# Cholera Outbreak Trend in Blue Nile State, Sudan, 2017

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## ABSTRACT

   **Background:** Cholera continues to be a global health threat. Pandemics of cholera have been experienced in some countries with sporadic attacks throughout the world, especially in areas where water supply, sanitation, food hygiene and safety continue to be a challenge. **Objectives:** This study aimed to contribute data on trends in cholera-related mortality in Blue Nile State, 2017.

  **Materials and methods:** A descriptive epidemiological study was carried out in Blue Nile State during cholera outbreak 2017. Data was collected from patients' records during period of outbreak from August to November 2017.

**Results:** During outbreak a number of 862 cases were reported. Most of cholera cases was reported in Eldamazin locality 576 (66.8%) followed by Eltadamon locality 100 (11.6%). Female was more affected by cholera 493 (42.8%) compared to male 369 (42.8%). The proportion of deaths was 1.0% with case fatality rate of 0.001/1000. Gender was significantly affect death with

cholera but not age group.

**Conclusion:** The study concludes that the proportion of death was relatively low with low case fatality rate. Gender was significantly influence death due to cholera but not age group. It is recommended that localities and administrative units surveillance systems be activated to facilitate a quicker and more timely response in future outbreaks to prevent spread of cholera disease, current and future development projects must be geared towards provision of more water treatment plants, provision of regular community education on cholera signs and symptoms and prevention and treatment measures even in periods outside epidemics.

**Keywords**: *Cholera, Blue Nile state, Sudan, 2017*

**INTRODUCTION:**

Cholera is a bacterial infection of humans caused bythe Gram-negative rodV. Cholera and classified into more than 200 different serogroups.(1) V. cholerae serogroup O1, biotype El Tor and serotypes Ogawa or in abaare the major pathogens 1993, a new serotype V. cholerae O139 was reported from southern Indiain1993,causingoutbreaks in Bangladesh and Thailand. Ingestion of food or water contaminated with feces containing high concentrations of V. cholera results in infection. There are two routes of transmission: the fecal-oral route ("person-to-person fecal transmission") and direct transmission from the environment (environmentally acquired infection). Only a small percentage (10-20%) of cholera infections present with mild acute watery diarrhea (AWD) that is symptomatic and treatable with oral rehydration solutions. About 20% of symptomatic cases are severe, characterized by the sudden onset of profuse watery diarrhea and vomiting, which leads to dehydration. Without prompt and appropriate intravenous rehydration, correction of electrolyte imbalances, and antibiotics, patients with severe cholera quickly die (2).Cholera remains slow to control in endemic and endemic areas of the world. Cholera is endemic in South and Southeast Asia, sub-Saharan Africa, and has recently returned to the Americas with the spread of the disease in Haiti.(2)In 2015,a total of 172,454choleracases, including 1304 deaths, were reported to WHO from 42 countries.(3)The cholera epidemic has been growing rapidly in the Americas and has been spreading to other parts of the world. However, the annual incidence of cholera is estimated at1.3to4million cases, resulting in 21,000to143, 000 deaths worldwide. In cholera-endemic countries, approximately1.3 billion people remain at risk of cholera (4). The purpose of this study is to provide data on trends in cholera-related mortality in Blue Nile State in 2017.

## MATERIALS AND METHODS:

**Study design:**

A descriptive epidemiological study was carried out. Cholera-related mortality in the    year 2017 was analyzed according to location, age, and sex.

**Study area:**

Blue Nile State lied in southern part of the country bordering from southeast Ethiopia, southwest of South Sudan and north is Sinner state. With an area of 38,000 km square and 1,250.00 populations. Blue Nile River is crossing the state from south to north fed by numbers of streams and tributes. This gives unique feature for agricultural and live stocks herding activities. Rainy season starts early in June and ends in late October. Elroseres High Dam famous hydro-electric project that supplies country with electricity and irrigation water sources, particularly Aljazeera agriculture scheme and it is rich of mechanized agriculture in Al Tadamon locality. BNS is served by number of (160) health facilities (HFs). The population at Blue Nile State depends on different water sources. Water from network, which covers approximately (25%) of the population; The other sources are out network e.g., Hand pumps, water yards, dug wells (open/closed), river, seasonal streams, open sources (shallow wells, hafeers).

**Study population:**

Blue Nile State Community.

**Inclusion criteria**:

   All patients during the outbreak attending to health facilities with acute watery diarrhea.

**Exclusion criteria**:

Patients with diarrhea not diagnosed as cholera case.

**Sample size and sampling technique**:

All cholera cases during outbreak period.

