



## A CROSS-SECTIONAL STUDY OF SALMONELLA TYPHI ISOLATED FROM PATIENTS IN TERTIARY CARE HOSPITAL, NAWABSHAH PAKISTAN

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### Abstract

Typhoid fever, caused by Salmonella Typhi, is a significant public health issue, especially in regions with poor sanitation and limited access to clean water. This study examines the prevalence and socioeconomic determinants of Salmonella Typhi infections among 300 patients at a tertiary care hospital in Nawabshah, Pakistan, from December 12, 2022, to June 30, 2023. Using non-probability convenience sampling, data were collected and analyzed using SPSS Version 23. The study population comprised 37.3% males and 62.7% females, indicating a higher prevalence of typhoid fever among females. A majority of patients (59%) resided in urban areas. Educational attainment varied, with 29.6% having no formal education and 28% having only primary education. Occupationally, laborers represented the largest group (46.3%), followed by housewives (29.3%). Demographic study noted that 75.7% of the patients belong to the low socioeconomic category. To this effect, this study examines the influence of the demographic variables including gender, residential status, education, occupation and SES on typhoid fever incidence and control in GMA. These results suggest the need for focused efforts on modifying known health risk factors as well as other types of campaigns to raise health literacy. Elimination of inequalities and ill-health barriers that affect typhoid fever incidence in the study population based on age, gender and geographical location is also important when developing strategies for prevention and management. More studies are needed to establish the causes of these differences as this will provide the basis for development of programs and policies for addressing these statistics.

**Keywords:** Salmonella Typhi, public health, infections.

### Introduction

Typhoid fever remains a pertinent global health problem affecting populations significantly and holds a tremendous impact on the sphere of public health.<sup>1-3</sup> Its main effects are felt where there are poor or limited assessed and unavailable supplies of uncontaminated and safe water, which in turn compounds the consequences of this sickness.<sup>4,5</sup> Typhoid fever is acquired by the bacterium Salmonella Typhi with transmission attributed to the intake of food and water contaminated through human feces.<sup>6</sup> It is

an acute febrile ailment that presents with gastrointestinal symptoms, which may worsen by the development of life-threatening complications if appropriately unrecognized or unmanaged.<sup>7,8</sup> The epidemiology of typhoid fever particularly the frequency, rate of occurrence, and cost incurred show that there is a need to embrace practical measures that can aid in the control, packaged diagnosis, and treatment of this disease.<sup>9-11</sup>

Salmonella Typhi belongs to the microorganisms of the Gram-negative type, and it is the only bacterium causing the communicable disease called typhoid fever. It is specially designed to invade human beings and chiefly thrives in the human digestive system.<sup>12</sup> The facts listed above give Salmonella Typhi specific properties favoring its growth, colonization, invasion, and distribution throughout the human host. Some of the bacterial important factors and mechanisms that support its pathogenicity have been described as follows.<sup>5,13</sup> Knowledge and detailed understanding of the microbiology and life cycle of S. Typhi are important lessons in the, and hence the development of specific interventional measures and effective treatment modalities essential in the management of typhoid fever.<sup>3,9,14</sup>

In particular, knowledge of the annual proportion of Salmonella Typhi isolates and antibiotic gram is crucial for appropriate management of typhoid fever. It also assists in establishing the periodicity, giving an epidemiologic framework for measuring the magnitude of typhoid, and assessing control efforts.<sup>15</sup>

The main objectives of the present research is to determine the frequency of Salmonella Typhi isolates procured from those patients who are suffering from typhoid fever in a tertiary care teaching hospital located in Nawabshah. To achieve this aim, specific research questions relevant to the field will be posed and systematically answered. Firstly, the prospect of isolating Salmonella Typhi among the presented group of patients diagnosed with typhoid fever is to be determined by the study.

By following this method of posed inquiries, the investigation aims at narrowing down the findings and attaining critical advancements of understanding regarding the frequency of Typhi Salmonella in typhoid patients. The outcomes derived from this endeavor are poised to exert ramifications not only within the realm of clinical implementation but also within the broader scope of public health undertakings. The accumulation of empirical evidence shall serve as the bedrock upon which the formulation of tactics, grounded in rigorous analysis, is predicated. These stratagems, in turn, are anticipated to facilitate the enhancement of the modus operandi associated with the management and containment of typhoid fever, thereby aligning clinical procedures and public health measures with the tenets of empiricism.

