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INDIVIDUAL FACTORS ASSOCIATED WITH THE OCCURRENCE OF TYPHOID FEVER AMONG ADULTS ATTENDING BAY REGIONAL HOSPITAL IN BAIDOA DISTRICT, SOMALIA. A CROSS-SECTIONAL STUDY.

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Abstract.

Aim.

The study aims to determine the individual factors associated with the occurrence of Typhoid Fever among adults attending Bay Regional Hospital in Baidoa district, Somalia.

Methods.

A cross-sectional design was used in this study as it is the most relevant design when assessing the prevalence of diseases and it is particularly useful in informing the planning and allocation of health resources.

Results.

The results obtained indicated that the occurrence of typhoid fever was about twice more likely to be experienced by males (corrected odds ratio, COR = 2.2551, 80% CI = 0.5820, 8.7373) who are aged 19-30 years (COR = 2.0660, 80% CI = 0.5868, 7.2734) than females. Families with a household size of 7-9 people were about 3.5 times more likely to have typhoid (COR = 3.7522, 80% CI = 1.8104, 7.7771) and this was significant (P = 0.020). Unlike initially hypothesized, depending on donation (COR = 0.5660, 80% CI = 0.3120, 1.0267), the household's monthly income (COR = 0.6980, 80% CI = 0.2719, 1.7922) and having no toilet (COR = 0.7790, 80% CI = 0.1370, 2.8138) had no independent associations with the occurrence of typhoid fever.

Conclusion.

The occurrence of typhoid fever was independently associated with males aged 19-30 years, families with household size of 7-9 people, not washing hands, and absence of clean water and sanitation facilities presented twice the risk of contracting typhoid fever.

Recommendation.

This study recommends that maintaining a lower household size and effective implementation of government policies on typhoid prevention could be effective strategies for the prevention of typhoid fever among adults attending the Medical Outpatient Unit at Bay Regional Hospital.

Keywords: *Individual Factors, Typhoid Fever, Bay Regional Hospital, Baidoa District, Somalia*.
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Background.

The bacteria *Salmonella enterica typhi* is one of three species of the *Salmonella* genus; together these diseases are known as salmonellosis. Typhus in Greek means 'to smoke' or 'cloud' or 'vapor.' Typhoid fever was thought to have been transmitted through a cloud of sickness known as miasma. The *Salmonella typhi* bacteria are an obligate parasite with no other known reservoir outside of humans. After recovering from an infection, 3-5% of humans become carriers of the disease. The bacteria infect the intestinal tract and occasionally the bloodstream (Getachew & Wale et al, 2018). There are over 100 strains of *Salmonella typhi* but only a few strains cause typhoid fever. 100,000 organisms of *Salmonella typhi* make up an infectious dose, and the disease is typically spread through the feces and urine of infected people in contaminated food and water (Lutui, & Ofanoa, et al. 2019). Reports by the International Committee of the Red Cross (ICRC) released 50 years after the incident revealed that the Israeli forces, at the siege of Acre in 1948, released typhoid bacteria into the city's water supply. According to Dr. Uri Milstein, an Israeli historian, a typhoid outbreak seized the city a few days before the city fell. Israeli soldiers disguised as Arabs were caught on 23 May 1948 in Gaza near wells. Egyptian authorities maintained these soldiers carried liquid with dysentery and typhoid bacteria. The Israeli soldiers were charged,

convicted, and executed (Hossain, & Goswami, et al. 2021). Several socio-demographic factors are believed to be associated with typhoid fever among adults. These include age, marital status, household income, occupation, educational level, number of people in the household, residence, knowledge, and perceptions. The study aims to determine the individual factors associated with the occurrence of Typhoid Fever among adults attending Bay Regional Hospital in Baidoa district, Somalia.

Methods.

Research Design.

This study was a health facility-based cross-sectional study. It adopted a quantitative research approach. The quantitative approach enabled the collection and analysis of data in a numerical form, permitting the investigation of the factors associated with the occurrence of typhoid fever among adults attending Bay Regional Hospital (BRH) Medical Outpatient Unit in Baidoa district, Somalia. A cross-sectional design was used in this study as it is the most relevant design when assessing the prevalence of diseases and it is particularly useful in informing the planning and allocation of health resources (Black & Levine et al., 2020).