**Data collection:**

Data will be collected from all health facilities according to outbreak records.

**Data analysis**:

Data was analyzed using SPSS version 24.0. Descriptive statistics was used. Chi-square test was used to find an association between variables. P-value considered significant at less than 0.05 levels.

## RESULTS:

Table 1 shows that most of cholera cases was reported in Eldamazin locality 576 (66.8%)

followed by Eltadamon locality 100 (11.6%); Elroseries locality 79 (9.2%), Geisan locality 68 (7.9%); ; Elkurmuk locality 10 (1.2%) ; Wadalmahi locality 7 (0.8%)and Out of state 7 (0.8%).

Figure 1 shows that the    cholera cases was started in May (2017) 26 (3.0%) and July (2017) 41 (4.8%) and began to increased during August (2017) 271 (31.4%) and reached the highest level at September (2017) 343(39.8%).

Figure 2 show that female was more affected by cholera 493 (42.8%) compared to male 369 (42.8%).

Figure 3 illustrates that the most age group affected by cholera was the age ranged between 21-40 years 280(32.5%) followed by the age group 1-20 years 253(29.4%) and the age group ranged between 41-60 years 195 (22.6%)   while the lowest age group was the age group less than 1 year 3(0.3%). The mean age of cholera patients was (35.3±22.1) years with maximum age of 90 years and minimum age of 0.1 year.

Table 2 indicates that the proportion of deaths was 1.0% with case fatality rate of 0.001/1000.

Table 3 indicates that only 23 (2.7%) of cholera patients have to prior contact with suspected/confirmed cholera cases.

As displayed in table 4 there was significance difference found between gender, $p<0.05$. Male was significantly more dead 77.8% compared to female 22.2%. The proportion of deaths was significantly increased by 0.2 folds (OR=0.2; 95% CI (.04-1.0)) among male compared to female.

Table 5 shows that there was no significance difference between cholera deaths among age group, $p>0.05$. The proportion of deaths was not significantly found high among age group ranged between 41-60 years (44.4%).

Table 6 illustrates that there was significance differences between cholera deaths and contact with suspected/confirmed cholera cases, p=.000. The most deaths was significantly found among those who having prior contact with suspected /confirmed cholera cases (55.6%).


**Table 1.** Distribution of cholera cases by localities in Blue Nile State, 2017

| Locality | No. | % |
|---|---|---|
| Elroseris | 79 | 9.2 |
| Eldamazin | 576 | 66.8 |
| Baw | 15 | 1.7 |
| Wad Almahi | 7 | .8 |
| Elkurmuk | 10 | 1.2 |
| Geisan | 68 | 7.9 |

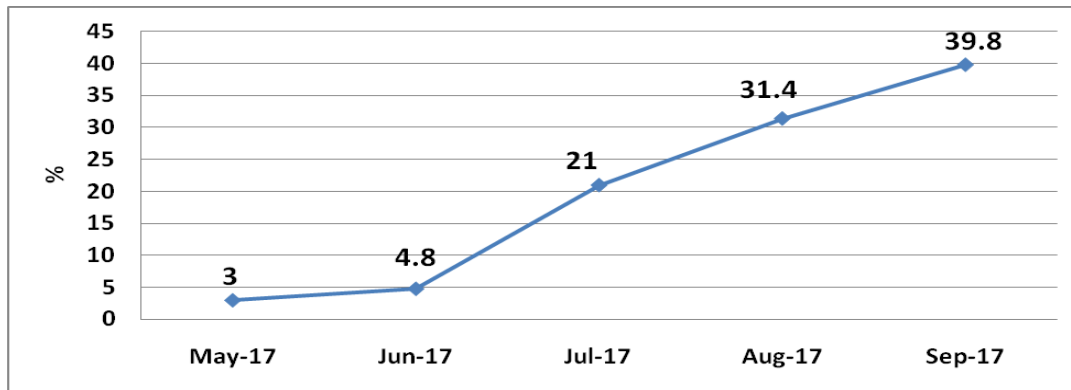| | | |
|---|---|---|
| Eltadamon | 100 | 11.6 |
| Out of state | 7 | .8 |
| **Total** | **862** | **100.0** |



