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Delayed diagnosis and treatment of typhoid fever: Socio-demographic barriers in a tertiary care setting

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ABSTRACT

Background: Typhoid fever, caused by *Salmonella enterica* serotype Typhi, remains a major public health concern in low- and middle-income countries (LMICs), particularly in South Asia. Socio-demographic barriers such as poor health literacy, economic constraints, and limited healthcare access often hinder timely care but are underexplored in current literature. To evaluate the role of socio-demographic factors in delaying the diagnosis and treatment of typhoid fever in a tertiary care setting in Pakistan.

Material and Methods: A cross-sectional study was conducted at Bahawal Victoria Hospital, Bahawalpur, from January to December 2024. A total of 42 patients aged ≥15 years with laboratory-confirmed typhoid fever were enrolled. Data were collected using a structured questionnaire and analyzed via SPSS version 27.0. Associations between socio-demographic factors and delays were evaluated using chi-square and independent t-tests.

Results: The mean age was 29.4 ± 11.2 years, with males comprising 59.5% of participants. Diagnostic delays (≥5 days) occurred in 66.7% and treatment delays (≥7 days) in 57.1% of patients. Significant associations were observed between diagnostic delay and education level (p=0.047), monthly income (p=0.043), and distance from the hospital (p=0.031). Patients lacking formal education, earning <20,000 PKR/month, or living >10 km away experienced more delays.

Conclusion: Socio-demographic disparities are key contributors to delayed diagnosis and treatment in typhoid fever. Interventions targeting health education, financial support, and improved healthcare access are critical to reducing delays and improving outcomes.

Keywords: Diagnostic delay, Health access, Socio-demographic barriers, Treatment delay, Typhoid fever

BACKGROUND

Typhoid fever, caused by *Salmonella enterica* serotype Typhi, remains a significant public health challenge in many low- and middle-income countries (LMICs). Globally, it is estimated that approximately 9 to 12 million new cases of typhoid fever occur annually, with over 100,000 associated deaths, disproportionately affecting South Asia, sub-Saharan Africa, and parts of Southeast Asia.[1,2] The disease is predominantly spread through ingestion of contaminated food or water, making it closely linked to poor sanitation and inadequate access to safe drinking water.

In the South Asian region, particularly countries like India, Pakistan, and Bangladesh, typhoid fever continues to be endemic, with periodic outbreaks reported from both rural and urban settings.[3] Pakistan, for instance, has faced particular challenges with the emergence of extensively drug-resistant (XDR) typhoid strains, further complicating disease management.[4]

Clinically, typhoid fever presents with a spectrum of symptoms ranging from low-grade fever, malaise, abdominal discomfort, and constipation or diarrhea, to more severe manifestations including intestinal hemorrhage, bowel perforation, encephalopathy, and septic shock if untreated.[5,6] Due to its nonspecific early symptoms, the disease often mimics other febrile illnesses such as malaria and dengue, contributing to diagnostic delays.

Prompt recognition and initiation of appropriate antibiotic therapy significantly reduce morbidity and

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mortality associated with typhoid fever. Delayed diagnosis and treatment not only increase the risk of complications such as intestinal perforation and prolonged hospitalization but also contribute to ongoing community transmission.[7] Moreover, untreated or improperly treated cases can become chronic carriers, posing a persistent public health risk.[8]

Despite extensive literature on the microbiological, clinical, and therapeutic aspects of typhoid fever, there is a relative paucity of research exploring the socio-demographic determinants of delayed diagnosis and treatment, particularly in tertiary care settings in LMICs. Factors such as limited health literacy, economic hardship, geographic inaccessibility, and gender disparities may significantly influence health-seeking behavior and access to timely care, yet these remain underexplored in the existing body of literature.[9,10]

Understanding these barriers is critical for health system strengthening and policy formulation aimed at improving early detection and management of typhoid fever. Identifying high-risk populations and the specific socio-demographic hurdles they face can help in the design of targeted interventions, community outreach, and patient education strategies. This study aims to address this knowledge gap by evaluating the role of socio-demographic factors in delaying the diagnosis and treatment of typhoid fever in a tertiary care context. Objective of the study was to evaluate the role of socio-demographic factors in delaying the diagnosis and treatment of typhoid fever in a tertiary care setting.