## **Methodology**

Data on the frequency of Salmonella Typhi isolates were collected from typhoid patients at a tertiary care hospital in Nawabshah. This descriptive cross-sectional study was conducted from December 12, 2022, to June 30, 2023. Using the RaoSoft sample size calculator with a prevalence (P) of 26%, a confidence level of 95%, a margin of error of 5%, and a population size of 20,000, the required sample size was determined to be 292. To ensure robustness, a sample size of 300 was used. Non-probability convenience sampling was employed for participant selection.

The inclusion criteria included patients who met the clinical diagnosis criteria for typhoid fever, including patients fifteen years old and above, attending a tertiary care hospital in Nawabshah, Pakistan, and both male and female. Criteria for exclusion were active antibiotic treatment for typhoid fever before enrolment, patients with missing clinical data pertinent to this study, patients who defaulted from the study and did not consent for their samples to be used. The permission for conducting the study was sought and granted by the ethical review committee of PUMHS. Approval of the study was obtained from the institutional review board, and patient informed consent was sought from all patients or their next of kin if they were incompetent.

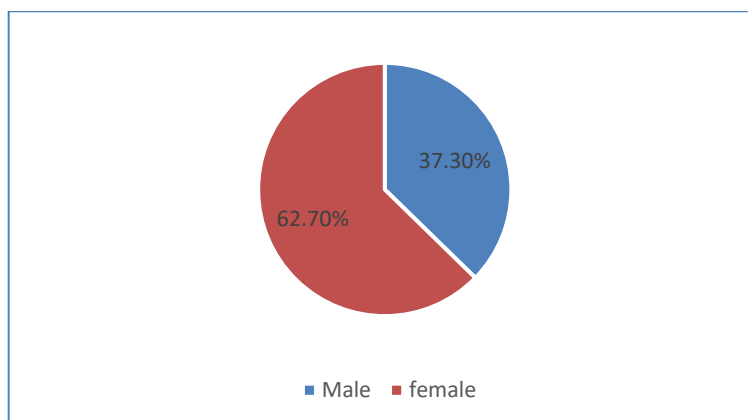
Hence an exposure bias was used to ensure identification of the necessary data sample from the target populace. Preparatory stage involved getting the adequate ethic clearance and permission, together with the protocol of the study formulated, and research crew recruited. Among the inclusion criteria developed include; The participant must be currently using an implant and willing to participate in

the study. Data collection instruments, such as structured questionnaires and data forms, were developed to gather demographic and clinical information. These instruments were pretested and refined based on feedback. Venous blood samples (10 ml) were collected from each participant using sterile disposable syringes. The samples were transferred into blood culture bottles and incubated at 35-37°C for 24 hours. After incubation, samples were checked for turbidity and subcultured on XLD, MacConkey Agar, and other biochemical media. Confirmed Salmonella Typhi growth was identified and documented. The collected data were entered into SPSS Version 23 for analysis. Data cleaning and preparation included checking for missing values, outliers, and inconsistencies. Descriptive analysis was performed to summarize sociodemographic and clinical variables, calculating frequencies, percentages, means, and standard deviations. The findings were interpreted in the context of the study objectives and relevant literature.

