



<https://journal.mdpi.com/index.php/oapr>

Open Access Public Health and Health Administration Review



Original Article

Knowledge, Attitudes, and Practices Regarding Typhoid Conjugate Vaccine: A Cross-Sectional Study

Muhammad Dawood Khan

Institute of International Education, I.M. Sechenov First Moscow State Medical University, Russian Federation.

Corresponding author:

Muhammad Dawood Khan

Institute of International Education,
IM. Sechenov First Moscow State
University, Russian Federation.

Email: khandawood866@gmail.com

Received: 14 July 2026

Accepted: 13 September 2026

Published: 14 September 2026

DOI Prefix

10.59644

Quick Response Code:



ISSN (p): 2959-619X

ISSN (e): 2959-6203

Website: mdpi.com

Publisher: MDPIP

ABSTRACT

Typhoid fever remains a serious public health problem in Pakistan especially with the advent of multidrug-resistant (MDR) and extensively drug-resistant (XDR) strains of *Salmonella Typhi*. Introduction of typhoid conjugate vaccine (TCV) into the Expanded Programme on Immunization in Pakistan is a historic preventive intervention but its success will depend on the perception and acceptance of the population. The survey was a national cross-sectional web-based survey that was conducted between December 2023 and January 2024 and included the general population of Pakistan. A total of 918 participants were included (mean age: 25.9 ± 9.6 years; 51.0% female). While general knowledge regarding vaccination was high, only 54.2% were aware of TCV and 52.1% knew about government-led TCV campaigns. Most respondents perceived TCV as safe (77.7%) and effective (80.8%), and 91.8% supported mandatory vaccination programs. Booster dose acceptance was high (83.1%). Higher household income was positively associated with booster willingness ($aOR = 2.85$, $p < 0.001$), while negative attitudes toward vaccine efficacy significantly reduced acceptance ($aOR = 0.20$, $p = 0.011$). Notwithstanding the positive attitude towards the TCV, the gaps in the awareness and the lack of optimal vaccination habits are still present. Different health-educational interventions and communication strategies should be considered to enhance better vaccine coverage and maintain long-term control of typhoid in Pakistan.

Key Words: Typhoid Conjugate Vaccine (TCV), Knowledge, Attitudes, and Practices (KAP), Vaccine Acceptance, Typhoid Fever, Cross-Sectional Study.

How to cite this article: Khan, M.D. (2026). Knowledge, Attitude, and Practices Regarding Typhoid Conjugate Vaccine: A Cross-Sectional Study. *Open Access Public Health & Health Administration Review*, 5(1), 42-61. [https://doi.org/10.59644/oaphhar.5\(1\).289](https://doi.org/10.59644/oaphhar.5(1).289)



Copyright: 2026. This open-access article is distributed under the terms and conditions of the Creative Commons Attribution License 4.0 (CC BY) license <https://creativecommons.org/licenses/by/4.0/>. Reproduction, distribution, and use in other forums are permitted provided the copyright owner (s) and the original authors are credited, and the original publication is cited. ©2026 Published by Multidisciplinary Publishing Institute (SMC-Private) Limited, Mardan 23200, Khyber Pakhtunkhwa, Pakistan.

INTRODUCTION

Typhoid fever is a serious health threat to the population of low and middle-income countries that contributes to the development of significant morbidity and mortality (Tahir *et al.*, 2023). The country has a relatively large burden with Pakistan having an approximate incidence of 493.5 cases per 100,000 population in 2018, the highest incidence in the south Asian region. This has only worsened the situation as of 2016 due to the outbreak of XDR *Salmonella* Typhi. in Sindh, a strain that is resistant to chloramphenicol, ampicillin, trimethoprim-sulfamethazine, fluoroquinolones, and third-generation cephalosporins (Batool *et al.*, 2023). The existing treatment solutions include azithromycin and carbapenems, and the risk of the emergence of azithromycin resistance and the necessity to use intravenous carbapenems have placed a significant strain on medical systems, creating the risk of typhoid infections that can no longer be treated (Memon *et al.*, 2020).