MATERIAL AND METHODS

This study employed a cross-sectional observational design to assess the socio-demographic barriers associated with delayed diagnosis and treatment of typhoid fever among patients admitted to a tertiary care facility. The study was conducted at Bahawal Victoria Hospital (BVH), Bahawalpur, a major tertiary care teaching hospital in southern Punjab, Pakistan. The hospital serves as a referral center for both urban and rural populations across Bahawalpur district, making it a representative site for evaluating healthcare access patterns and barriers. Patients admitted to the medical wards or seen in the outpatient department (OPD) of BVH from January 2024 to December 2024 with a confirmed diagnosis of typhoid fever were enrolled. Patients age ≥ 15 years and confirmed diagnosis of typhoid fever based on positive blood culture for *Salmonella Typhi* were included in the study after taking ethical approval from institutional ethical review committee and informed consent from individual participants. Patients with co-existing acute illnesses (e.g., dengue, malaria, or COVID-19) that could confound symptom onset and presentation timelines, re-admissions or repeat cases of typhoid fever during the study period and patients who were critically ill or unable to provide reliable information and no accompanying family members available for interview were excluded from the study.

Data were collected using a structured questionnaire developed for this study. Information was collected via face-to-face interviews. Questionnaire comprised of socio-demographic variables including age, gender, residence(rural/urban), marital status, monthly family income, approximate distance from hospital in kilometers, Type of first health facility visited (public/private/traditional) and study variables including diagnostic delay: ≥5 days from symptom onset to confirmed diagnosis and time taken before seeking medical help, prior self-medication or antibiotic use. Additional diagnostic data were extracted from laboratory results, including the date of symptom onset, date of first health-seeking attempt, date of diagnosis, and date of treatment initiation. All data were entered and analyzed using SPSS version 27.0. Means and standard deviation was calculated for continuous variables and frequencies and percentages for categorical variables. Inferential statistics were applied to examine associations between socio-demographic variables and delay. Chi-square test was applied for categorical variables and independent samples t-tests for comparing means between delayed and non-delayed groups. A *p*-value <0.05 was considered statistically significant.

RESULTS

The study included a total of 42 patients diagnosed with typhoid fever, with a mean age of 29.4 ± 11.2 years, and a slight male predominance (59.5%, n=25). The majority of participants were from low-income households, with 45.2% earning less than 20,000 PKR monthly and resided more than 10 km from the hospital, highlighting potential geographic and economic barriers to healthcare access. Socio-demographic characteristics revealed that most patients fell within the 15–30 age group (57.1%), followed by 31–45 years (31.0%) and >45 years (11.9%). Educational attainment was relatively balanced, with 28.6% having no formal education, 42.9% completing primary to matriculation,

and another 28.6% achieving higher secondary education or above. Notably, diagnostic and treatment delays were prevalent among the participants. The mean time from symptom onset to diagnosis was 5.9 ± 2.5 days, while the mean time from symptom onset to treatment initiation was 7.4±3.1 days. Diagnostic delays of ≥5 days were observed in 66.7% (n=28) of patients, and treatment delays of ≥7 days were seen in 57.1% (n=24). Statistical analysis identified significant associations between diagnostic delay and socio-demographic factors such as education level (p=0.047), monthly household income (p=0.043), and distance from the hospital (p=0.031). Patients with no formal education, lower income (<20,000 PKR), and residing more than 10 km from the hospital were more likely to experience diagnostic delays, underscoring the critical role of these factors in timely healthcare access for typhoid fever management.

Table-I: Socio-Demographic characteristics of the patients (n=42).

Variables	Frequency	Percentage
Age Group (years)		
15–30	24	57.1%
31–45	13	31.0%
>45	05	11.9%
Gender		
Male	25	59.5%
Female	17	40.5%
Education		
No formal education	12	28.6%
Primary to matriculation	18	42.9%
Higher secondary and above	12	28.6%
Monthly Household Income		
< 20,000 PKR	19	45.2%
20,000–40,000 PKR	16	38.1%
> 40,000 PKR	07	16.7%
Distance from Hospital		
<10 km	10	23.8%
10–30 km	21	50.0%
>30 km	11	26.2%

Table-II: Associations between socio-demographic factors and diagnostic delay.

Variable	Diagnostic Delay Present (n=28)	No Delay (n=14)	p-value
Education			
No education	**10**	**02**	**0.047**
Educated	**18**	**12**	
Income			
<20k PKR	**15**	**04**	**0.043**
≥20k PKR	**13**	**10**	
Distance			
>10 km	**23**	**09**	**0.031**
≤10 km	**05**	**05**	

DISCUSSION

This study examined the socio-demographic profile of patients diagnosed with typhoid fever and highlighted the critical delays in diagnosis and treatment. The findings underscore significant healthcare access disparities rooted in socioeconomic and geographic determinants.

