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Typhoid Burden in Blue Nile State, Sudan, 2015-2022

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ABSTRACT

Background: Typhoid fever is a systemic infection that presents with multisystem signs and symptoms albeit without pathognomonic clinical features.

Objectives: This study aimed to explained burden of typhoid disease in Blue Nile State, 2015-2022.

Materials and methods: A descriptive cross sectional study health facility-based study. Data was collected from Blue Nile health facilities during the years 2015-2022.

Results: The overall prevalence of the typhoid fever was 13.5/100 person –years with 95% confidence interval (CI) (3.0-4.0). The Year 2020 significantly showed high prevalence of typhoid fever 18.2 % while the year 2015 reported less typhoid fever prevalence 9.1%. Also there was significant difference between the mean prevalence of the months of the studied years, p=.001. High prevalence of typhoid fever was significantly found during October 15.9% and November 15.6% of each studied year. Hence our study showed that there was no significant

difference between weekly mean prevalence of the studied years, p=.379.

Conclusion: The prevalence of typhoid fever is considered high therefore efforts should be directed toward effective treatment options, to provide care as early as possible to achieve better outcomes. Also systematic surveillance and also the efforts to improve water, sanitation, and health infrastructure in Blue Nile State should be developed and accomplished as long-term goals towards the global UN Sustainable Development Goals.

Keywords: *Typhoid, Blue Nile state, Sudan, 2015-2022*

INTRODUCTION:

Typhoid fever is a febrile illness caused by infection with the Gram-negative bacterium Salmonella enterica serovar Typhi (S. Typhi). There are several Salmonella enterica species: the serovar Paratyphi causes paratyphoid fever; further, there are non-typhoidal serovars, the most prevalent being serovars Enteritidis, Typhimurium, and Dublin, which cause invasive non-typhoidal salmonellosis (iNTS). (1,2) Typhoid fever represents a significant public health burden, particularly in resource-constrained settings. (3,4) While typhoid fever has been largely eliminated in higher-income countries with modern sanitary facilities and safe drinking water, the disease persists as a significant public health issue in many low- and middle-income countries (LMICs) worldwide. (5,6) This public health issue is compounded by increasing antimicrobial resistance (AMR) and rampant economic loss due to the impact of this disease on productive members of the population. (7) The World Health Organization (WHO) estimates the global burden of typhoid fever at 11–20 million cases per year, resulting in ~140,000 deaths. (8) Typhoid conjugate vaccines (TCV) are highly effective and have been recommended for use in typhoid fever-endemic countries. (9,10) Vaccine introduction can address the enduring problem of pediatric typhoid fever as well as the evolving problem of multi-drug resistance (MDR) in affected regions. Typhoid fever is a systemic infection that presents with multisystem signs and symptoms albeit without pathognomonic clinical features.4 Transmission usually occurs via the fecal-oral route, typically when an individual ingests contaminated food or water. (4) S. Typhi characteristically invades the gastrointestinal tract and progresses to systemic infection. (3) The risk of infection has previously been linked to factors such as exposure to contaminated water, inadequate waste management, poor hygiene conditions as well as inhabitation of urban slums. (11) Clinical diagnosis is challenging because of its nonspecific and diverse symptoms that include fever, diarrhea, and abdominal pain. (12) The gold standard for the diagnosis of typhoid fever is a bone-marrow culture. While this modality is highly sensitive, it is invasive and

technically unfeasible in most settings. (13) Thus, this disease is typically diagnosed by the more practical method of blood culture despite its limited (40–60%) sensitivity and the challenges in establishing contamination-free blood culturing in LMIC settings. (14,15) While typhoid fever can usually be treated effectively with appropriate antibiotics if diagnosed accurately during the early stages of the disease, the limited resources available in most of the endemic regions often lead to delays in diagnosis and treatment, followed by empirical treatment only. (16,17) New diagnostic tools with improved accuracy, including antibody-based serologic assays used to evaluate samples collected through serosurveys, are currently under development and will hopefully be available for use in field settings. (18,19) The purpose of this study is to provide data on burden of typhoid disease in Blue Nile State during the years 2015-2022.

MATERIALS AND METHODS:

Study design:

A descriptive cross sectional study health facility-based study.

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 health facilities in Blue Nile State.

Exclusion criteria:

Patients not diagnosed as typhoid fever.

Sample size and sampling technique:

All reported typhoid fever registered in Blue Nile health facilities during the years 2015-2022.