Description of the study area.

This study was carried out at the BRH Medical Outpatient Unit in the Baidoa district of the Bay region in Somalia. BRH is the largest hospital in the Baidoa district which serves a high number of outpatients suffering from different illnesses. The medical records at the hospital indicated high cases of typhoid fever registered among adults. The hospital thus served as an ideal study area for understanding the occurrence of typhoid and its associated factors among adults in Baidoa district which is the largest hospital in Baidoa district in the Bay region of Somalia.

Study population.

The study population consisted of adult patients attending the BRH medical outpatient unit. The study targeted patients who are 18 years and above attending the BRH medical outpatient unit. Before the patients enrolled and consented, they were briefed about the purpose of the study and asked if they could share their information on the illness or disease that had been diagnosed after medical examination with evidence of medical card/form or medical laboratory results. This is because typhoid fever is confirmed through proper medical laboratory tests using viable reagents. The adult outpatients were chosen because they come with a diverse range of diseases among which typhoid is one of them which has been reported to be among the major cases at the hospital thigh the actual statistics are not indicated. Based on the records at the BRH medical outpatient unit, an average number of 400 patients are registered in a period of two weeks. The 400 patients were used as the accessible population for the study.

Inclusion criterion.

Outpatients who have their demographic and other information about the illness being treated and consented are included in the study.

Exclusion criterion.

All inpatients and outpatients and those outpatients who did not have consent or were found to be too ill to participate in the study were excluded.

Sample size.

The study sample size was calculated based on the Yamane (1967) formula that assumes a 95% confidence level.

$$n = \frac{N}{1+N(e^2)}$$

Where N is the total number of patients is the sample size to be determined and e is the level of precision. The formula is applied to the total number of adult patients attending BRH at a precision level of 0.05.

$$n = \frac{400}{1 + 400(0.05)^2}$$

$$n = \frac{400}{2}$$

$$n = 200$$

Therefore, a total of 200 adult patients were recruited for this study.

Sampling procedure.

A simple random sampling method was employed to select the study respondents. A total number of 200 respondents were selected to participate in the study and this number was large enough to provide meaningful results related to the study, but manageable in terms of data collection and analysis. All adult outpatients who turned up on the days of data collection were briefed about the study and those who consented were given identifiable numbers for random selection purposes.

Data Collection Methods and Instruments.

Survey.

The study adopted a quantitative method of data collection. The study used the survey method to collect data because it allows for the collection of large amounts of data from the respondents in a short period. Survey questionnaires are also cheap and fast to distribute, allowing respondents to fill out information in a short period.

Questionnaire.

This study used a researcher-administered questionnaire. The questionnaire was directly administered to the study participants by the researcher. The questionnaire contained four sections; Section A captured data on socio-demographic factors, Section B captured data on environmental factors, section C captured data on

institutional factors and Section D captured data on the occurrence of typhoid in adults. Data on typhoid fever occurrence was captured based on the information provided by the outpatients at the BRH medical outpatient unit who consented to share the information contained in the treatment/medical forms with the researcher detailing the medical condition diagnosed or being treated. The data captured contained all the medical conditions being treated.

Validity and Reliability.

The data quality control was achieved by ensuring the validity and reliability of the data collection instruments.

Validity.

Validity is the appropriateness of the instrument. This study used the content validity index (CVI) as it is the most widely use index in quantitative evaluation. Content validity refers to the extent to which the items on a test are fairly representative of the entire domain the test seeks to measure (Salkind, 2010). Salkind recommends that an instrument with an average index of 0.7 or above be considered valid. Two experts in the field of typhoid fever and related diseases were consulted to assess the validity of the tool by identifying the relevant items. The content validity index (CVI) was then computed as follows;

$$CVI = \frac{\text{Number of items declared valid}}{\text{Total number of items}}$$

$$= \frac{17}{20}$$

$$= 0.85 \times 100$$

$$= 85$$

Therefore, a CVI of 0.85 was attained which implied that the instrument will be valid as recommended by Salkind (2010).