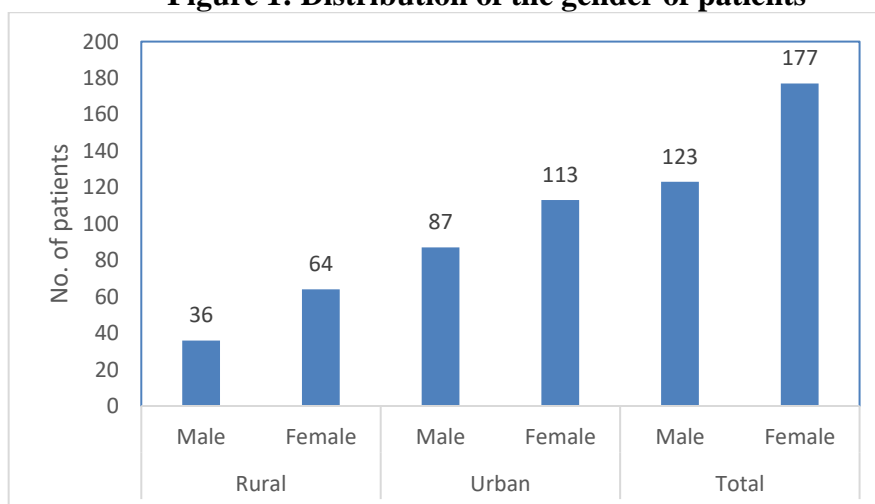
**Results**

In this study, we examined the demographic and socioeconomic characteristics of 300 patients diagnosed with typhoid fever at a tertiary care hospital. Out of the total patient population, 112 (37.3%) were male, and 188 (62.7%) were female, indicating a notable gender disparity with a higher proportion of female patients (Fig 1). This gender distribution could be influenced by various factors, including differences in health-seeking behaviors, biological susceptibility to infections, or differential exposure to risk factors between genders.

The residential distribution of the patients revealed that 123 (41%) resided in rural areas, whereas 177 (59%) were from urban areas (Fig 2). This suggests a higher incidence of typhoid fever cases among urban residents seeking medical care at the tertiary care hospital, indicating a potential urban predominance in the occurrence of typhoid fever within the study population.



**Figure 1: Distribution of the gender of patients**



**Figure 2: Distribution of the Residential status of patients**

The educational status of the patients was also assessed. Of the total 300 patients, 29.6% had no formal education, 28.0% had attained primary education, 21.3% had secondary education, and 21.1% had higher education, detail shown in table 1. The variation in educational status among patients may have implications for healthcare-seeking behavior and health awareness. Patients with higher educational levels might exhibit more proactive health-seeking behaviors, leading to early diagnosis and better disease management. Conversely, those with lower educational levels may face challenges in understanding healthcare information and accessing medical services promptly.

**Table1: Educational status of Salmonella typhi patients**

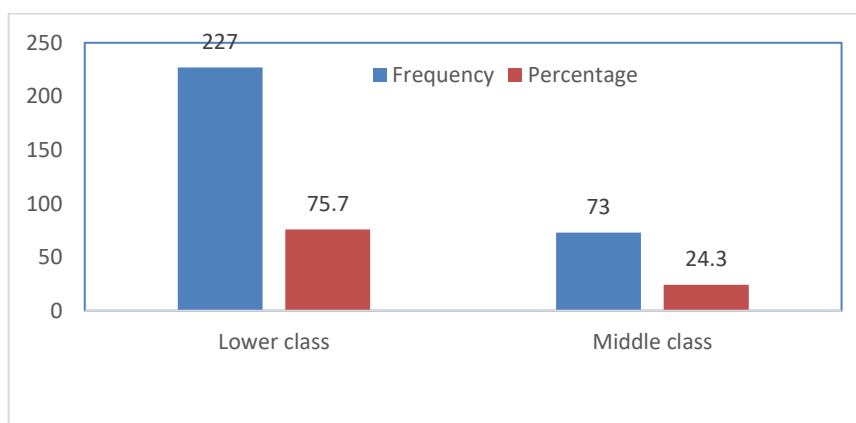
Educational status		No. of patients	%age
No education		89	29.6
Primary		84	28
Secondary		64	21.3
Higher	Matric	10	3.4
	Intermediate	22	7.3
	Graduation	31	10.4

Regarding occupational distribution, laborers constituted the largest group, accounting for 46.33% of the patients, followed by housewives at 29.33%. Other occupational groups included students (3.67%), employee (9.0%), and shopkeeper (6.67%), detail shown in table 2. These findings provide valuable demographic insights into the socio-economic background of typhoid fever patients in the study population.

**Table 2: Distribution of the Occupation of Salmonella typhi patients**

Occupation	No. of patients	%age
Labour	139	46.33
Housewives	88	29.33
Employee	27	9.0
shopkeeper	20	6.67
Students	11	3.67
Teacher	6	2.0
Peon	5	1.67
Farmer	4	1.33

Socioeconomic status was another critical factor examined in the study. A majority of the patients, 75.7%, belonged to the lower socioeconomic class, while 24.3% were from the middle socioeconomic class (Fig 2). The distribution based on socioeconomic status highlights significant implications for disease risk and healthcare access, as individuals from lower socioeconomic backgrounds may have limited access to healthcare resources and preventive measures.