Data collection:

Data was collected from all health facilities according to health facilities registration in Blue Nile State.

Data analysis:

Data was analyzed using SPSS version 24.0. Descriptive statistics was used. Analysis of variance was used. P-value considered significant at less than 0.05 levels.

RESULTS:

Table 1 and figure shows that there was significant difference between mean of typhoid fever prevalence during the studied years, p=.000.

The Year 2020 significantly showed high prevalence of typhoid fever 18.2 % while the year 2015 reported less typhoid fever prevalence 9.1%.

Table 2 and figure 2 indicates that there was significant difference between the mean prevalence of the months of the studied years, p=.001.

High prevalence of typhoid fever was significantly found during October 15.9% and November 15.6% of each studied year.

Figure 3 shows that there was no significant difference between weekly mean prevalence of the studied years, p=.379.

Table 1. Mean prevalence of typhoid fever during the period from the year 2015 to the year 2022 in Blue Nile State

Year	Mean	SD	95% Confidence Interval for Mean	
			Lower Bound	Upper Bound
2015	9.1	.6	7.9	10.2
2016	9.2	.4	8.3	10.0
2017	12.8	.7	1.4	4.2
2018	15.6	.6	4.4	6.8
2019	14.3	.7	2.9	5.6
2020	18.2	.7	6.7	9.7
2021	15.2	.6	4.0	6.4
2022	13.8	.6	2.6	5.1
Total	**13.5**	**.3**	**3.0**	**4.0**
P-value			**.000***	

P-value considered significant at less than 0.05 levels

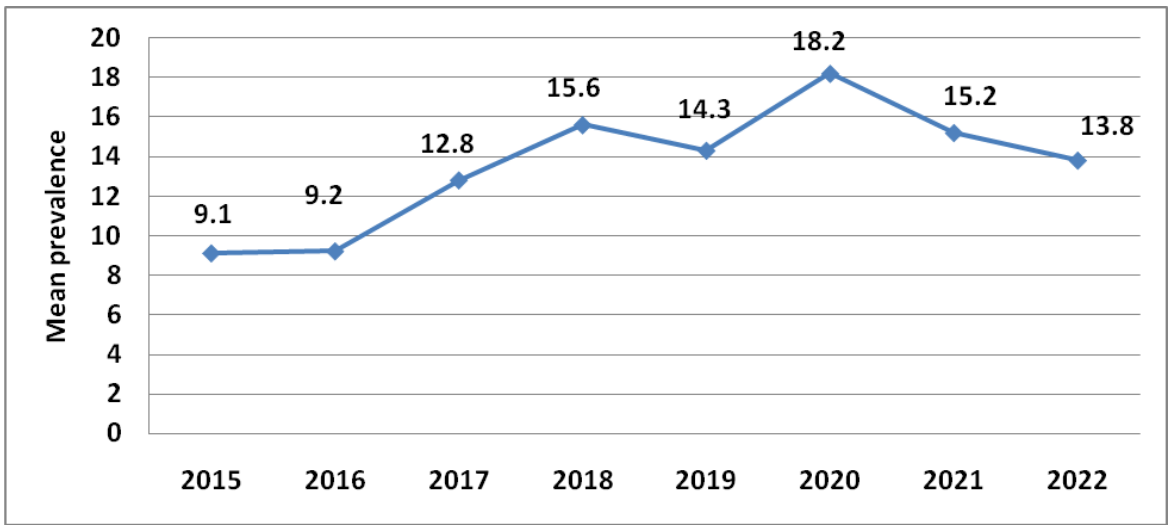

Fig. 1. Mean prevalence of typhoid fever during the period from the year 2015 to the year 2022 in Blue Nile State

Table 2. Mean prevalence of typhoid fever by months in Blue Nile State

Year	Mean	SD	95% Confidence Interval for Mean	
			Lower Bound	Upper Bound
January	13.5	.7	2.0	4.9
February	13.1	.8	1.5	4.7
March	12.9	.8	1.4	4.6
April	12.4	.9	1.5	4.2
May	11.3	.8	6.5	9.1
June	11.9	.9	1.0	3.8
July	12.2	.9	1.2	4.2
August	14.3	.9	1.5	6.2
September	13.3	.8	1.5	5.0
October	15.9	.8	4.4	7.6
November	15.6	.9	3.8	7.5
December	14.9	1.0	2.7	7.0
Total	**13.5**	**.3**	**3.0**	**4.0**
P-value			**.001***	