Reliability.

Reliability refers to the consistency of the instrument in measuring whatever it is intended to measure. Beck et al. (1996) provide that the reliability of an instrument indicates the stability and consistency with which the instrument measures the concept and helps to assess the goodness of a measure. The researcher used the inter-rater method to assess the reliability of the tool. The researcher consulted professionals in treating typhoid fever and other medical personnel to rate the study instruments based on their experiences. The views of the experts (medical professionals and public health workers) were used to harmonize and come up with a reliable research instrument (questionnaire).

Data Collection Procedure.

Data collection is the process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer stated research questions, test hypotheses, and evaluate outcomes. The researcher sought approval from Kampala University, School of Graduate Studies Research Committee. Thereafter, permission was sought through the IRB, after which a letter from the Dean of Kampala University was issued to the researcher that was presented to the administration of Baidoa District.

The questionnaires were administered to consenting participants in a language locally understood by them. The collected data were cross-checked by the data collectors immediately after finalizing the questionnaire. Data completeness, quality, and consistency were checked daily.

Data Analysis.

The collected data were cleaned and entered into an Excel sheet from where it was exported into SPSS (version 20.0, IBM Inc.) for analysis. The data were analyzed using descriptive and inferential statistics. Descriptive analysis included the expression of data as percentages and frequencies of the study variables. The explanatory variables were classified into three major categories: Individual, Community, and Institutional factors. Independent variables were tested for association with dependent variable (occurrence of typhoid fever) using odds ratio and Binary logistic regression analysis. Multivariable logistic regression analysis was conducted to identify factors associated with the occurrence of typhoid fever among adults specifically considering those variables with p-values less than 0.05 in bivariate regression. The p-values less than 0.05 will be considered significant in the multivariable regression to establish the association between the study factors and typhoid occurrence.

Results.

Socio-demographic profile and characteristics of the respondents.

A total of 200 respondents participated in the study. The majority (58.0%, 116/200) of the participants were males and the rest were females (42.0%, 84/200). The age of the participants ranged from 19 to 78 years with a mean age of 33.91±11.56 years (Table 1). Most respondents were in the age bracket of 31-40 years and were mostly married (43.5%, 87/100) or single (37.5%, 75/200). Over 70% of the study participants were able to read and write, with 45% of these having attended tertiary level of education.

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Table 1. Socio-demographic profile of the participants (n = 200).

Characteristics	category	Frequency	Proportion (%)
Gender			
	Female	84	42
	Male	116	58
Age (years)			
	19-30	111	55.5
	31-40	38	19.0
	41-50	33	16.5
	51-60	13	6.5
	61 and above	5	2.5
Marital status			
	Married	87	43.5
	Single	75	37.5
	Divorced	32	16.0
	Widowed	06	3.0
Educational level			
	Primary	34	17.0
	Secondary	32	16.0
	Tertiary	85	42.5
	None	49	24.5
Household size (people)			
	1-3	53	26.5
	3-5	43	21.5
	5-7	48	24.0
	7-9	56	28.0
Source of income			
	Business	60	30.0
	Family	54	27.0
	Service	33	16.5
	Labor class	23	11.5
	Donation	15	7.5
	Farmer	15	7.5
Monthly household income (Somali shillings)			
	Less than 2,700,00	81	40.5
	2,7000,000-8,073,000	68	34.0
	More than 8,073,000	51	25.5

Occurrence of typhoid fever among adults attending the Medical Outpatient Unit at Bay Regional Hospital.

Out of the 200 respondents, 44% (n = 88) indicated that they had a fever or body temperature greater than 37.5 degrees centigrade when they reported to the Medical Outpatient Unit at Bay Regional Hospital. Of these, 94.3% (83/88) were diagnosed with typhoid fever (Figure 1). Seventy-nine (79) respondents, representing 89.9% indicated that they or someone they knew had ever had typhoid after receiving the typhoid vaccine.

