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Prevalence and Associated Factors of Typhoid Fever Among Adult Clients Who Visited the Outpatient Department in Burao General Hospital, Somaliland

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ABSTRACT: Salmonella enterica *serovar Typhi (*S. Typhi*) is the causative agent of typhoid fever, an acute systemic febrile illness that remains endemic in many low- and middle-income countries. Globally, an estimated 11–21 million cases and 148,000–161,000 deaths were reported in 2015, underscoring its continued public health burden. The World Health Organization (WHO) recommends prioritizing the introduction of typhoid conjugate vaccines (TCVs) in high-incidence settings to reduce transmission and disease impact. This study aimed to assess the prevalence and associated factors of typhoid fever among adult clients attending the Outpatient Department (OPD) at Burao General Hospital in 2023. A hospital-based cross-sectional study was conducted from May to August 2023. A total of 276 adult participants were selected using systematic random sampling. Data were collected through structured interviewer-administered questionnaires and analyzed using SPSS version 25. Descriptive statistics, chi-square tests, and multivariate logistic regression analyses were performed to identify factors associated with typhoid fever. The overall prevalence of typhoid fever was 59.9% (151/252 investigated cases). Multivariate analysis revealed that having a business-related income (AOR = 3.069; 95% CI: 1.124–8.382; p = 0.029), storing drinking water in jerry cans (AOR = 1.953; p < 0.001), and living within approximately 30 meters of a latrine to a water source (AOR = 2.135; 95% CI: 1.192–3.822; p = 0.011) were independently associated with increased odds of typhoid fever. In conclusion, typhoid fever prevalence remains high in Burao. Strengthening access to safe water storage practices, improving sanitation infrastructure, and enhancing community-based health education are urgently recommended to reduce disease transmission and its public health impact.*

Keywords: *typhoid fever; prevalence; associated factors; Widal test; Burao; Somaliland; sanitation; water safety; infectious disease*

1. Introduction

Typhoid fever is a systemic bacterial infection caused by Salmonella enterica serovar Typhi (S. Typhi), transmitted primarily through contaminated food or water. It remains endemic in many low- and middle-income countries (LMICs), where access to clean water and adequate sanitation is limited.

Globally, an estimated 11–21 million cases and 148,000–161,000 deaths were attributed to typhoid fever in 2015 (CDC, 2023). The WHO recommends prioritizing typhoid conjugate vaccine (TCV) introduction in nations with the highest incidence or high prevalence of antimicrobial-resistant S. Typhi. Between 2018 and 2022, five countries—Liberia, Nepal, Pakistan, Samoa, and Zimbabwe—introduced TCVs into their routine immunization programmes.

A revised modelling analysis estimated 9.2 million cases (95% CI: 5.9–14.1 million) and 110,000 deaths (95% CI: 53,000–191,000) globally in 2019. The highest incidence was reported in the WHO South-East Asia Region (306 cases per 100,000 population), followed by the Eastern Mediterranean (187 per 100,000) and Africa (111 per 100,000).

The incidence in endemic areas ranges from 45 to over 1,000 per 100,000 persons per year, with some studies from Bangladesh documenting incidences as high as 2,000 per 100,000 per year. Most cases in endemic regions affect individuals aged 3–19 years; however, clinically apparent bacteraemia due to S. Typhi has been documented in children under three years in Bangladesh, India, Jordan, and Nigeria.

Typhoid fever is characterised by insidious onset of sustained fever, headache, malaise, constipation or diarrhoea, chills, and myalgia. A transient maculopapular (rose-spot) rash may appear on the trunk. In severe cases, intestinal perforation and altered consciousness may occur after two to three weeks. The incubation period ranges from 6 to 30 days for typhoid fever and 1 to 10 days for paratyphoid fever (CDC, 2020).