P-value considered significant at less than 0.05 levels

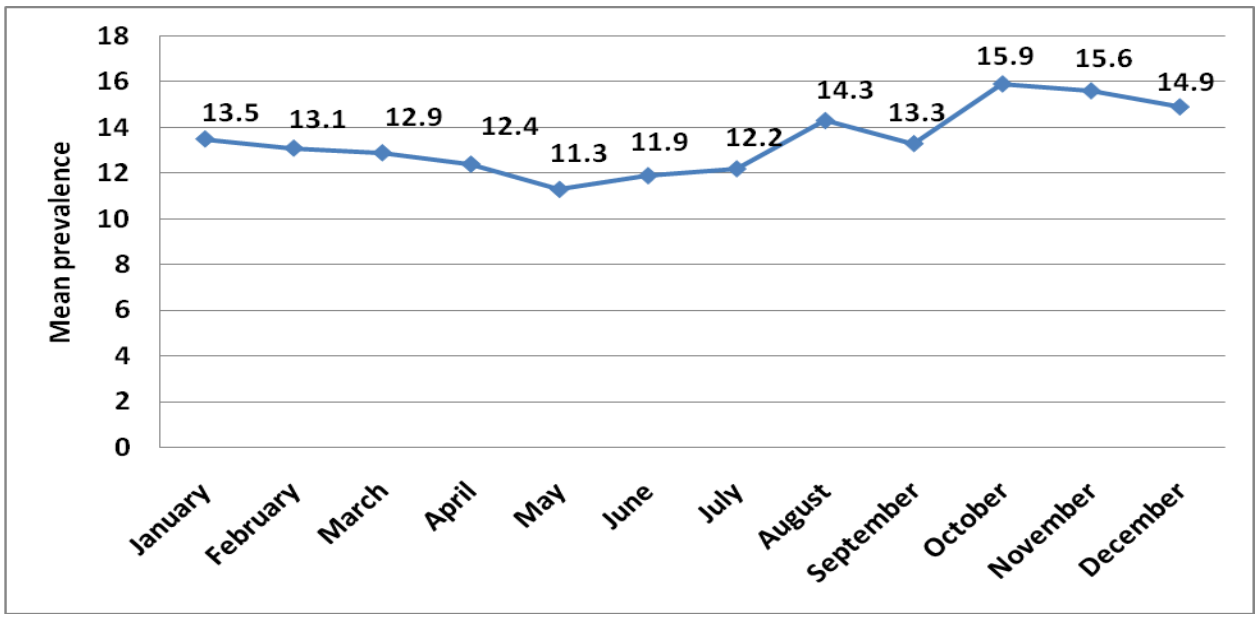

Fig. 2. Mean prevalence of typhoid fever by months in Blue Nile State

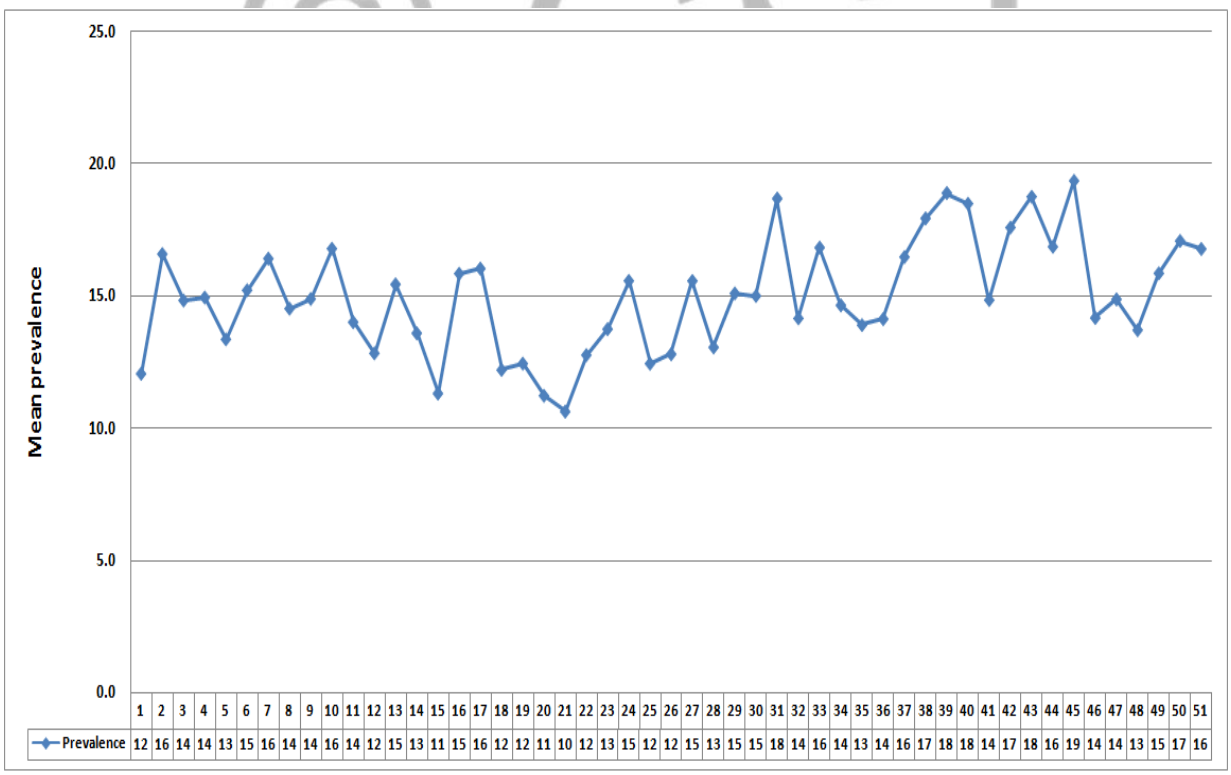

Fig. 3. Mean plots prevalence of typhoid fever by epidemiological weeks in Blue Nile State

F- test= 1.1; P-value =.397 (Not significant)

DISCUSSION:

This study aimed to explained burden of typhoid disease in Blue Nile State, 2015-2022.The study showed that there was significant difference between mean of typhoid fever prevalence during the studied years, p=.000. The overall prevalence of the typhoid fever was 13.5/100 person –years with 95% confidence interval (CI) (3.0-4.0). The Year 2020 significantly showed high prevalence of typhoid fever 18.2 % while the year 2015 reported less typhoid fever prevalence 9.1%. Also there was significant difference between the mean prevalence of the months of the studied years, p=.001. High prevalence of typhoid fever was significantly found during October 15.9% and November 15.6% of each studied year. Hence our study showed that there was no significant difference between weekly mean prevalence of the studied years, p=.379. Several researchers have recently estimated the incidence of disease and mortality rates at levels that are similar, if not higher, than those identified in South/Southeast Asia. (20,21) Nevertheless, the results of one recent study show the high degree of heterogeneity in different settings and between countries.20 In their 2017 review, Antillón *et al*. (22) estimated the burden