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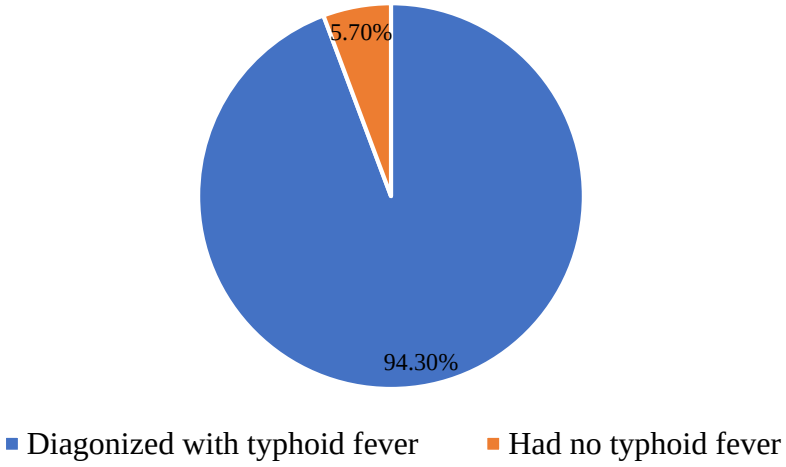
Figure 1. Occurrence of typhoid fever among adults attending the Medical Outpatient Unit at Bay Regional Hospital.



Individual factors associated with the occurrence of typhoid fever among adults attending the Medical Outpatient Unit at Bay Regional Hospital.

In this study, the individual factors associated with the occurrence of typhoid fever among adults attending the Medical Outpatient Unit at Bay Regional Hospital were assessed (Table 2). The results obtained indicated that the occurrence of typhoid fever was about twice more likely to be experienced by males (corrected odds ratio, COR = 2.2551, 80% CI = 0.5820, 8.7373) who are aged 19-30 years (COR = 2.0660, 80% CI = 0.5868, 7.2734) than females. Families with a household size of 7-9 people were about 3.5 times more likely to have typhoid (COR = 3.7522, 80% CI = 1.8104, 7.7771) and this was significant (P = 0.020). Unlike initially hypothesized, depending on donation (COR = 0.5660, 80% CI = 0.3120, 1.0267), the household's monthly income (COR = 0.6980, 80% CI = 0.2719, 1.7922) and having no toilet (COR = 0.7790, 80% CI = 0.1370, 2.8138) had no independent associations with the occurrence of typhoid fever. Lastly, not washing hands (COR = 2.3154, 80% CI = 1.3266, 4.0935) probably due to the absence of clean water and sanitation facilities (odds ratio = 1.8725, 80% CI = 0.2021, 2.9354) presented twice the risk of contracting typhoid fever.

Table 2 Individual factors associated with the occurrence of typhoid fever among adults attending the Medical Outpatient Unit at Bay Regional Hospital

Variable	Category	Frequency (n=%)	Occurrence of typhoid fever		COR (80% CI)	P-Value
			Yes	No		
Gender	Female	84 (42%)	126	74	0.5820, 8.7373	0.442
	Male	116 (58%)				
Age (years)	19-30	111 (55.5%)	126	74	0.5868, 7.2734	0.46
	31-40	38 (19.0%)				
	41-50	33 (16.5%)				
	51-60	13 (6.5%)				
	61 and above	5 (2.5%)				
Level of education	Primary	34 (17.0%)				
	Secondary	32 (16.0%%)				
	Tertiary	85 (42.5%)				
	None	49 (24.5%)	126	74	0.4068, 1.7522	0.766
Household size (people)	1-3	53 (26.5%)				
	3-5	43 (21.5%)				
	5-7	48 (24.0%)				
	7-9	56 (28.0%)	126	74	1.8104, 7.7771	0.020*
Source of income	Business	60 (30.0%)				
	Family	54 (27.0%)				
	Service	33 (16.5%)				
	Labor class	23 (11.5%)				
	Donation	15 (7.5%)	126	74	0.2719, 1.7922	0.625
	Farmer	15 (7.5%)				
Monthly household income (Somali shillings)	Less than 2,700,00	81 (40.5%)	126	74	0.3120, 1.0267	0.221
	2,7000,000-8,073,000	68 (34.0%)				
	More than 8,073,000	51 (25.5%)				
Washing hands	Yes	171 (85.5%)				
	No	29 (14.5%)	126	74	1.3266, 4.0935	0.054
Having a toilet	Yes	132 (66.0%)				
	No	68 (34.0%)	126	74	0.1370, 2.8138	0.686
Clean water and sanitation facilities	Yes	136 (68.0%)				
	No	64 (32.0%)	126	74	0.2021, 2.9354	0.803

