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IDENTIFICATION OF RISK FACTORS AND EVIDENCE-BASED STRATEGIES TO CONTROL TYPHOID FEVER IN LAHORE: A CROSS SECTIONAL STUDY.

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ABSTRACT

OBJECTIVES: To identification of risk factors and evidence-based strategies to control typhoid fever in Lahore. **METHODOLOGY:** The cross - sectional study is conducted in General hospital and Gulab Devi hospital Lahore Pakistan, from April to June 2023. A total 76 patients with the history of continuous history of fever, headache, abdominal pain and discomforts will be included in the study. The data about demographic, hygiene practices, and illness characteristic, treatment, and biochemical parameters, including serum electrolyte, CBC blood culture will be assessed. **RESULTS:** Results have been evaluated on the basis of the responses and feedback as the result of the survey. There were 76 patients included in this study. Among these patients 45 were female and the remaining were male who responded to the questionnaire. The results of different nutritional indices like BMI, socio economic status and education of patients, their hygiene practices, water and food sanitation, food handling, symptoms, effects and biochemical tests including serum creatinine, RBC and vaccination in these patients. **CONCLUSION:** The study concluded that personal hygiene, good sanitation, clean water and food, proper food processing, and clean environment can control the spread of typhoid and other fatal diseases. Less educated people should be given the necessary information and measures to defeat the typhoid epidemic. It also needs to be provided to the lower middle class, who have little or no access to clean water.

KEYWORDS: Typhoid fever, BMI, anthropometric, nutritional indices, risk factors of typhoid.

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INTRODUCTION

Typhoid fever or enteric fever may be a bacterial disease which is caused by Salmonella typhi. Typhoid fever may be a possibly lethal illness that's predominant in creating nations. Within the joined together States, most cases happen in excursionist to other nations [1]. Typhoid fever is a disease which is caused by Salmonella typhi that encourage the circulatory framework, causing rudimentary impacts and different incertitude [2].Typhoid fever is the wellbeing issue in numerous middle-income nations [3]. Typhoid and paratyphoid fever are intestinal contaminations caused by the life forms Salmonella enteric serovar S. typhi (S. Typhi) and paratyphoid fever and cause intestinal fever. In spite of the fact that typhoid fever is uncommon within the joined together States since of enhancements in water and sewage treatment early within the century, it remains a common infection in numerous creating nations. People are the sole supply of Salmonella typhi, and transmission of the malady happens through the fecal-oral course, as a rule through ingestion of nourishment or water sullied with human feces [4]. The World Wellbeing Organization detailed approximately 21 million cases of typhoid fever around the world in 2014 and 200,000 of her passing. There are roughly 2.16 million cases of typhoid fever around the world and 200,000 passing's, 93% of which occur in Asian nations. Globally, incidence is most noteworthy in creating countries. Typhoid fever is an intense illness caused by Salmonella enteric serovar Salmonella typhi (S. Typhi) and is endemic in numerous middle-income nations. Asian nations such as India and Pakistan have detailed tall rate of typhoid fever. Typhoid fever has the most noteworthy predominance in Asia, with roughly 93% of worldwide cases ascribed to this locale. South Asia incorporates a long history of typhoid fever, well archived among the more than one billion individuals who lived in pre- and post-colonial India. The British Armed force conducted extensive trials of typhus immunization on officers conveyed to India between 1904 and 1908. At that time, typhoid fever was predominant all through the Indian subcontinent and was related with tall horribleness and mortality within the pre-antibiotic time [5]. In Pakistan, typhoid mortality is quite high, requiring mediation in open wellbeing. Hot months have higher recurrence of typhoid [6]. Typhoid fever is an intense disease caused by the bacterium Salmonella enteric serovar Typhi. Typhoid and paratyphoid fevers are collectively alluded to as enteric fevers. In most endemic regions, around 90% of enteric fever is typhoid. Typhoid is transmitted by the fecal-oral course through sullied nourishment and water and is hence common where clean conditions are insufficient and get to clean water is restricted. In spite of the fact that typhoid fever was common within the United States and Europe within the 19th century, it is presently experienced for the most part throughout the creating world. The rustic ranges had a better predominance of typhoid fever than the urban region. Typhoid fever can influence anybody, but understudies and college understudies were more likely to be influenced. Male patients and those who lived in rustic ranges moreover showed an expanded chance of disease [7]. Patients with fever, gastrointestinal side effects like anorexia, sickness, spewing, the runs, and stomach torment were enlisted, particularly in case they too had other indications like a cerebral pain, joint torment, weakness, feeling unwell, or hacking. Patients with clear confirmation on beginning appraisal of pneumonia, pyelonephritis, abscesses, meningitis, tuberculosis or hepatitis. Tall fever, clogging during to begin with seven day extend of fever, the runs amid moment seven day extend of fever, tender splenomegaly and leucopenia or neutropenia, muddled by encephalopathy, gastrointestinal release and gap amid third seven day extend of fever are the average signs of typhoid fever [8]. It has been shown that updates in induction to clean water and encourage created sanitization bring about emotional diminishes in typhoid fever-related passing rates in various settings. Due to their centrality for human wellbeing, the universal community has too announced sanitation and secure drinking water to be infringement of human rights. It is abundantly clear that the spread of enteric fever malady and the introduction to S. Typhi and S. Paratyphoid microbes within the environment, as well as moved forward sanitation and get to secure water, ought to essentially diminish. In any case, worldwide progress toward widespread get to clean water and made strides sanitation at the family level, where the wellbeing benefits

