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Cholera Outbreak in Blue Nile State, Sudan, 2016

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ABSTRACT

Background: Cholera is an acute watery diarrhoea disease that is caused by the ingestion of food or water contaminated with the toxigenic strains of Vibrio cholerae serogroup O1 or O139.

Objectives: This study aimed to contribute data on trends in cholera-related mortality in Blue Nile State.

Materials and methods: A descriptive epidemiological study was carried out in Blue Nile State during cholera outbreak 2016. Data was collected from patients' records during period of outbreak from August to November 2016.

Results: Most of cholera cases was reported in Elroseries locality 833 (58.3%) followed by

Eldamazin locality 544 (38%). The proportion of deaths was 2.4% with case fatality rate of 0.0024/1000. Age and sex not significantly influence death related mortality.

Conclusion: Despite a high number of cases; the cholera related deaths is found low in the Blue Nile 2016 , these might attributed to successful WASH intervention and effective case management.

Keywords: *Cholera, Blue Nile state, Sudan, 2016*

INTRODUCTION:

Overthepast150 years, cholera remains an important public health problem in many countries in Africa, Asia, and Latin America, although the transmission routes, infection control measures, and methods to control outbreaks have become better known(1).Furthermore, the current seventh pandemic of cholera (which beganin South Asia in 1961andspreadto Africa in 1971and the Americas in 1991) is still ongoing (2). Today, cholera is endemic in many countries (1).Cholera deaths have previously been reported to be estimated at 95,000 annually during the five years studied (2008-2012).(3) Cholera remained a significant global problem during the last decade of the 20th century. Cholera has occurred in the form of large outbreaks (Haiti and Yemen, Nigeria, Democratic Republic of Congo ,Dominican Republic, Egypt, Somalia, Bangladesh, Pakistan, Philippines, China, Ghana, Cameroon, etc.) and endemic disease in many countries(4). Cholera is a symbol of inequality, affecting the poorest people in the world and hitting those already vulnerable due to poverty and conflict (3). In areas where basic infrastructure is lacking and access to clean water and adequate sanitation is lacking ,increased humanitarian crises (e.g. ,camps for internally displaced persons and refugees), climate change, high incidence of other diseases, optimization/delays in surveillance (hindering response ,lack of laboratory capacity, use of heterogeneous case definitions, etc.),delays or depletion of the medical supplies supply chain, limited availability of medical resources, and availability of oral cholera vaccine are typical risk areas(5).

To this day, cholera remains a global threat to public health and an indicator of inequity and lack of social development (1).Yet cholera remains a neglected and underreported disease (6). The true burden of cholera is underreported (7). The discrepancy between the reported and estimated number of cholera cases is due to the fact that many cases are not recorded due to the limitations of surveillance systems. Furthermore, since 2005, notification of cholera cases to the World Health Organization (WHO) is no longer mandatory (1). The purpose of this study is

to provide data on trends in cholera-related mortality in Blue Nile State.

MATERIALS AND METHODS:

Study design:

A descriptive epidemiological study was carried out. Cholera-related mortality in the year 2016 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 indicates that most of cholera cases was reported in Elroseries ocality 833 (58.3%) followed by Eldamazin locality 544 (38%); Geisan locality 36 (2.5%), Wad almahi locality 6 (0.4%); Eltadamon locality 4 (0.3%) and Elkurmuk locality 4 (0.3%). Figure 1 shows that the peak of cholera cases was started in August (2016) 21 (1.5%) and reached the highest level at September (2016) 1291(90.3%) and began to decreased in October 2016 95(6.6%) and November (2016) 23 (1.6%).