Note: COR = Corrected odds ratio, CI = Confidence interval, *statistically significant at p < 0.05.

Discussion.

Socio-demographic characteristics of respondents in the study among adults attending the Medical Outpatient Unit at Bay Regional Hospital.

The demographic characteristics of the respondents in this study were profiled. In comparison to a similar study in Nyahururu Municipality, Kenya, 52.0% of the respondents were females (Kibiru, 2011). In other reports from Lalo Assabi District and Ambo Hospital (Ethiopia), Eba and Bekele (2019) and Deksissa and Gebremedhin (2019) reported that females (54.5% and 59.1%, respectively) were the dominant respondents which are not in agreement with the results obtained in this study. Only one study in the Gombe metropolis, Nigeria (Tawfiq et al., 2022) indicated that males constituted more than half of the respondents

(51.7%) which is similar to the results obtained in this study. Regarding the ages, Eba and Bekele (2019) and Tawfiq et al. (2022) cited that most of the respondents in their studies were aged between 28-37 years and 18-35 years, which is similar to the age bracket of 31-40 years reported in this study. In terms of education levels, a study in Ethiopia found that the majority (30.2%) of the respondents attained secondary school and the lowest percentage (5.5%) of respondents were illiterate (Eba and Bekele, 2019). In this study, however, 24.5% of the participants had not attended any education. This is also reflected in the high levels of participants being into business (30.0%) with less than 2,700,00 Somali shillings earned per month. These results are divergent from that of Eba and Bekele (2019) where the majority (56.5%) of the participants were earning medium income (1500-2000 Birr per month), with 19.6% being grouped under low income (<1500 Birr per month).

For the occurrence of typhoid, 83 respondents representing 94.3% of the diagnosed patients had typhoid characterized by fever and high body temperatures. These results resonate well with a previous report by Mulu et al. (2021) at Injibara General Hospital, Northwest Ethiopia where more than 59.1-90.7% of study participants knew about typhoid fever and its mode of transmission. Eba and Bekele (2019) also reported that 54.9% of the patients interviewed in Lalo Assabi District, West Wollega, Oromiya, Ethiopia had typhoid fever based on clinical examination and serological test results. In comparison to our results, the number of patients who had been diagnosed with typhoid was lower than reported in most previous studies, plausibly due to differences in the sampling size and the study area characteristics.

Individual factors associated with the occurrence of typhoid fever among adults attending the Medical Outpatient Unit at Bay Regional Hospital.

Regarding the individual factors associated with the occurrence of typhoid fever among adults attending the Medical Outpatient Unit at Bay Regional Hospital, we found that males aged 19-30 years had higher odds of getting typhoid than females. Vollaard et al. (2004) and Deksissa et al. (2019) found similar results where age was a major predictor of typhoid fever (in Jakarta, Indonesia) and enteric fever seropositivity among febrile patients at Ambo Hospital, Ethiopia (adjusted odds ratio = 2.45; 95% CI = 1.38–4.37; P = 0.002), respectively. These results also support the literature that higher fatality rates due to typhoid fever occur in males than females (Dewan et al., 2013; Hechaichi et al., 2023; Kabwama et al., 2017). Moreover, the occurrence of typhoid in endemic areas is expected to be highest in individuals in the age bracket of 5 to 19 years of age i.e., school-aged children and youths (Kabwama et al., 2017; Kim et al., 2022). The risk is exacerbated in individuals with preexisting diseases and conditions such as malaria, compromised immunity (HIV), hemoglobinopathies, biliary and urinary tract abnormalities, schistosomiasis, and histoplasmosis (Colomba et al., 2008; Keddy et al., 2016).