are ideal, is insufficient and likely exacerbated by a number of components, including coverage dissimilarity, where the foremost defenseless populaces need get to; extending urbanization; and far reaching water shortage compounding [9].

MATERIAL AND METHODOLOGY

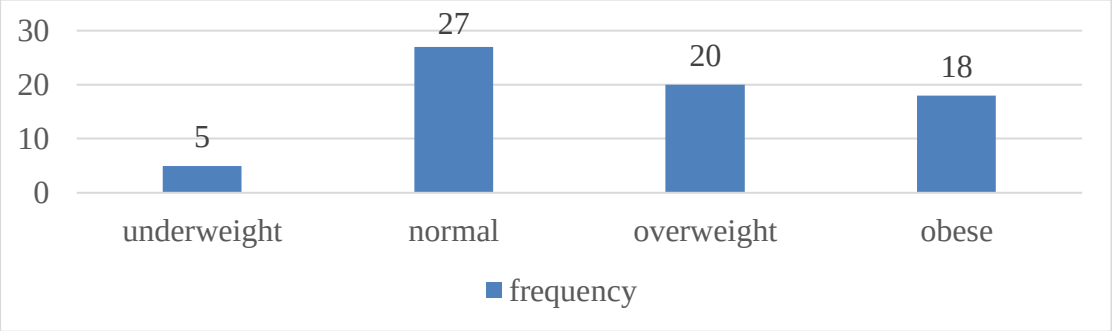
This cross - sectional study is conducted in General hospital and Gulab Devi hospital Lahore Pakistan, from April to June 2023. A total 70 patients with the history of continuous history of fever, headache, abdominal pain and discomforts will be included in the study. The data about demographic, hygiene practices, and illness characteristic, treatment, and biochemical parameters, including serum electrolyte, CBC blood culture will be assessed. Inclusion Criteria**:** Participants falling in this category would be recruited into this study. People who are newly diagnosed typhoid Patients, age group will be 15 – 55, patients who are willing to consent. Exclusion Criteria**:** Participants failing to fall in inclusion criteria excluded of the study. Participants who were taking any supplement. Participants who were having any other disease. Participants who were having history of any physiological and psychological disorders. Data collection procedure**:** In this study's sample size of 70 new diagnosed typhoid patients was taken. 45 patients included in study were women while remaining were men. Data regarding there BMI, hygiene practices, water and food sanitation, symptoms and biochemical tests was taken. By this prevalence of typhoid fever was assessed in Lahore. This study will help reduce the risk factors of this disease and to construct strategies to control typhoid fever in Lahore Data Analysis**:** Data was analyse using the SPSS version 21. Descriptive analysis was carried out using the software and the results were tabulated.