of typhoid fever in sub-Saharan Africa at 762 per 100,000 person-years. The prevalence in our study highlight an incidence that is significantly less than that identified in Southeast Asia, East Asia, and Oceania (estimated incidence of 108 per 100,000 person-years). Also the prevalence is less than, a 2019 comprehensive review by Marchello *et al*. (23) estimated the African incidence of typhoid fever from previous results and presented an initial pooled estimate of 112.1/ 100,000 person-years, with a 95% confidence interval (CI) of 46.7–203.5. The finding of the study not in line with the typhoid Fever Surveillance in Africa Program (TSAP) that was conducted between the years 2010 and 2014 was setup in 13 sites in 10 Africa countries (Burkina Faso, Ghana, Guinea-Bissau, Senegal, Ethiopia, Sudan, Kenya, Tanzania, South Africa, and Madagascar) to determine age-stratified incidences of invasive Salmonella infections. Typhoid fever incidence estimates ranged from 0 in Sudan to 383/100,000 person-years in Burkina Faso. (24)

CONCLUSION:

The prevalence of typhoid fever is considered high therefore efforts should be directed toward effective treatment options, to provide care as early as possible to achieve better outcomes. Also systematic surveillance and also the efforts to improve water, sanitation, and health infrastructure

in Blue Nile State should be developed and accomplished as long-term goals towards the global UN Sustainable Development Goals.

DECLARATION OF COMPETING INTEREST:

The authors declared that there is no conflict of interest.