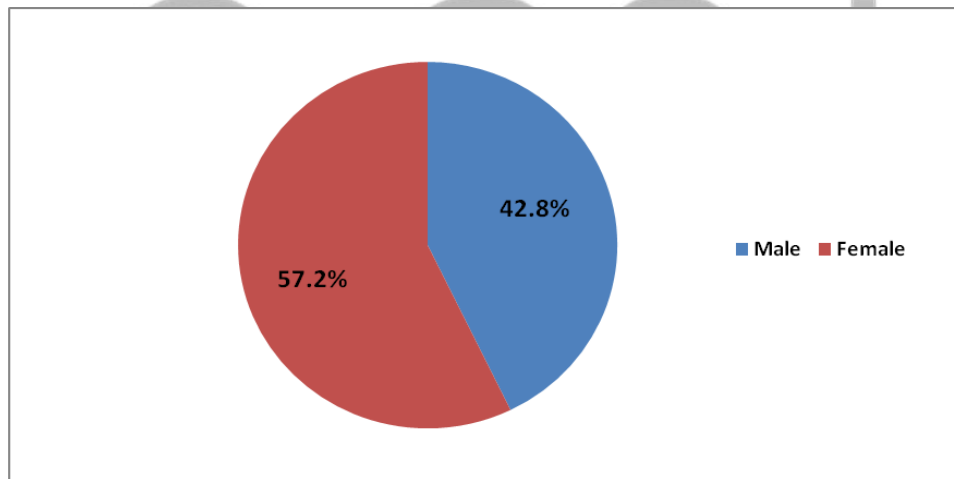**Fig.1.** Distribution of cholera cases according to months in Blue Nile State 2017 (n=862)



**Fig.2.** Distribution of cholera cases according to gender in Blue Nile State 2017(n=862)
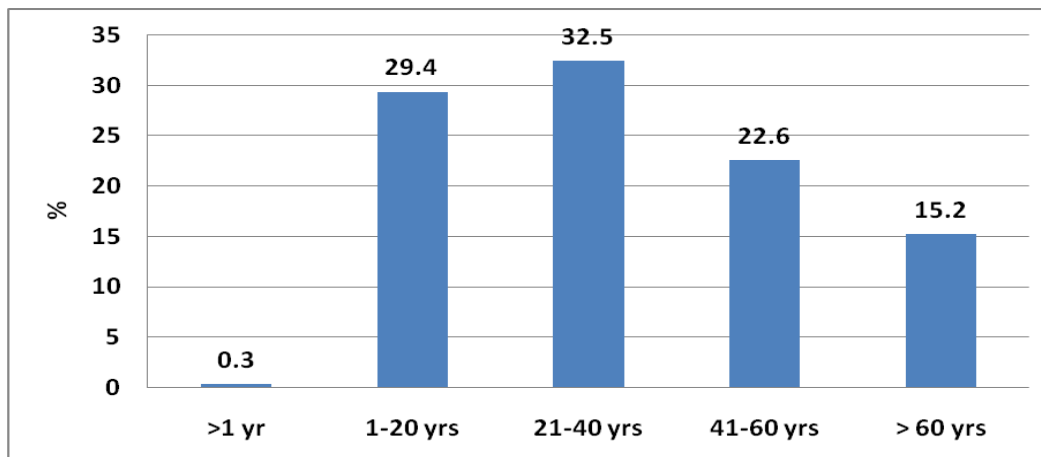
**Fig.3.** Distribution of cholera cases according to age group in Blue Nile State 2017(n=862)

Mean age: mean± SD= 35.3±22.1; Maximum age = 0.1 yrs; Minimum age= 90 yrs.

**Table 2.** Proportion of cholera death in Blue Nile State 2017

| Condition | No. | % | Case Fatality rate (CFR) |
|---|---|---|---|
| Alive | 853 | 99.0 | |
| Dead | 9 | 1.0 | 0.001 |
| **Total** | **862** | **100.0** | |

**Table 3.** Distribution of cholera cases according to prior contact with suspected/confirmed cholera cases in Blue Nile State 2017

| Contact | No. | % |
|---|---|---|
| Yes | 23 | 2.7 |
| No | 839 | 97.3 |
| **Total** | **862** | **100.0** |

**Table 4.** Distribution of cholera deaths according to gender in Blue Nile State 2017

| Sex | | General condition | | Total | χ2 | df | P-value | OR | 95% CI | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Alive | Dead | | | | | | Lower | Upper |
| Male | n | 362 | 7 | 369 | | | | | | |
| | % | 42.4% | 77.8% | 42.8% | 4.5 | 1 | .037 | .2 | .04 | 1.0 |
| Female | n | 491 | 2 | 493 | | | | | | |
| | % | 57.6% | 22.2% | 57.2% | | | | | | |
| Total | n | 853 | 9 | 862 | | | | | | |
| | % | 100.0% | 100.0% | 100.0% | | | | | | |