As a reaction, the World Health Organization (WHO) revised its policy guidelines in 2018, supporting the use of TCVs programmatically in endemic areas. The WHO recommended a single dose of TCV for children who are six months old, with priority given to the regions with high rates of antimicrobial-resistant strain of *S. Typhi*. This was endorsed by the Gavi, the Vaccine Alliance that offered a substantial amount of money in the introduction of TCV. In 2019, Pakistan was the first country to include the TCV in its Expanded Programme on Immunization and began countrywide campaigns (Jamil *et al.*, 2025). More than 30 million children have since been protected by vaccine in provinces and evaluation studies have shown a demonstration of an approximation of 95% protection of typhoid infection in actual outbreak scenarios (Qamar *et al.*, 2020).

Although the first impression of TCV has been very positive, there are still concerns about long-term protection and the need for booster injections. Clinical trials in Nepal, Bangladesh, and Malawi report an 80% efficacy of at least three years with just one dose, but it is not yet understood how long the humoral immune response will persist with the effect of a single dose. Prototypic vaccines have been proposed in the past that a single dose is immunogenic, but that additional doses induce strong booster effects and convert the immunity to a T-cell-dependent, long-term memory phenotype. In turn, perceiving the desire of the community to accept boosters is necessary to establish long-term immunization plans and orienting the further vaccine-timeline (Rahu *et al.*, 2026).

High uptake is of paramount importance to the success of any national vaccination programme, and it is determined by the level of knowledge, attitudes, and practices of the general population. Even though TCV has been rolled out on a large scale in Pakistan, there has been a significant gap in the national KAP data. Localized populations (e.g., the population around a vaccination center, a town, etc.) have been the predominant target of the previously conducted studies, leaving the national perspectives unexplored. Such a lack of information is particularly alarming considering the heterogeneity of socio-demographic groups in Pakistan and how they perceive the safety and effectiveness of vaccines differently. Furthermore, there are still misconceptions; some segments of the population are afraid of vaccines or certain conspiracy theories that one can be exploited to gain personal profits (Ambreen *et al.*, 2026). Therefore, this study aimed to investigate the knowledge, attitudes, and practices regarding Typhoid Conjugate Vaccine in Pakistan.

LITERATURE OF REVIEW

Typhoid fever is an acute febrile condition caused by a Gram-negative bacterium called Gram-negative bacterium, *Salmonella enterica*, Serovar Typhi (*S. Typhi*). The pathogen infects mostly via the small intestine, gets located in the macrophages, and then spreads through the bloodstream. Clinical manifestations range between the long-term step-ladder fever and frontal cephalgia to serious conditions such as intestinal perforation (Batool *et al.*, 2023). The mortality rate of the hospitalized patients has been estimated at between 1-5%, but the global burden is high. The World Health Organization estimated several cases of typhoid and deaths in the year 2019 by estimating about 9.2 million cases and 110,000 deaths each year. The highest rate of this has been reported in the WHO Southeastern Asia, Eastern Mediterranean and African regions. Children are the most vulnerable to the threat in endemic settings particularly those in the 5-9 years bracket (Nizamuddin *et al.*, 2021).

One of the main issues in modern technology of managing typhoid is the rapid increase in antimicrobial resistance (AMR). Chloramphenicol was traditionally used as the first-line, but in the 1970s resistance has occurred. In the 1980s, multidrug-

resistant (MDR) isolates became prevalent in South Asia and the East African region; these are resistant to chloramphenicol, ampicillin, and trimethoprim-sulfamethoxazole. The further development of non-susceptibility to fluoroquinolone further limited treatment options in the 1990s (Khan, 2010).