RESULTS

There were 76 patients included in this study from General Hospital Lahore and Gulab Devi Hospital Lahore. Among these patients 45 were female and the remaining were male who responded to the questionnaire. The results of different nutritional indices like BMI, socio economic status and education of patients, their hygiene practices, water and food sanitation, symptoms, effects and biochemical tests including serum creatinine, RBC and vaccination in these patients

Table 1: : Distribution of BMI of patients suffering from typhoid fever

Among nutritional indices assessing the BMI of patients from which 7.1 % patients were underweight, 28.6 % patients were overweight, 25.7 % patients were obese and remaining 38.6 % lies under normal range. It was observed that typhoid fever is more prevalent in overweight and obese people.



BMI	Frequency n(%)
<18.5 (Underweight)	5 (7.1)
18.6 – 24.9 (Normal)	27 (38.6)
25– 29.9 (Over Weight)	20 (28.6)
>30 (Obese)	18 (25.7)
TOTAL	70

Figure 1: Frequency Distribution of BMI of patients suffering from typhoid fever

There were total of 70 patients included from which 45 of them were female and 25 were male. It was observed that typhoid fever was more prevalent in females than males. **Table 2: Distribution of Gender of patients suffering from typhoid fever**

Gender	Frequency n(%)
Female	45 (64.2)
Male	25 (35.7)
TOTAL	70

Table 3: Distribution of Marital Status of patients suffering from typhoid fever

Among these patients 51.4 % were married, 7.1 % were divorced and the remaining 41.4 % were single. It was assesd that typhoid fever has no significant effect on marital status of patients.

Marital Status	Frequency n(%)
Married	36 (51.4)
Single	29 (41.4)
Divorced	5 (7.1)
TOTAL	70

Table 4: Distribution of Socioeconomic Status of patients suffering from typhoid fever

The socioeconomic status of patients from which 18.6 % patients were from low, 61.4 % from middle and 20 % were from upper class. It was observed that typhoid fever was prevalent in middle class society and lower class society than higher class society.

Socioeconomic Status	Frequency n(%)
Low	13 (18.6)
Middle	43 (61.4)
Upper	14 (20.0)
TOTAL	70

Table 5: Distribution of Education of patients suffering from typhoid fever

In educational status 11.4 % patients were matric passed, 28.6 % have completed their college, 38.6 % were graduated and the remaining 21.4 % were post graduated. It was seen that typhoid fever was more prevalent in less educated people because of lack of awareness.

Education	Frequency n(%)
Matriculation	8 (11.4)
Intermediate	20 (28.6)
Graduate	27 (38.6)
Post Graduate	15 (21.4)
TOTAL	70

Table 6: Distribution of Type of Diet of patients suffering from typhoid fever

Among different hygiene practices 42.9 % of patients were using filtered water and 57.1 % were using tap water. This shows that typhoid fever is more common among people who use tap water instead of safe filtered water.

Type of Water	Frequency n(%)
Filtered	30 (42.9)
Tap	40 (57.1)
TOTAL	70

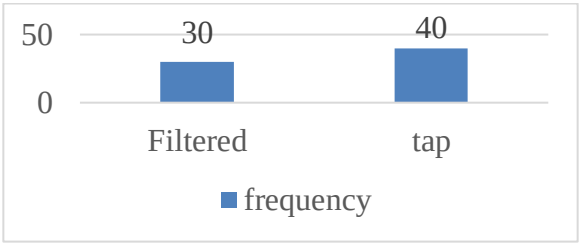


Figure 6: Frequency Distribution of Type of Diet of patients suffering from typhoid fever

Table 7: Distribution of Washing Hands of patients suffering from typhoid fever

44.3 % patients were used to wash their hands before eating and 100 % patients were used to wash their hands after using toilet. From these patients 41.4 % were used to wash their hands after throwing garbage and 48.6 % do the same practice after blowing nose. Fortunately all patients included in this study were used to wash hands after coughing and sneezing. It was observed that typhoid fever was more prevalent in patients who don't do safe hygienic practices to prevent infections and diseases.