Figure 2 illustrates that the most age group affected by cholera was the age ranged between 1-20 years (37.9%) followed by the age group 21-40 years (34.7%) while the lowest age group was the age group less than 1 year (0.8%). The mean age of cholera patients was (29.7±20.1) years with maximum age of 95 years and minimum age of 0.3 year. Figure 3 show that female was more affected by cholera 60.8% compared to male 39.2%. Table 2 indicates that the proportion of deaths was 2.4% with case fatality rate of 0.0024/1000. As stated in table 3 there was no significance difference was found between gender, $p>0.05$. Male was not significantly more dead 51.4% compared to female 48.6%. The proportion of deaths was not significantly increased by 0.6 folds (OR=0.6; 95% CI (.3-1.2)) among male compared to female. Table 4 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 1-20 years (42.9%).

Table1. Distribution of cholera cases by localities in Blue Nile State 2016

Locality	No.	%
Elroseris	833	58.3
Eldamazin	544	38.0
Baw	3	.2
Wad Almahi	6	.4
Elkurmuk	4	.3
Geisan	36	2.5
Eltadamon	4	.3
Total	**1430**	**100.0**

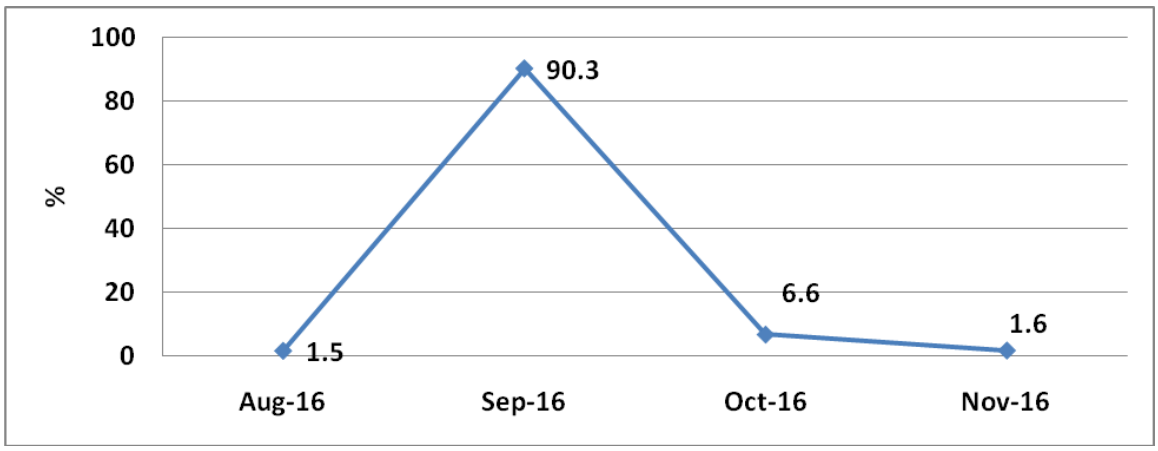

Fig.1. Distribution of cholera cases by months in Blue Nile State 2016 (n=1430)

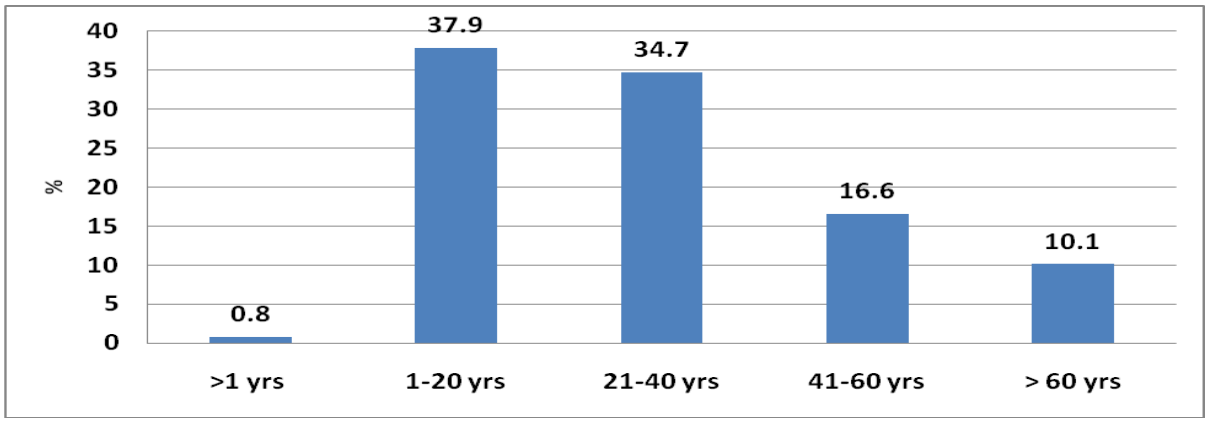

Fig.2. Distribution of cholera cases by age group in Blue Nile State 2016 (n=1430)