REFERENCES:

1. Basnyat B, Qamar FN, Rupali P, Ahmed T, Parry CM. Clinical update: Enteric Fever. *BMJ*. 2021;372:n437.

2. Haselbeck AH, Panzner U, Im J, Baker S, Meyer CG, Marks F. Current perspectives on invasive nontyphoidal Salmonella disease. *Curr Opin Infect Dis*. 2017;30(5):498.

3. Dougan G, Baker S. Salmonella enterica serovar Typhi and the pathogenesis of typhoid fever. *Annu Rev Microbiol*. 2014;68:317–336.

4. Crump J, Sjöund-Karlsson M, Gordon M, Parry C. Epidemiology, clinical presentation, laboratory diagnosis, antimicrobial resistance, and antimicrobial management of invasive Salmonella infections. *Clin Microbiol Rev*. 2015;28(4):901–937.

5. Cutler D, Miller G. The role of public health improvements in health advances: the twentieth-century United States. *Demography*. 2005;42(1):1–22.

6. World Health Organization. Typhoid and other invasive salmonellosis. Vaccine-preventable diseases, surveillance standards; 2018. Available from: https://www.who.int/immunization/monitoring_surveillance/burden/.

7. John J, Van Aaart C, Grassly N. The burden of typhoid and paratyphoid in India: systematic review and meta-analysis. *PLoS Negl Trop Dis*. 2016;10(4):e0004616.

8. World Health Organization. Typhoid; 2018. Available from: https://www.who.int/news-room/fact-sheets/.

9. Bentsi-Enchill AD, Hombach J. Revised global typhoid vaccination policy. *Clin Infect Dis*. 2019;68(Suppl 1):S31.

10. World Health Organization. Typhoid vaccines: WHO position paper, March 2018 - recommendations. *Vaccine*. 2019;37(2):214–216.

11. Uzoka F-ME, Akwaowo C, Nwafor-Okoli C, et al. Risk factors for some tropical diseases in an African country. *BMC Public Health*. 2021;21 (1):2261.

12. Mweu E, English M. Typhoid fever in children in Africa. *Trop Med Int Health*. 2008;13(4):532–540.

13. Wain J, Hosoglu S. The laboratory diagnosis of enteric fever. *J Infect Dev Ctries*.

2008;2(06):421–425.

14. Parry CM, Wijedoru L, Arjyal A, Baker S. The utility of diagnostic tests for enteric fever in endemic locations. *Expert Rev Anti Infect Ther*. 2011;9 (6):711–725.

15. Mogasale V, Ramani E, Mogasale V, Park J. What proportion of Salmonella Typhi cases are detected by blood culture? A systematic literature review. *Ann Clin Microbiol Antimicrob*. 2016;15(1).

16. Dougan G. Typhoid in Africa and vaccine deployment. *Lancet Glob Heal*. 2017;5(3):e236–e237.

17. Parry CM, Wijedoru L, Arjyal A, Baker S. The utility of diagnostic tests for enteric fever in endemic locations. *Expert Rev Anti Infect Ther*. 2014;9 (6):711–725.

18. Andrews JR, Khanam F, Rahman N, et al. Plasma immunoglobulin a responses against 2 Salmonella Typhi antigens identify patients with typhoid fever. *Clin Infect Dis*. 2019;68(6):949–955.

19. Najib MA, Mustaffa KMF, Ong EBB, et al. Performance of immunodiagnostic tests for typhoid fever: a systematic review and meta-analysis. *Pathog*. 2021;10(9):1184.

20. Kim J-H, Im J, Parajulee P, et al. A systematic review of typhoid fever occurrence in Africa. *Clin Infect Dis*. 2019;69(Suppl 6):S492–S498.

21. Marchello CS, Birkhold M, Crump JA. Complications and mortality of typhoid fever: a global systematic review and meta-analysis. *J Infect*. 2020;81(6):902–910.

22. Antillón M, Warren JL, Crawford FW, et al. The burden of typhoid fever in low- and middle-income countries: a meta-regression approach. *PLoS Negl Trop Dis*. 2017;11(2):e0005376.

23. Marchello CS, Hong CY, Crump JA. Global typhoid fever incidence: a systematic review and meta-analysis. Clin Infect Dis. 2019;68(Suppl 2): S105–S116.

24. Marks F, Kalckreuth V, Aaby P, et al. Incidence of invasive Salmonella disease in sub-Saharan Africa: a multicentre population-based surveillance study. *Lancet Glob Heal*. 2017;5(3):e310–e323.