**Figure 3: Distribution of the socioeconomic status of patients**

The demographic and socioeconomic analysis of typhoid fever patients at the tertiary care hospital underscores the influence of gender, residential area, education, occupation, and socioeconomic status on the prevalence and management of the disease. These findings emphasize the need for targeted public health interventions and educational programs to improve health outcomes for diverse population groups.

## Discussion

Typhoid fever due to *S. Typhi*, this is a major health challenge especially in the developing world due to inadequate sanitation and clean water supply. If allowed to progress through the infection cycle, these infections can cause significant morbidity and mortality in the affected individuals. Thus, the problems of enteric fever are most threatening in Asia, especially within the Indian region which has long become an area of endemicity.<sup>7,16</sup> Thus, enteric fever creates a significant public health problem and has a significant burden on the health systems in Pakistan.

Our research, carried out at a teaching hospital in Nawabshah, Pakistan, revealed 300 diagnostic findings of *Salmonella typhi* infection. It was also observed that out of the total patients treated, the majority of them were female patients (62. 7%) while male patients constituted only 37. 3% of total patients treated. This gender distribution is in contrast to some global studies thereby emphasizing the impact of regional characteristics, societal traditions and perceptions, as well as health-seeking behaviour preferences on the occurrence of typhoid fever.<sup>9,12</sup>

Prior studies have reported that the prevalence of typhoid fever in either gender has different results indicating that exposures and behaviors of different genders may vary and this may lead to different incidents of typhoid fever. For example, it may be acknowledged that males partake in more outdoor activities and take street foods and these are likely to contract typhoid fever. Research in Karachi has associated the consumption of street-vended food with the transmission of *Salmonella*-related infections, with this pointing towards the need for developing methods of sanitizing the foods that are sold in the streets.<sup>3,11</sup>

Pregnant women and individuals aged 18 to 35 years developed typhoid fever and for the trigonid number, a seasonal variance that was significantly higher during summer and monsoon was evident based on our findings. Such findings have also been observed in other companies and attributed to things like contaminated food and water intake coupled with flood-prone situations during monsoon period.<sup>4,15</sup>

In terms of residential distribution, most of the patients in our study represented the urban sector (59%) which reasonably signifies that the urbanization is a significant phenomenon in a majority of the developing countries including Pakistan. Urbanization could be another factor that boosted the typhoid fever cases in urban areas since patients living in these areas may access health facilities easily or water supply as well as sanitation may be better in urban areas.<sup>11</sup>

The present study revealed that 75. 7% of the admitted patients were in low socioeconomic status which supported the findings evidencing poor economic class of the population affected with typhoid fever. Since patients from low socioeconomic backgrounds often may not have proper access or cooking water or inadequately sanitized conditions, and overall poor health care in these low populations, this increases the risk and vulnerability to typhoid fever.<sup>13,16</sup>

In addition, the gender distribution of the patients was almost equal male and female with a slightly higher number of female patients (52%). Moreover the educational status of the patients were also heterogeneous; a large number of patients had no formal education(29. 7%) followed by those who had only primary education(28. 3%). This can be attributed to how education may affects prevention, healthcare-seeking, and health consciousness especially with regards to typhoid fever.<sup>6</sup>

Analyzing occupational status, laborers were the most affected group accounting to 46. 3% of all typhoid fevers illustrate the socio-economic stratum of the population in the study area. Heavy work activities involving the manual handling of items and tasks within homes may make people more exposed to conditions favoring the spread of typhoid fever; in addition, they may find it difficult to obtain prompt medical care.<sup>10,17</sup>

To create effective focused prevention, detection, and treatment plans, more has to be done to close

the gap on the gaps of gender distribution, resident status, SES, education level, and employment status. Knowledge of the demographic and socioeconomic parameters of the typhoid fever patients will help in working out strategies to prevent or control the disease that may help in reducing the incidence of typhoid fever among this population and other similar populations. More investigations on operational factors that lead to these gaps and the implications on disease distribution and outcomes are needed to inform the efforts at developing effective interventions and policies.<sup>15,18</sup>

### Conclusion:

There is ample evidence illustrating the relationship between typhoid frequencies and segments of the population regarding their socio-economic and demographic status, and applying these results to Nawabshah, Pakistan, serious recommendations for preventive measures can be made. This paper finds that interventions relating to the provision of clean water, sanitation, healthcare and health education should be targeted aimed at reducing typhoid fever prevalence in this region.

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