Mean age: mean± SD= 29.7±20.1; Maximum age = 0.3 yrs;
Minimum age= 95 yrs.

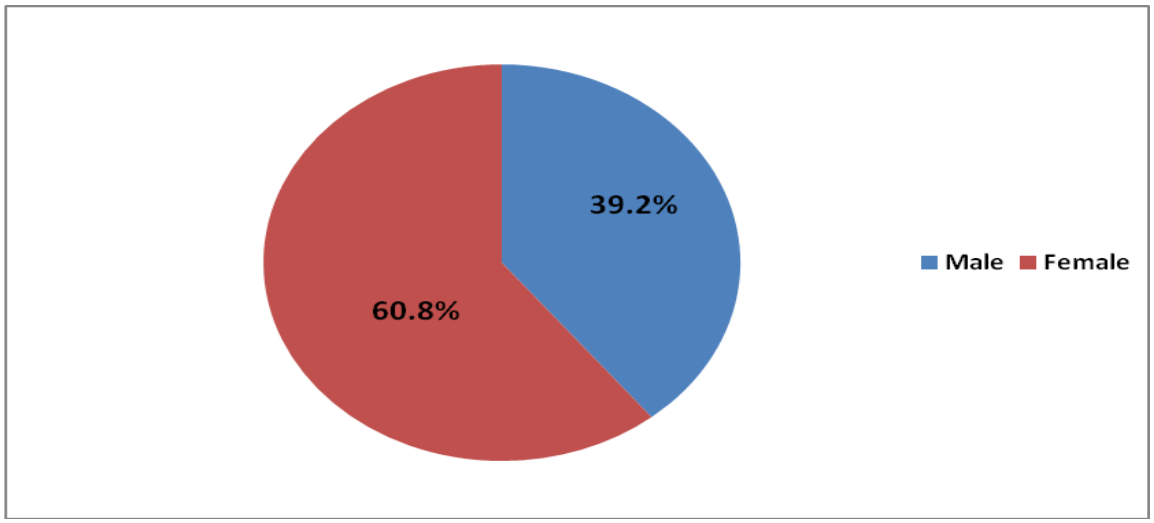

Fig.3. Distribution of cholera cases by gender in Blue Nile State 2016 (n=1430)

Table 2. Proportion of cholera death in Blue Nile State 2016

Condition	**No.**	**%**	**Case Fatality rate (CFR)**
Alive	1395	97.6	
Dead	35	2.4	0.0024
Total	**1430**	**100.0**	

Table 3. Distribution of cholera deaths according to gender in Blue Nile State 2016

Sex		General condition		Total	χ2	df	P-value	OR	95% CI	
		Alive	Dead						Lower	Upper
Male	n	543	18	561	**2.2**	**1**	**0.094**	**.6**	**.3**	**1.2**
	%	38.9%	51.4%	39.2%						
Female	n	852	17	869						
	%	61.1%	48.6%	60.8%						
Total	n	1395	35	1430						
	%	100.0%	100.0%	100.0%						

Table 4. Distribution of cholera deaths according to age group in Blue Nile State 2016

Age	General condition	Total	χ2	df	P-value

		Alive	Dead				
>1 yr	n	10	1	11			
	%	.7%	2.9%	.8%			
1-20 yrs	n	527	15	542			
	%	37.8%	42.9%	37.9%			
21-40 yrs	n	486	10	496	**2.8**	**4**	**0.586**
	%	34.8%	28.6%	34.7%			
41-60 yrs	n	232	5	237			
	%	16.6%	14.3%	16.6%			
> 60 yrs	n	140	4	144			
	%	10.0%	11.4%	10.1%			
Total	n	1395	35	1430			
	%	100.0%	100.0%	100.0%			