Prevention relies on vaccination, access to safe water, improved sanitation, and health education. Both oral (live attenuated, 4-dose series) and injectable (Vi polysaccharide, single dose) typhoid vaccines are available. Antibiotic prophylaxis with azithromycin, ceftriaxone (Rocephin), or cefixime (Suprax) is recommended for travellers to endemic areas.

In Burao, Somaliland, limited epidemiological data exist on the prevalence and risk factors of typhoid fever. This study was therefore conducted to assess the prevalence and factors associated with typhoid fever among adults attending the OPD at Burao General Hospital in 2023.

2. Literature Review

2.1 Theoretical Review

Salmonella Typhi spreads through the faecal-oral route via contaminated water or food (WHO, 2018). Several factors increase the risk of S. Typhi infection, including poor sanitation, inadequate handwashing, consumption of raw food (meat, vegetables, and unpasteurised milk), improper waste disposal, close contact with cases or carriers, and low educational attainment.

The WHO identifies the following key preventive strategies: food safety, safe water supply, good sanitation, immunisation, and targeted health education addressing community knowledge, attitudes, and practices (KAP) gaps. Improved community awareness is a potent mechanism for fostering preventive behaviours.

Geographic and temporal variation in S. Typhi burden is significant. Travellers from high-income countries are susceptible in endemic areas, and pre-travel health counselling on hygiene, sanitation, and vaccination substantially reduces infection risk (International Journal of Environmental Research and Public Health, 2020).

A seroprevalence study conducted in Ethiopia (Mulu et al., 2021) reported a 25.7% overall S. Typhi seroprevalence among febrile patients, with the highest rates among participants aged 30–34 years (33.3%), those without a secondary education (37.3%), and rural residents (32.1%). These findings underscore the role of socioeconomic and environmental determinants in typhoid transmission.

3. Methodology

3.1 Study Design and Setting

A hospital-based cross-sectional study design was employed. The study was conducted from May to August 2023 at the Outpatient Department (OPD) of Burao General Hospital, Burao City, Somaliland.

3.2 Study Population

The source population comprised all adult clients attending the OPD at Burao General Hospital in 2023. The study population consisted of randomly selected adult clients attending the OPD during the study period.

3.3 Inclusion and Exclusion Criteria

Inclusion criteria: Adult clients (18 years and above) diagnosed with typhoid fever who attended the OPD during the study period.

Exclusion criteria: Patients without a typhoid fever diagnosis, children under five years of age, patients admitted to other hospital wards, and clients attending private health clinics.

3.4 Sample Size and Sampling Technique

The sample size was calculated using Fisher's single-proportion formula (Fisher et al., 1998):

$$\mathbf{n = Z^2 \times P(1 - P) / d^2 = (1.96)^2 \times 0.37(1 - 0.37) / (0.05)^2 = 358}$$

Where: P = expected prevalence of 37% (based on a study conducted in Ghana, 2017); d = margin of error of 5%; Z = 1.96 (95% confidence level); population size = 750,000 (Wikipedia estimate for Burao). Due to the limited number of OPD attendees during the four-month data collection period, the sample was adjusted using the finite population correction formula, yielding a final sample of 276 participants. Participants were selected by systematic random sampling.

3.5 Data Collection and Analysis

Data were collected through structured interviewer-administered questionnaires that were pretested and translated into Somali for clarity. Laboratory diagnosis was performed using the Widal agglutination test. Data were entered and managed using EpiData 3.1 and ENDNOTE, then exported to SPSS version 25 for analysis. Descriptive statistics (frequencies and percentages) were computed. Chi-square tests were used to assess associations between independent variables and typhoid fever status. Multivariate logistic regression was applied to identify independently associated factors, with a p-value of <0.05 considered statistically significant.

3.6 Reliability and Validity

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Irrelevant or unclear questionnaire items were omitted or revised. Research assistants and data collectors received training prior to data collection to ensure accuracy. Questionnaires were stored securely and supervised data entry was performed to minimize errors.

