera rapid diagnostic test (RDT). The samples were collected as whole stool or rectal swab, and prepared for the RDT.

## **RESULTS**

A total of 50 case-patients were recorded during the outbreak, with median age of 20 years, and age range of 1–50 years. There were more female (68%) than male (32%) case-patients. Highest number of case-patients was in the 21-50 years age-group (48%), followed by the less than 10years age-group (28%), and the 10-20years age-group with 24% of cases. Seven deaths were recorded during the outbreak, giving a case fatality rate (CFR) of 14%. The CFR was higher in females (14.7%) than in males (12.5%). Age specific case fatality rate (ASCFR) was highest among the <10 years age group (21.4%), followed by the 10-20 years age-group (16.7%), then the 21-50 years age-group with 8.3% (Table 1). Only two cases (4%) had their samples tested using cholera RDT, and both tested positive.

The first cases (6) were recorded on the 28 August, 2015. The outbreak lasted for a period of three days, with highest number of cases (23) seen on the third day of the outbreak. The outbreak starts declining and ended on the 2 September, 2015. The epidemic curve demonstrated a point source outbreak with only one peak (Figure 1). Deaths were recorded only on the third day (4) and forth

day (3) of the outbreak (Figure 1). All cases were from Dutsen-Abba ward.

Drinking un-boiled water was a risk factor for developing diarrhoea and vomiting during the outbreak (OR: 12.67, 95%CI: 2.33–68.93.  $p$ -value=0.001), while regular hand washing (OR: 0.22, 95%CI: 0.06–0.90.  $p$ -value=0.03)

and proper waste-disposal practices (OR: 0.07, 95%CI: 0.02–0.36.  $p$ -value=0.0004) were found to be protective from developing diarrhoea and vomiting during the outbreak. Drinking water from the village central well has no effect on the developing diarrhoea and vomiting during the cholera outbreak (Table 2).

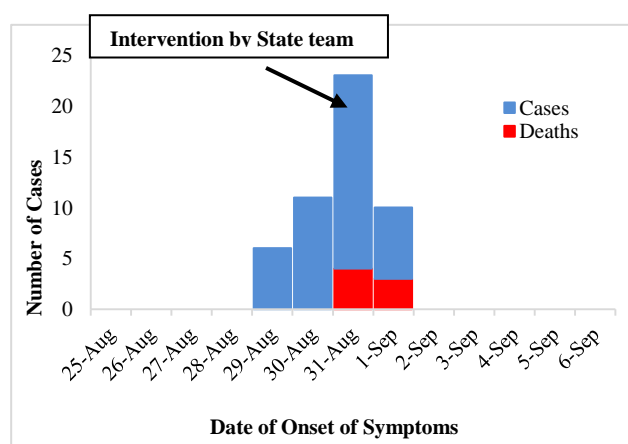
**Table 1: Sex and age distribution of cases and deaths, with fatality rates during the cholera outbreak at Dutsen-Abba ward, Zaria LGA Kaduna State, 2015.**

Sex	Cases	Deaths	Total (%)	CFR %
Male	14	2	16 (32)	12.5
Female	29	5	34 (68)	14.7
Total	43	7	50 (100)	14.0
Age Group (Years.)	ASCFR %			
<10	11	3	14 (28)	21.4
10 - 20	10	2	12 (24)	16.7
21 -50	22	2	24 (48)	8.3
>50	0	0	0 (0)	0.0
Total	43	7	50 (100)	14.0

**Table 2: Significance of hygienic practices among cases and controls during the cholera outbreak at Dutsen-Abba ward, Zaria LGA Kaduna State, 2015.**

Hygienic practices	Cases n=14 (%)	Controls n=28 (%)	OR (95% CI)	P-Value
<b>Boiling drinking water</b>				
Drink un-boiled water	12 (86)	9 (32)	12.67 (2.33 - 68.93)	0.001*
Drink boiled water	2 (14)	19 (68)		
<b>Hand washing with soap</b>				
Regular handwashing	4 (29)	18 (64)	0.22 (0.06 - 0.9)	0.03*
Not regular	10 (71)	10 (36)		
<b>Waste disposal</b>				
Proper waste disposal	3 (21)	22 (79)	0.07 (0.02 - 0.36)	0.0004*
Improper waste dump	11 (79)	6 (21)		
<b>Source of drinking water</b>				
Drink from Central well	13 (93)	23 (82)	2.83 (0.30 - 26.87)	0.64
Does not drink from well	1 (7)	5 (18)		

\*statistically significant



**Figure 1: Epicurve showing the number of cases against onset of symptoms for the cholera outbreak at Dutsen-Abba, Zaria Kaduna State 2015.**

## DISCUSSION

We confirmed an outbreak of cholera cases at Dutsen-Abba ward of Zaria LGA. The cholera outbreak had a case fatality rate (CFR) higher than what had been reported in other studies from Nigeria.<sup>12,13</sup> The CFR is also far above the maximum value set by the World Health Organization.<sup>4</sup> The high CFR can be due to either poor case management due to lack of emergency resuscitation facilities in the close health facility, or delay in seeking medical assistance by the populace. Also, failure of the local surveillance apparatus to identify and report the outbreak may be having worsened outcome many cases. affected more women than men. This can be explained, because in most rural settings of northern, women are the ones who usually take care of the sick at home or even in the hospitals. So, they are more exposed to the bacteria than their male counterparts, hence tend to



be affected more by the disease. Despite having more cholera cases in the adults, there were more deaths among the children less than ten years. It is a known fact that children have more proportion of their body mass as water; hence they are more adversely affected by severe loss of body fluid than adults. During the cholera outbreak, very few cases had their stool samples tested through cholera RDT. This is due to lack of the RDT test kits in the health facilities.

The cholera outbreak at Dutsen-Abba ward showed a point source outbreak. This suggests the infection originates from a single source, probably a water source, and it spreads to individuals with poor hygienic practices. Intervention by the State response team and NFELTP residents led to a drastic reduction in the number of cases and end to the cholera outbreak. It's worth noting that early identification of the outbreak and reporting through a more sensitive surveillance system would have reduced the fatality of the outbreak.

We found good hygienic practices such as regular hand washing, proper refuse disposal, and drinking of boiled water to be protective from developing diarrhoea and vomiting during the cholera outbreak. *Vibrio cholera*, the causative organism for cholera can be killed by heat; hence boiling drinking water will clear the organism and protect against infection. In addition, washing hands with soap clears the organism from the hands and proper refuse disposal prevents spread to people in the communities. Same with washing hands with soaps, which clears the organism from the hands, and proper refuse disposal which prevent house from, pick organisms from the wastes into homes.

## CONCLUSION

Our investigation of cholera outbreak at Dutsen-Abba ward in Zaria, showed how important hygienic practices at home are. Despite having a common source of infection, development of cholera tends to differ among individuals in the settlements due to differences in their hygienic practices. Poor hygienic practices among the populace seem to be the driver for the outbreak. We recommended public health enlightenment on importance of hygienic practices in the communities and strengthening of the local surveillance apparatus to be able to identify similar outbreaks early in the future.

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