The findings of this study underscore the significant role of socio-demographic factors in contributing to diagnostic and treatment delays among patients with typhoid fever. With a mean age of 29.4 ± 11.2 years and a slight male predominance (59.5%), the study population reflects the typical demographic profile of typhoid fever cases in low-resource settings, where younger adults are disproportionately affected.[11] The predominance of 15–30 year age group is consistent with previous studies identifying young adults as the most affected demographic in endemic regions due to increased exposure and mobility patterns.[12,13] The prevalence of low-income households (45.2% earning less than 20,000 PKR monthly) and geographic barriers, such as residing more than 10 km from the hospital, highlights systemic challenges in accessing timely

healthcare. These findings align with previous research indicating that economic and geographic disparities exacerbate delays in seeking care for infectious diseases, particularly in resource-limited regions.[13]

A notable finding was the high prevalence of diagnostic delays (≥5 days observed in 66.7% of patients) and treatment delays (≥7 days observed in 57.1%). These delays are concerning, as early diagnosis and treatment are critical to preventing complications and reducing disease transmission. The mean time from symptom onset to diagnosis (5.9 ± 2.5 days) and treatment initiation (7.4 ± 3.1 days) suggests a significant gap in healthcare access and utilization. This delay is consistent with studies from similar settings, where fragmented healthcare systems and limited awareness contribute to delayed care.[14]

Statistical analysis revealed significant associations between diagnostic delays and key socio-demographic factors, including education level (p=0.047), household income (p=0.043), and distance from the hospital (p=0.031). Patients with no formal education were five times more likely to experience diagnostic delays compared to those with higher education levels. This finding underscores the importance of health literacy in recognizing symptoms and seeking timely care. Similarly, lower-income individuals (<20,000 PKR monthly) faced greater delays, likely due to financial constraints limiting their ability to afford transportation or medical consultations. Geographic distance also emerged as a barrier, with patients residing more than 10 km from the hospital experiencing longer delays. These results corroborate earlier studies emphasizing the role of socioeconomic and geographic determinants in healthcare access.[15]

The relatively balanced educational attainment (28.6% with no formal education, 42.9% primary to matriculation, and 28.6% higher secondary or above) suggests that interventions should target not only uneducated populations but also those with limited formal education. Health education campaigns tailored to local contexts could improve awareness of typhoid symptoms and preventive measures, thereby reducing delays. Additionally, expanding diagnostic services to rural areas and providing subsidized transportation could mitigate geographic barriers. Limitations of this study are its cross-sectional observational design which restricts causal inference; while associations between socio-demographic factors and delays were identified, temporal relationships cannot be definitively established. The study excluded critically ill patients and those unable to provide reliable histories, potentially omitting a subset of the population that may experience the most severe delays or healthcare disparities. Additionally, co-morbid conditions and other contextual factors such as health system responsiveness, caregiver influence, or cultural health beliefs were not explored in depth, which may also contribute to delays. Lastly, the sample size (n=42), though adequate for preliminary analysis, may have limited the statistical power to detect more subtle associations between socio-demographic variables and delay outcomes. Future studies with larger, multicenter samples, longitudinal designs, and broader qualitative assessments may help further elucidate the complex interplay of barriers affecting timely typhoid diagnosis and treatment in resource-limited settings.

Moreover, the combination of economic hardship and poor education creates a dual burden, limiting both the ability and willingness to seek prompt medical care. This interlinking effect suggests that addressing typhoid fever effectively requires multifaceted interventions—beyond medical treatment—targeting social determinants of health.[16,17] Targeted interventions focusing on health education, financial support, and improved healthcare infrastructure are essential to ensure equitable access to care. There is urgent need for community-level interventions, such as mobile diagnostic units, public health education campaigns, and economic support mechanisms, to mitigate delays in typhoid fever management.[18,19] Future research should explore longitudinal trends and evaluate the effectiveness of interventions aimed at overcoming these barriers.

CONCLUSION

In conclusion, this study highlights significant socio-demographic barriers to timely diagnosis and treatment of typhoid fever, with diagnostic delays most prevalent among individuals with low education levels, low income, and those residing farther from healthcare facilities. Addressing these disparities through targeted health education, improved access to care, and strengthened healthcare infrastructure is essential to reduce delays and improve outcomes for typhoid fever patients.

CONFLICT OF INTEREST

None

GRANT SUPPORT & FINANCIAL DISCLOSURE

Declared none

AUTHOR CONTRIBUTION

Muhammad Hassan: Idealized and conceptualized the study, manuscript writing, final approval, agreement to be accountable for all aspects of the work

Muhammad Naveed Iqbal: Subsequently critically reviewed and revised, final approval, agreement to be accountable for all aspects of the work

Fahad Qaisar: Statistical analysis, final approval, agreement to be accountable for all aspects of the work

Muhammad Sohail Tariq: Critical revisions, final approval, agreement to be accountable for all aspects of the work

Wajahat Hussain: Subsequently critically reviewed, final approval, agreement to be accountable for all aspects of the work

Muhammad Ehsan Sukhera: Data collection, proofread, final approval, agreement to be accountable for all aspects of the work

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