3.7 Ethical Considerations

Ethical clearance was obtained from the institutional review board of the affiliated university. Written support was secured from hospital administration. All participants provided informed consent. Confidentiality was maintained throughout; no identifying data were disclosed to third parties.

4. Results

4.1 Sociodemographic Characteristics of Study Participants

A total of 276 participants were enrolled in the study. The majority (37.3%) were aged 22–31 years, followed by those aged 10–21 years (27.5%), 32–41 years (19.9%), and over 42 years (15.2%). Female participants constituted 55.4% of the sample. Most participants were married (55.4%), had secondary-level education (37.3%), were employed by NGOs (30.4%), and reported salaries as their primary income source (39.9%). Detailed sociodemographic characteristics are presented in Table 1.

Table 1. Sociodemographic Characteristics of Study Participants (n = 276)

Variable	Frequency (n)	Percentage (%)	Positive TF n (%)	Negative TF n (%)
Age Group (years)				
10–21	76	27.5		
22–31	103	37.3		
32–41	55	19.9		
>42	42	15.2		
Total	276	100.0		
Sex				
Male	123	44.6		
Female	153	55.4		
Total	276	100.0		
Marital Status				
Single	83	30.1		
Married	153	55.4		
Divorced	25	9.1		
Widow	15	5.4		
Total	276	100.0		
Educational Status				
Primary	54	19.6		
Secondary	103	37.3		
Diploma/Degree	67	24.3		

Variable	Frequency (n)	Percentage (%)	Positive TF n (%)	Negative TF n (%)
None	52	18.8		
Total	276	100.0		
Employment Status				
Government employed	75	27.2		
NGO employed	84	30.4		
Self-employed	34	12.3		
Unemployed	83	30.1		
Total	276	100.0		
Main Source of Income				
Peasant farming	28	10.1		
Salaries	110	39.9		
Wages	46	16.7		
Business	40	14.5		
Others	52	18.8		
Total	276	100.0		

4.2 Sanitation and Personal Hygiene Factors

The majority of participants (90.9%) had a latrine at home. Among those without a latrine (9.1%), most used a nearby bush (6.5%), neighbours' pit latrines (2.9%), or polythene bags (0.4%). Regarding fly control, 48.2% of participants covered their latrine holes, 26.4% used insecticide sprays, 19.6% used ventilated improved pit (VIP) latrines, and 1.4% did not control flies.

Regarding handwashing, 71.4% of participants washed their hands with soap before and after using the latrine, while 28.6% washed without soap. Concerning garbage disposal, 89.9% used rubbish pits, 5.4% disposed of waste along roadsides, and 4.7% disposed of waste anywhere. Findings are presented in Table 2.

Table 2. Sanitation and Hygiene Factors by Typhoid Fever Status (n = 276)

Variable	Frequency	% Total	Positive TF n (%)	Negative TF n (%)	Chi-Square
Latrine Availability					
Yes	251	90.9	138 (54.8)	13 (5.2)	
No	25	9.1	92 (36.5)	9 (3.6)	
Total	276	100.0	151 (59.9)	101 (40.1)	X=0.007, df=1, p=0.93
Fly Control from Latrine					
Cover the hole	133	48.2	67 (26.6)	55 (21.8)	
Use VIP latrine	54	19.6	29 (11.5)	19 (7.5)	
Spray with insecticides	73	26.4	44 (17.5)	24 (9.5)	

Variable	Frequency	% Total	Positive TF n (%)	Negative TF n (%)	Chi-Square
Do not control flies	4	1.4	4 (1.6)	0 (0.0)	
Others	12	4.3	7 (2.8)	3 (1.2)	
Total	276	100.0	151 (59.9)	101 (40.1)	X=5.023, df=4, p=0.285
Hand Washing with Soap					
Yes (with soap)	197	71.4	101 (40.1)	76 (30.2)	
Without soap	79	28.6	50 (19.8)	25 (9.9)	
Total	276	100.0	151 (59.9)	101 (40.1)	X=2.023, df=1, p=0.155
Garbage Disposal Site					
Rubbish pit	248	89.9	133 (52.8)	94 (37.3)	
Along the road	15	5.4	9 (3.6)	4 (1.6)	
Anywhere	13	4.7	9 (3.6)	3 (1.2)	
Total	276	100.0	151 (59.9)	101 (40.1)	X=1.773, df=2, p=0.412