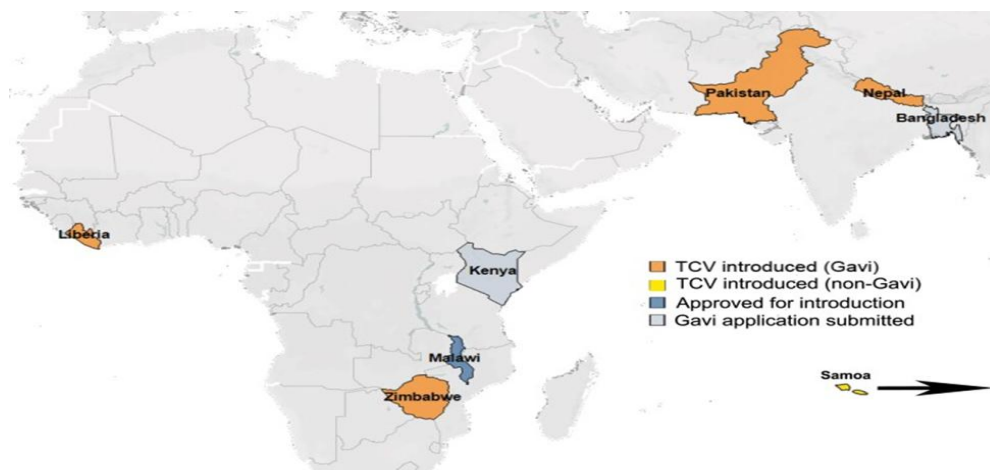


Figure 1

Countries that have introduced typhoid conjugate vaccines (TCV), are approved for introduction and have applied to Gavi as of September 2022.

This crisis became critical in 2016 after the discovery of extensively drug-resistant (XDR) *S. typhi* in the province of Sindh in Pakistan. These XDR strains exhibit resistance to all first-line agents as well as fluoroquinolones and the third generation cephalosporins, and avail only azithromycin and carbapenems as effective treatment regimens. The possibility of the successful treatment of typhoid is a threat to come, especially since the resistance to azithromycin has come out of its own to several nations (Shafiq *et al.*, 2017).

Typhoid vaccinations have developed since the development of early heat-killed whole-cell preparations, which, despite their effectiveness were hampered by their side effects, to some of the more sophisticated vaccines, including the live attenuated Ty21a and Vi-PS vaccines. However, both Ty21a and Vi-PS have severe shortcomings: neither is advised in children below two or five years old, both do not induce any long-term immunologic memory, and they require periodic re-vaccination (Kurkuri *et al.*, 2025). To overcome these shortcomings, Typhoid Conjugate Vaccines (TCVs) were developed, in which the Vi-polysaccharide has been chemically conjugated to a carrier protein, such as tetanus toxoid (Vi-TT). This conjugation stimulates T-cell-mediated immune reaction that makes infants with young age (six months) highly immunogenic and allows the immunologic memory to be developed. Typbar-TCV (WHO-prequalified, manufactured by Bharat Biotech) has proven itself to be effective in more than 80% of various clinical trials and can last a minimum of three years after administration in one dosage (Ravi & Ayando, 2024).

Based on the escalating AMR menace, the WHO updated its policy in 2018 to support the use of TCVs programmatically in endemic nations with a high burden of drug-resistant *S. typhi*. Such a move was backed by an 85 million US dollar funding promise by Gavi, the Vaccine Alliance. Pakistan was the first country to make TCV a part of its Expanded Programme on Immunization (EPI) and thus became a global pioneer (Virk *et al.*, 2026). Since 2019, over 30million children have been vaccinated against polio in Pakistan through staged introductions and catch-up efforts against those between 6months and 15years old. The real-world effectiveness of XDR strains in the epidemiology of TB vaccines has been introduced in Pakistan with a vaccine effectiveness of about 95% (Delali *et al.*, 2026). Regardless of the success of the rollout, there exist several challenges towards the effective management of typhoid. Routine immunization services and surveillance were greatly affected due to the COVID-19 pandemic. Additionally, there is a widespread hindrance of vaccine uptake due to

misinformation and socio-cultural barriers. Localized research in Pakistan has also indicated several misconceptions such as the rumors that vaccines are international conspiracies or that they contain substances that are forbidden by the Islamic laws (Lubanga *et al.*, 2026).