Washing Hands	Frequency n(%)	
	Yes	No
Before Eating	31 (44.3)	39 (55.7)
After Washroom	70 (100)	0 (0)
After Garbage	29 (41.4)	41 (58.6)
Blowing Nose	34 (48.6)	36 (51.4)
After Coughing	0 (0)	70 (100)
After Sneezing	0 (0)	70 (100)
TOTAL	70	

Table 8: Distribution of Handling of Food of patients suffering from typhoid fever

Practices regarding proper washing of food were only seen in 55.7 % patients and 44.3 % patients were not doing this practice. Only 31.4 % were doing proper storage of food while 68.6 % of patients were not storing their food

properly. 100 % patients were practicing the cooking their food properly. It was seen that typhoid fever was more prevalent among people who don't wash and store their food properly with a safe method. Only 38.6 % patients had safe drinking water available and remaining 61.4 % were using tap water or municipal water. Typhoid fever was more common among people who didn't have safe drinking water available in the areas of their residence. It is mainly because of lack of resources. 51.4 % of mothers had clean baby bottles available for their babies while remaining 48.6 % didn't have them available because of different reasons. 57.1 % of mothers were not using breast pumps and remaining 42.9 % of mothers were using clean breast pumps for their babies. It was assessed that typhoid fever was more prevalent among those infants whose mothers don't use clean baby bottles and breast pumps for them. All patients do not practice washing their hands after using comb or hair brush. 64.3 % patients brush their teeth in morning while remaining 35.7 % don't do the same practice. 41.4 % patients don't brush their teeth before bed while other 58.6 % patients brush their teeth before bed. Typhoid fever was more prevalent among who don't wash their hands after using comb and don't brush their teeth two times a day.

Handling of Food	Frequency n(%)	
	Yes	No
Washing of Food	39 (55.7)	31 (44.3)
Storage of Food	22 (31.4)	48 (68.6)
Cooking of Food	70 (100)	0 (0)
Safe Drinking	27 (38.6)	43 (61.4)
Baby Bottles	36 (51.4)	34 (48.6)
Breast Pump	30 (42.9)	40 (48.6)
Washing Hand After Brushing Hair	0 (0)	70 (100)
Brushing Teeth Before Bed	41 (58.6)	29 (41.4)
Brushing Teeth After Bed	45 (64.3)	25 (35.7)
TOTAL	70	

Table 9: Distribution of Symptoms of patients suffering from typhoid fever

From symptoms 100 % patients were suffering from fever, 88.6 % had headache, 85.7 % had body pain, 67.1 % had lost their appetite, 94.3 % had lost weight, 70 % had dry cough, 71.4% had abdominal pain, 65.7 % had abdominal swelling, 62.9 % had diarrhea, 67.1 had vomiting, 70 % had itching, 61.4 % had rashes on their body, 35.7% had constipation and 11.7 % suffered from hair loss . Almost all patients suffered from all symptoms. Only constipation and hair loss was a bit less likely to be seen among all patients.