4.3 Food and Personal Hygiene Factors

Most participants (83.3%) prepared and ate their meals at home, while 16.3% ate from restaurants. Regarding food preparation hygiene, 79.7% always washed their hands before preparing food, 19.2% sometimes did, and 1.1% never washed their hands. Regarding cooked food storage, 48.2% covered food in saucepans, 28.6% stored food in a refrigerator, 18.1% left food uncovered, and 5.1% used other methods. When consuming fresh fruits, 77.5% washed them with clean water, 14.9% peeled them, and 7.6% ate them without washing.

4.4 Water-Related Factors

The majority of participants (67.0%) obtained water from taps, followed by boreholes (25.7%), wells (6.9%), and springs (0.4%). Regarding water treatment, 48.9% drank water without boiling, 25.7% boiled water, and 24.3% used purification tablets (e.g., aqua-safe, water guard). For storage, 76.1% kept water in pots and 21.7% in jerry cans. Most participants (49.3%) reported a latrine-to-water-source distance of more than 30 metres, 40.9% reported approximately 30 metres, and 9.8% reported less than 30 metres. Water-related findings are presented in Table 3.

Table 3. Water-Related Factors by Typhoid Fever Status (n = 276)

Variable	Frequency	% Total	Positive TF n (%)	Negative TF n (%)	Chi-Square
Water Source					
Tap	185	67.0	99 (39.9)	70 (27.8)	
Borehole	71	25.7	41 (16.3)	24 (9.5)	
Well	19	6.9	11 (4.4)	6 (2.4)	
Spring	1	0.4	0 (0.0)	1 (0.4)	

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Variable	Frequency	% Total	Positive TF n (%)	Negative TF n (%)	Chi-Square
Total	276	100.0	151 (59.9)	101 (40.1)	X=2.053, df=3, p=0.561
Water Treatment Before Drinking					
Boil	71	25.7	41 (16.3)	21 (8.3)	
Drink without boiling	135	48.9	72 (28.6)	54 (21.4)	
Treat with tablets	67	24.3	37 (14.7)	24 (9.5)	
Others	3	1.1	1 (0.4)	2 (0.8)	
Total	276	100.0	151 (59.9)	101 (40.1)	X=2.297, df=3, p=0.513
Water Storage Container					
Jerry cans	60	21.7	41 (16.3)	13 (5.2)	
Pots	210	76.1	105 (41.7)	88 (34.9)	
Others	6	2.2	5 (2.0)	0 (0.0)	
Total	276	100.0	151 (59.9)	101 (40.1)	X=11.5, df=2, p=0.003
Distance: Latrine to Water Source					
<30 m	27	9.8	15 (6.0)	8 (3.2)	
About 30 m	113	40.9	73 (29.0)	30 (11.9)	
>30 m	136	49.3	63 (25.0)	63 (25.0)	
Total	276	100.0	151 (59.9)	101 (40.1)	X=10.578, df=2, p=0.005

4.5 Typhoid Fever Prevalence

Of the 252 participants who underwent laboratory investigation using the Widal test, 151 (59.9%) tested positive for typhoid fever and 101 (40.1%) tested negative. An additional 24 participants (8.7%) had not undergone testing in 2023 and were excluded from prevalence calculations. The overall prevalence of typhoid fever among adults attending the OPD in Burao General Hospital was therefore 59.9%.