DISCUSSION:

This study aimed to contribute data on trends in cholera-related mortality in Blue Nile State in the years 2016. The study showed that the proportion of deaths was 2.4% with case fatality rate of 0.0024/1000. This rate was very low compared to globally cholera outbreaks .i.e. in Nigeria, during the whole period observed, intermittent outbreaks have been occurring, but 2010 was marked with a severe outbreak characterized by the highest case-fatality rate: in total, it was 4.5%, while the Nigerian states with the highest case-fatality rates in the 2010 outbreak were Plateau, Kaduna, and Katsina with rates 23.0%, 9.0%, and 7.6%, respectively (8). The case-fatality rates in Nigeria could be in part due to changes in *Vibrio cholerae* infectivity (a highly virulent multidrug resistant atypical O1 El Tor biotype and non-O1/non-O139 *Vibrio cholerae* strains) that were disseminated across the country by human travel (8,9). Also two substantial upsurges in the number of deaths from cholera in the world were observed in several successive years, around 2010 and 2018. Namely, in four consecutive years (since 2007), the number of cholera-related deaths has been increasing worldwide and almost doubled in 2010 due to large epidemics in several countries (including Haiti, Nigeria, Cameroon, Chad, the Democratic Republic of Congo) (2,10–11). Also the CFR in our study is lower than that occurred during a cholera outbreak in Kenya during civil unrest in 2008, an active community-based case-finding showed that 200% more fatal cases were found than reported, raising the estimated case-fatality rate from 5.5% to 11.4% (12). In this study the most age group affected by cholera was the age ranged between 1-20 years (37.9%). The mean age of

cholera patients was (29.7±20.1) years with maximum age of 95 years and minimum age of 0.3 year. 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 1-20 years (42.9%). However the study showed that female was more affected by cholera 60.8% compared to male 39.2%. No significance difference was found between gender, p>0.05. Male was not significantly more dead 51.4% compared to female 48.6%. The proportion of deaths was not significantly increased by 0.6 folds (OR=0.6; 95% CI (.3-1.2)) among male compared to female. In contrast study showed that the number of male patients with cholera disease 55.05% was greater than the number of female patients with the same disease (13). Also dissimilar to a results of Tesfay and Biru (14) which also presents that the number of males was more affected and These results also not related with the a study in Ethiopia, those who were between the ages 15 to 44 years were more affected than the three categories of age group (less than 5, 5 to 14 and 45 and above). Other study showed that the cholera patients of age group 15 to 44 years have higher odds of surviving from the disease than those aged under 5. Then in the other study (15), the cholera disease affected all age groups, age group 5–9 years had the highest proportion of cases excluded aged 0–5 years. On the other hand the study showed that the peak of cholera cases was started in August (2016) 21 (1.5%) and reached the highest level at September (2016) 1291(90.3%) and began to decreased in October 2016 95(6.6%) and November (2016) 23 (1.6%). This may be due to rainy season and floods during September in Blue Nile State where the chance of drinking water contamination might be increased. Comparable finding found that cholera infection during the rainy season appeared to have increased the odds of cholera-related death in comparison to dry season; and by 30% in flooded states when compared with non-flooded states. These could be explained by increased precipitation during the rainy season, often characterized by flooding, especially in the context of poor drainage networks (16).

CONCLUSION:

The study concludes that cholera related deaths is lower when internationally compared ; these may be due to effective intervention implemented during outbreak an in Blue Nile state during the 2016 outbreak. However the low case fatality rate reflects good case management and hospitalization during outbreak. It is suggested that the importance of adopting a multi-sectoral approach to the design and implementation of public health interventions against

adverse clinical outcomes among cholera patients.

DECLARATION OF COMPETING INTEREST:

The authors declared that there is no conflict of interest.

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