Symptoms	Frequency n(%)	
	YES	NO
Fever	70 (100)	0 (0)
Headache	62 (88.6)	8 (11.4)
Body pain	60 (85.7)	10 (14.3)
Loss of appetite	47 (67.1)	23 (32.9)
Weight loss	66 (94.3)	4 (5.7)
Dry Cough	49 (70.0)	21 (30.0)
Abdominal Pain	50 (71.4)	20 (28.6)
Abdominal Swelling	46 (65.7)	24 (34.3)
Diarrhea	44 (62.9)	26 (37.1)
Vomiting	47 (67.1)	23 (32.9)
Itching	49 (70.0)	21 (30.0)
Rashes	43 (61.4)	27 (38.6)
Constipation	25 (35.7)	45 (64.3)
Hair loss	8 (11.4)	62 (88.6)
TOTAL	70	

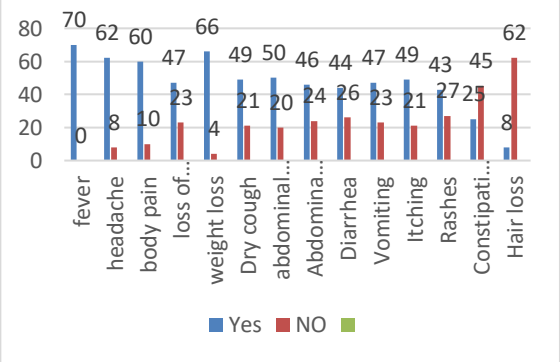


Figure 3.12: Frequency Distribution of Symptoms of patients suffering from typhoid fever

Table 10: Distribution of Biochemical tests of patients suffering from typhoid fever

Among biochemical tests serum creatinine levels, RBC levels and vaccination was assessed. 85.7% of patients had high serum

creatinine levels, 11.4 % had low and remaining 2.9% had normal levels. For RBC levels 84.3% had high levels, 8.6 % had low and remaining 7.1% had normal levels. Only 35.7 % of patients were vaccinated. Almost every patient had high serum creatinine levels and high RBC levels. Only a few patients were vaccinated against typhoid fever.

Test	Frequency n(%)		
	High	**Normal**	**Low**
Serum Creatinine	60(85.7)	2 (2.9)	8 (11.4)
RBC	59(84.3)	5 (7.1)	6 (8.6)
Vaccination	**YES**	**NO**	
	25 (35.7)	45 (64.3)	
TOTAL	70		

DISCUSSION

The current study's sample size of 70 patients with typhoid fever and 45 individuals suggests that the majority of the patients included in the study are female. According to the BMI Scale, the majority of the patients are overweight or obese. In a research done in Nigeria, the control group of 70 patients included in the study had normal BMI ranges, but when the trial began, practically all patients dropped body weight and muscle mass [10].

In the recent study among the various hygiene practices, some patients used filtered water while the rest used tap water. Most patients were assumed to be involved with this due to lack of adequate drinking water in their places of residence. Only 38.6% of patients had access to clean drinking water. Another research was conducted to determine the prevalence of typhoid fever in Gujrat, Pakistan, as well as related risk factors. Data were obtained from confirmed typhoid patients visiting several public and private sector hospitals using a standardized questionnaire developed with the assistance of a physician. Females appear to have a greater typhoid incidence (52.62%) than men (47.38%). 82.46% of patients were infected with typhoid during the summer season (July-September). 64.81% of patients who were infected were unvaccinated, and 58.37% drank unfiltered water [11].

According to a recent survey, 44.3% of patients wash their hands before eating and all patients wash their hands after using the loo. Some of these patients were used to washing their hands after dumping rubbish, and almost half of them did the same after blowing their nose. Fortunately, all participants in this trial were taught to wash their hands after coughing and sneezing. Practices regarding proper washing of food was not much seen and proper cooking of food was observed among all. 64.3 % patients brush their teeth in morning and 58.6 % patients brush their teeth before bed.

Another study found that the majority of illnesses are avoidable by using safe water, appropriate sanitation, immunisation, and, most importantly their hygienic behaviours such as washing hands with soap. Even with many efforts done by public health officials, no significant progress has been made in the areas of environmental reconcile and behavioural modification [12].