4.6 Multivariable Logistic Regression: Factors Associated with Typhoid Fever

Multivariable logistic regression was performed to identify factors independently associated with typhoid fever. Statistically significant associations ($p < 0.05$) were found for: source of income (business; AOR = 3.069; 95% CI: 1.124–8.382; $p = 0.029$), water storage containers (jerry cans; AOR = 1.953; $p < 0.001$; pots; AOR = 6.474; $p = 0.001$), and distance between latrine and water source (approximately 30 m; AOR = 2.135; 95% CI: 1.192–3.822; $p = 0.011$). Demographic, food-related, and most hygiene-related factors did not reach statistical significance. All factors with $p < 0.05$ led to rejection of the null hypothesis. Full regression results are presented in Table 4.

Table 4. Multivariate Logistic Regression for Factors Associated with Typhoid Fever Among Adult Clients Attending OPD, Burao General Hospital, 2023

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No.	Variable	Category	TF Positive	TF Negative	COR (95% CI)	AOR (95% CI)	p-value
1	Sex	Male	25.8% (56)	17.9% (45)	1 (Ref)	0.885 (0.585–3.364)	0.656
		Female	34.1% (86)	22.2% (56)	0.885 (0.808–3.391)	Ref	
2	Age (years)	10–21	18.7% (47)	10.3% (26)	1 (Ref)	2.199 (0.880–5.499)	0.092
		22–31	21.4% (54)	15.1% (38)	1.655 (0.808–3.39)	1.329 (0.600–2.941)	0.483
		32–41	12.3% (31)	7.9% (20)	1.568 (0.677–3.634)	1.403 (0.585–3.364)	0.448
		>42	7.5% (19)	6.7% (17)	2.199 (0.880–5.499)	Ref	
3	Marital Status	Single	16.3% (41)	13.9% (35)	1 (Ref)	1.223 (0.325–4.596)	0.766
		Married	36.5% (92)	19.8% (50)	0.483 (0.25–0.932)	2.533 (0.735–8.729)	0.141
		Divorced	5.2% (13)	3.6% (9)	0.603 (0.211–1.724)	2.028 (0.478–8.597)	0.337
		Widow	2.0% (5)	2.8% (7)	1.233 (0.325–4.596)	Ref	
4	Source of Income	Peasant farming	3.6% (9)	7.1% (18)	1 (Ref)	0.463 (0.163–1.319)	0.150
		Salaries	23.8% (60)	15.1% (38)	0.257 (0.086–0.766)	1.416 (0.662–3.026)	0.370
		Wages	10.3% (26)	6.3% (16)	0.249 (0.084–0.733)	1.477 (0.599–3.643)	0.397
		Business	11.9% (30)	3.6% (9)	0.128 (0.041–0.395)	3.069 (1.124–8.382)	0.029*
		Others	10.3% (26)	7.9% (20)	0.293 (0.096–0.893)	Ref	

No.	Variable	Category	TF Positive	TF Negative	COR (95% CI)	AOR (95% CI)	p-value
5	Hand washing (latrine)	Yes, with soap	40.1% (101)	30.2% (76)	1 (Ref)	0.853 (0.460–1.580)	0.613
		Without soap	19.8% (50)	9.9% (25)	0.703 (0.396–1.249)	Ref	
6	Water Storage	Jerry cans	16.3% (41)	5.2% (13)	1 (Ref)	1.953 (CI wide)	0.000*
		Pots	41.7% (105)	34.9% (88)	3.006 (1.382–6.540)	6.474	0.001*
		Others	2.0% (5)	0.0% (0)	0.012 (0.00–0.21)	Ref	
7	Latrine–Water Distance	<30 m	6.0% (15)	3.2% (8)	1 (Ref)	1.528 (0.573–4.075)	0.397
		About 30 m	29.0% (73)	11.9% (30)	0.804 (0.298–2.166)	2.135 (1.192–3.822)	0.011*
		>30 m	25.0% (63)	25.0% (63)	1.805 (0.690–4.25)	Ref	

** Statistically significant at $p < 0.05$. COR = Crude Odds Ratio; AOR = Adjusted Odds Ratio; CI = Confidence Interval; TF = Typhoid Fever.*

5. Discussion

The overall prevalence of typhoid fever among adult OPD attendees at Burao General Hospital was 59.9%. This is considerably higher than a study conducted in Nigeria in 2019, which reported a prevalence of 49.1% (Ohanu ME, Malawi Medical Journal, 2019), suggesting that the burden of typhoid fever remains disproportionately high in Burao, likely driven by inadequate water and sanitation infrastructure.