**Table 5.** Distribution of cholera deaths according to age group in Blue Nile State 2017

| Age | | General condition | | Total | χ2 | df | P-value |
|---|---|---|---|---|---|---|---|
| | | Alive | Dead | | | | |
| >1 yr | n | 3 | 0 | 3 | | | |
| | % | .4% | .0% | .3% | | | |
| 1-20 yrs | n | 252 | 1 | 253 | | | |
| | % | 29.5% | 11.1% | 29.4% | | | |
| 21-40 yrs | n | 279 | 1 | 280 | | | |
| | % | 32.7% | 11.1% | 32.5% | 6.2 | 4 | .183 |
| 41-60 yrs | n | 191 | 4 | 195 | | | |
| | % | 22.4% | 44.4% | 22.6% | | | |
| > 60 yrs | n | 128 | 3 | 131 | | | |
| | % | 15.0% | 33.3% | 15.2% | | | |
| Total | n | 853 | 9 | 862 | | | |
| | % | 100.0% | 100.0% | 100.0% | | | |

**Table 6.** Distribution of cholera deaths according to prior contact with suspected/confirmed cholera cases in Blue Nile State 2017

| Contact | | General condition | | Total | χ2 | df | P-value | OR | 95% CI | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Alive | Dead | | | | | | Lower | Upper |
| Yes | N | 18 | 5 | 23 | | | | | | |
| | % | 2.1% | 55.6% | 2.7% | 97.9 | 1 | .000 | .02 | .004 | .07 |
| No | N | 835 | 4 | 839 | | | | | | |
| | % | 97.9% | 44.4% | 97.3% | | | | | | |
| Total | N | 853 | 9 | 862 | | | | | | |
| | % | 100.0% | 100.0% | 100.0% | | | | | | |

## DISCUSSION:

This work aimed to investigate the death related cholera outbreak during the year 2017 in Blue Nile State. The study showed that most of cholera cases was reported in Eldamazin locality 576 (66.8%) followed by Eltadamon locality 100 (11.6%). The observed non-random distribution and sustained transmission of cholera is most likely influenced by demographic factors such as urbanization and overcrowding in the Blue Nile localities. This finding not differed from a study conducted in Ghana central Region where a total of 731 cases of cholera were reported with an overall attack rate of 67 cases per 100,000 populations (5).

Furthermore the study showed that the proportion of deaths was 1.0% with case fatality rate of 0.001/1000. This is considered low case fatality rate compared to 862 cases. According to the WHO in 2015, new major outbreaks of cholera are continuing to occur, especially in the wake of climate changes. There were 105,287 cholera cases of which 1,882 resulted in deaths giving rise to a Case Fatality Rate (CFR) of 1.8% within the African Sub region [4]. These reported cases were more than double that of the previous years 2013 and 2014. In total, 16 countries reported cholera cases of which Ghana was the second most affected country with 28,944 reported cases with CFR of 0.8% only topped by Nigeria with 45,996 cases representing 2.1% CFR while DR Congo had 22,203 reported cases with 1.7% CFR. Ghana, Nigeria and DR Congo accounted for 85% of all cases reported in 2014 (6). In this study female was more affected by cholera 493 (42.8%) compared to male 369 (42.8%) and the most age group affected by cholera was the age ranged between 21-40 years 280 (32.5%) followed by the age group 1-20 years 253(29.4%). There was significance difference found between gender, $p<0.05$. Male was significantly more dead 77.8% compared to female 22.2%. The proportion of deaths was significantly increased by 0.2 folds (OR=0.2; 95% CI (.04-1.0)) among male compared to female. Also there was no significance difference between cholera deaths among age. The proportion of deaths was not significantly found high among age group ranged between 41-60 years (44.4%).However, a likely explanation for the high number of female affected is the fact that females traditionally are more involved in fetching water for domestic use from any likely local stream, possibly drinking directly from the stream, which could expose them further to the infection (7). The study not in line with other study that documented that children below the age of 5 years have highest incidence of cholera, age-specific mortality is as well highest in this age group (8, 9).

## CONCLUSION:

The study concludes that the proportion of death was relatively low with low case fatality rate. Gender was significantly influence death due to cholera but not age group. It is recommended

that localities and administrative units surveillance systems be activated to facilitate a quicker and more timely response in future outbreaks to prevent spread of cholera disease, current and future development projects must be geared towards provision of more water treatment plants, provision of regular community education on cholera signs and symptoms and prevention and treatment measures even in periods outside epidemics.

## DECLARATION OF COMPETING INTEREST:

The authors declared that there is no conflict of interest.

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