According to the findings of a recent study, around 57.1% of patients used tap water, while the remaining 42.9% used filtered water. Another study found patients that were exposed to river water or built wells for washing and cooking, owing to a lack of clean and filtered water. According to scientific research, drinking water from open dug wells is a risk factor for typhoid disease since it is polluted by latrines runoff, particularly after a rain event. Their findings indicate that when people drink from unsafe sources, they are more likely to get in contact with typhoid [13].

According to an up-to-date investigation of the association between typhoid fever, exposure to water system, hygiene, sanitation and food exposure in case-control studies, including illness and disease. The water decreases, the water is not treated, there is no safe disposal, and there is no outside food there. Soft drinks and speciality meals, such as dairy products, ice water, fruit, and juice, can all contribute to typhoid fever [13].

In the current study, 11.4% of patients were matriculated, 28.6% had completed college, 38.6% had graduated, and the remaining 21.4% were postgraduates. Another study found that more than half of less educated adults had more typhoid illnesses in their lifetime than highly educated people. Typhoid is more common in older persons, and 87% (38-47 years) die from it. This might be because of an ageing immune system. This suggests that long-term slum inhabitants are more prone to get typhoid fever than newcomers. These findings are similar with the findings of who discovered that

travelling or staying in an endemic region is an endangerment for typhoid fever. While jobless and self-employed people had the same rate of typhoid fever (28.28%), employees have the lowest rate. The success of typhoid control will be determined by age limits and systemic measures. Typhoid affected both ladies equally [14].

According to current research, even if clean water and other resources are accessible, there is little public understanding about typhoid fever prevention. In poor and middle-class society, much more education and awareness are required. Despite several efforts, including the delivery of (WG) WaterGuard devices for water purification in comfort of home and teaching on their usage, typhoid fever cases persisted. To plan future outbreak interventions, information on typhoid fever knowledge, attitudes, and practises, clean water, and hygiene were necessary to guide response operations during the current Typhoid epidemic [14].

The first epidemic of highly resistant typhoid fever (XDR-TF) was discovered in Pakistan's Sindh region in November 2016. Since then, the incidence of XDR-TF cases in the United States has soared, owing to sewage and poor water quality, a lack of vaccine availability, and overcrowding in metropolitan areas. Children from age group of 2 to 16 years old are at high risk for typhoid fever, according to a research done in Karachi, Pakistan [15].

According to a study from Cameroon's Ministry of Public Health, typhoid fever is regularly detected among youngsters in Cameroon's health centres, prompting public dread, according to TE Akwa and SP Nguimbous (2021). As a result, it is classified endemic in Cameroon. The high cost of disease-related pharmaceuticals is a key issue in Cameroon's healthcare system [15].

Every year, an estimated 11 to 21 million people are killed by typhoid in numerous low-income countries and middle income countries, mostly in South and Southeast Asia and Sub-Saharan Africa. Access to potable water, sanitation, personal hygiene and nutrition, health education, effective antibiotic therapy, and immunisations are all preventative strategies for Salmonella typhi typhoid fever. While water, sanitation, and hygiene (WASH) initiatives are excellent instruments for typhoid fever control, most typhoid-endemic nations will require considerable financial investments in the short and medium term to manage infrastructure and limited WASH solutions [16].

The recent investigation found that clean toilets were not provided in hospitals and certain hotels. It can also be a key source of contact with typhoid disease. In another research, Harare City reported 1078 probable typhoid fever cases between October 2011 and January 2012. We launched an investigation to determine the possible source of the transmission and implement control measures.8/8 well water samples included faecal coli forms and E. coli. Salmonella typhi was cultivated and serotyped in stool, urine, and blood samples, and 24 cases were proven positive. Shigella, Giardia, and E coli were also found. The outbreak was most likely caused by contaminated water from unsafe water sources. Harare City Engineer must make an investment [17].

Serum creatinine levels were measured in the current investigation. 85.7% of patients had high blood creatinine levels, which was likewise significant in the previous research, 11.4% had low levels, and the remaining 2.9% had normal values. In another study, blood samples from typhoid patients were taken from the Michael Okpara University of Agriculture Medical Centre in Umudike, Abia State, Nigeria.Based on the physiological and biochemical characteristics in typhoid patients, this study seems to provide sufficient evidence to explain the effect of typhoid morbidity [12].