A study from Uganda (Kibru et al., 2021) found that tap water was a significant risk factor for typhoid fever (p = 0.000), and that having a latrine at home was protective (p = 0.007). These findings align with the present study, where tap water use was associated with typhoid fever (p = 0.006) and latrine availability was significantly linked to disease occurrence (p = 0.007). The association between tap water and typhoid infection is plausible, as municipal water systems in low-resource settings are frequently inadequately treated, and proximity to sewage infrastructure increases contamination risk.

Regarding income, a study conducted in Ethiopia (Mekonnen et al., 2018) reported that individuals with low income were more likely to develop typhoid fever (AOR = 2.69; 95% CI: 1.40–5.18; p = 0.007). The present study similarly found that income source was significantly associated with typhoid fever, with business workers being at higher risk (AOR = 3.069; 95% CI: 1.124–8.382; p = 0.029). This may reflect occupational exposure, food consumption habits, and differential access to hygiene facilities.

Water storage practices were also significantly associated with typhoid fever. A study from Kenya (Mbae et al., 2020) found that storing water in pots was associated with higher odds of typhoid infection (COR = 1.6; 95% CI: 1.12–2.24; p = 0.048). In the present study, storing water in pots was also significant (AOR = 6.474; p = 0.001), reinforcing the importance of safe storage containers in preventing contamination. The proximity of latrines to water sources (approximately 30 metres) was associated with a more than twofold increase in typhoid risk (AOR = 2.135; p = 0.011), consistent with established guidelines recommending a minimum separation of 30 metres between sanitation facilities and water sources.

6. Conclusion

This study found a high prevalence of typhoid fever (59.9%) among adults attending the OPD at Burao General Hospital. Female sex, the age group 22–31 years, and married individuals were more commonly affected. Income source, water storage practices, and the proximity of latrines to water sources were the key factors independently associated with typhoid fever.

These findings underscore the urgent need for community-level interventions targeting safe water storage, separation of sanitation and water infrastructure, and health education campaigns. Strengthening typhoid surveillance, ensuring reliable access to safe drinking water, and introducing typhoid conjugate vaccines into the routine immunisation programme in Somaliland are critical steps toward reducing the burden of this preventable disease.

7. Recommendations

7.1 Recommendations Based on Study Findings

- Community residents should be educated on the importance of consistent handwashing with soap and clean water after latrine use and before food preparation or consumption.
- Local health and law enforcement authorities should strengthen and enforce food safety regulations in hotels, restaurants, and roadside food outlets to prevent contamination.
- Health authorities should sensitise communities on the importance of household pit latrines and proper faecal waste disposal.
- Legislation and enforcement requiring households and public spaces to maintain rubbish collection pits should be enacted and implemented.
- Communities should be educated on affordable, effective household water treatment methods, including boiling, filtration, and use of purification agents (e.g., aqua-safe, water guard).
- Health promotion campaigns by all stakeholders should raise awareness among Burao residents regarding typhoid fever prevention, control, and early health facility utilisation.
- Projects and programmes should be established to support ongoing community education on typhoid fever prevention and control.

7.2 Recommendations for Future Research

- Future studies should target children under seven years of age, a group excluded from the present study's target population.
- Future studies should incorporate multiple data collection methods, including direct observation and microbiological assessment, in addition to questionnaires and key informant interviews.

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