In regards to family size, previous reports have cited that household contact is the core risk factor associated with the spread of typhoid (Akwa et al., 2021). Vollaard et al. (2004) found that the prevalence of typhoid was higher in households containing more than 6 members, which is similar to the observation in this study. Jakopo et al. (2014) found that having more than 4 members in a household (Odds ratio = 12.87, 95%CI = 4.00, 5-41.10) was one of the risk factors for contracting typhoid among residents of Bluegrass Resettlement Area, Sanyati District, Zimbabwe. It is positioned that crowding could be the risk factor associated with typhoid fever among households (Hosoglu et al., 2006).

Depending on the donation, the household's monthly income and having no toilet were not associated with the occurrence of typhoid fever. Gasem et al. (2004) earlier established that being unemployed or having only a part-time job (odds ratio = 31.3; 95% CI = 3.08-317.4) were pertinent risk factors associated with typhoid fever occurrence among inhabitants of Semarang, Indonesia. It would be expected that individuals who survive on donations also live under poor conditions (such as inadequate hygienic habits, crowded households, poor handwashing habits, not covering food, as well as coming into contact with typhoid fever-infected individuals) so that incidences of typhoid and other such diseases should be much higher (Batool et al., 2022; Hechaichi et al., 2023; Im et al., 2022; Jenkins et al., 2019; Khan, 2022; Penrose et al., 2010; Tran et al., 2014; Vollaard et al., 2004).

It was striking to find that not washing hands and the absence of clean water and sanitation facilities presented twice the risk of contracting typhoid fever. Similar results have been reported elsewhere. For example, Tran et al. (2005) found that drinking untreated water in Son La province, Vietnam (odd ratio = 3.9, 95% CI 2.0-7.5, P < 0.001) was associated with the occurrence of typhoid fever. Gasem et al. (2004) also reiterated that never or rarely washing hands before eating (Odds ratio = 3.28; 95% CI = 1.41-7.65), absence of water supply from the municipal network (OR = 29.18; 95% CI = 2.12-400.8) as well as presence of open sewers (OR = 7.19; 95% CI = 1.33-38.82) were associated with typhoid fever occurrence in Semarang, Indonesia. At Adare General Hospital (Ethiopia), patients who did not practice hand washing, especially after using the latrine were 9.76 times (odds ratio = 9.76, 95% CI = 1.13, 84.47, P = 0.038) more likely to have *Salmonella typhi* infection when compared with their counterparts (Awol et al., 2021). Regarding clean water, Kim et al. (2023) indicated that the use of metal coverage of water storage and keeping water containers covered were associated with around 80% lower odds of having typhoid fever. Such results suggest that ensuring access to piped, treated, and

clean water, and improving drinking water quality could be prioritized to reduce the incidences of typhoid fever in the study area (Bennett et al., 2018; Kim et al., 2023; Lee et al., 2013; Mogasale et al., 2018).

Of all the factors, only household size had a significant association with the occurrence of typhoid fever. Upon adjustment for those significantly associated variables using multivariable logistic regression analysis, the association between the occurrence of typhoid fever and household size remained statistically significant (P = 0.00). This suggests that individuals having big household sizes may be at higher risk of contracting typhoid, which is consistent with previous studies (Akwa et al., 2021; Hosoglu et al., 2006; Vollaard et al., 2004).

CONCLUSIONS.

The occurrence of typhoid fever was independently associated with males aged 19-30 years, families with household size of 7-9 people, not washing hands, and absence of clean water and sanitation facilities presented twice the risk of contracting typhoid fever. However, only household size is a significant contributor to the occurrence of typhoid at the multivariate regression level.

RECOMMENDATIONS.

This study recommends that maintaining a lower household size and effective implementation of government policies on typhoid prevention could be effective strategies for the prevention of typhoid fever among adults attending the Medical Outpatient Unit at Bay Regional Hospital.

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Conflict of interest.

The authors have no competing interests to declare.

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