According to a recent survey, 18.6% of patients were from the lower socioeconomic class, 61.4% people were from the middle class, and 20% people were from the upper class. This indicates that persons from the lower and middle classes are more prone to get this disease. According to another survey, 63% of inhabitants experienced one or more typhoid fevers in their lives, whereas just 37% did not. This definitely demonstrates that typhoid is present in Mina's slums. It suggests that some patients may have been unaware of the hazards and preventative procedures for typhoid fever ([18]). In a recent study, RBC levels were found to be lower in practically every patient included in the study when analysing biochemical test results. Another study sought to determine the changes in packed cell volume (PCV), red

blood cell count (RBC), haemoglobin content (HB), white blood cell count (WBC), and platelet (PLT) associated with typhoid fever male and female patients, as well as their potential implications in anaemia, leucopenia, immune deficiency, and thrombocytopenia. The HB content and RBC levels were found to be lower in the results, and both differences were statistically significant. [19]

In new investigation, the causes of typhoid fever were thoroughly monitored by adding questions to questionnaires and talking with patients. Many aspects, such as safe water, clean food, and excellent hygiene practises, were analysed among the patients participating in the study in order to understand more about the cause of the epidemic so that necessary preventative steps may be taken by higher authorities for a healthy community. Another 2020 research highlighted six goal groups: five WASH target areas (water resources, water treatment, water management, sanitation and hygiene), and one food group (food and food products). Individual-level risk is the emphasis of these exposures, rather than typhoid infiltrating community-level water or food sources. While viral introduction into the population is critical for eradication, most control studies have shown that have focused on factors associated with the spread of the virus. So this study is focused on avoiding future infections. [20]

Typhoid vaccine is an important component of typhoid fever prevention and control, and it is recommended for use in both endemic and epidemic conditions. In a recent research, only a tiny proportion of patients were vaccinated against typhoid fever, and the rest were unaware that vaccine was available. Despite the efficacy of numerous typhoid immunisation techniques, typhoid vaccines are underutilised. Implementation lessons should be used to develop effective vaccination techniques based on TCVs, which offer various predicted benefits, including the possibility for use in baby immunisation programmes and extended duration of protection [21]

CONCLUSSION

According to the study's findings, patients from General Hospital Lahore and Gulab Devi Hospital Lahore made up 70 of the study's participants. Of these patients, 45 answered to the questionnaire; the remaining 25 patients were men. When evaluating the BMI of patients, it was discovered that the majority of patients were within the normal and overweight range, with only a few being underweight. The majority of patients are from the middle class and lack access to resources like filtered water, clean food, etc. Most breastfeeding women did not provide their infants with clean baby bottles or clean breast pumps. Hygienic practices like washing hands, using clean equipments were not much satisfactory. Nearly all patients had elevated serum creatinine levels. Only a few patients were vaccinated while others didn't even know about presence of typhoid vaccination. It was concluded in the study that BMI, socioeconomic status, hygiene practices, resources access, education and knowledge about typhoid fever were the main causes for typhoid fever. Future research and education should be provided for this ailment.

ETHICS APPROVAL: This research study has received ethics approval from the Research Ethical Committee (REC) of Riphah International University, Lahore ensuring compliance with ethical guidelines. The study protocol upholds principles of participant rights, informed consent, data confidentiality, and minimization of risks. Approval confirms adherence to ethical standards as outlined in the Declaration of Helsinki and other relevant guidelines.

CONSENT TO PARTICIPATE: Written and verbal consent was taken from subjects and next of kin

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AUTHORS' CONTRIBUTIONS: All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated in the work to take public responsibility of this manuscript. All authors read and approved the final manuscript.

CONFLICT OF INTEREST: No competing interest declared.

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