Even though TCVs are currently being used as a single dose, the sustainability of such protection is being monitored. Early prototype experiments have indicated that a second dose would have even greater booster effects. As a result, it is important that the knowledge, attitudes and practices (KAP) of the public be known to make the programme sustainable. According to the current literature, despite the high level of general vaccination awareness, the knowledge about TCV and the desire to receive future booster doses still has not been studied in terms of national representation (Tahir *et al.*, 2021). These KAP gaps are crucial to address to customize communication interventions that will help reduce hesitancy with the goal of achieving long-term public health equity.

METHODS AND MATERIALS

Study Design and Setting

The study was a cross-sectional web-based study, carried out among the general population of Pakistan between 15 December 2023 and 30 January 2024. The study aimed to represent the representative range of views as it recruited the participants who represented all provinces and thus provided the inclusion of different regional and background views into the national context.

Ethical Considerations

The research was conducted in close compliance with the ethical guidelines and the review committee of the Fatima Memorial Institute of Medical Sciences in Lahore gave the approval (Ref: IRB/22/13). The interaction was voluntary in every way and informed consent was given by all the respondents before the questionnaire was started. To protect anonymity and confidentiality, no personal information like names or contact details were gathered and the participants had the option of pulling out any time before the end. The STROBE checklist was also followed in the study to maintain transparent reporting (Joseph *et al.*, 2015).

Sample Size and Sampling Technique

The minimum size of the sample was determined by Rao soft calculator [$n = N \times I ((N-1) E^2 + x)$] based on an approximate population of the country of around 227.3 million people. A minimum of 846 participants was needed with a 98% confidence interval and a margin of error of 4%. In the end 918 responses were received which provided a response rate of 96%. The convenience sampling methodology was embraced, and it was done through a special Google form that was distributed across social media like Facebook and WhatsApp. To ensure geographical relevance, non-Pakistani nationals and those with language comprehension issues were left out (Siddiqi *et al.*, 2022).

Data Collection Tools and Validation

The research tool was a structured questionnaire which was designed after a wide literature review and review panel consisting of experts in the field of public health and medical education. To ensure that the items are clear and relevant, a pilot study was carried out with 40 participants. The instrument was broken into four major parts:

1. Sociodemographic: age, gender, education, occupation, place of residence, and monthly family income.
2. Knowledge: Information on the advantages of the typhoid conjugate vaccine (TCV), awareness of government vaccination programmes, source of information and the likely side effects (e.g. fever, injection site pain).
3. Attitudes: The measurement of the perceptions about the vaccine safety, efficacy, religious issues, and the impact of the expert advice.
4. Practices: Investigation of the history of vaccination, adherence to booster vaccinations, and family limitations.

Statistical Analysis

The analysis of data was done under IBM SPSS version 21. To summarize numerical variables, the mean and standard deviation were used, whereas frequencies and percentages were used to summarize the categorical data. Univariate and multivariate logistic regression analyses were done to determine the relationship between socio-demographic variables and willingness to receive booster dose of TCV. Significance was taken as $p < 0.05$.

RESULTS AND FINDINGS

Participant Characteristics

A total of 918 respondents accomplished the survey (response rate: 96%). The mean age of participants was 25.9 ± 9.6 years, and the mean household size was 5.9 ± 3.7 members. Females participated 51.0% ($n = 468$) of the sample, while 25.7% ($n = 236$) were married. Most respondents resided in urban areas (82.7%, $n = 759$) and reported a monthly household income exceeding PKR 50,000 (60.2%, $n = 553$). Regarding education, 69.1% had at least a graduate-level qualification. Healthcare workers comprised 27.6% ($n = 253$) of participants, and 39.5% ($n = 363$) were currently employed (Rostkowska *et al.*, 2021).

Table 1

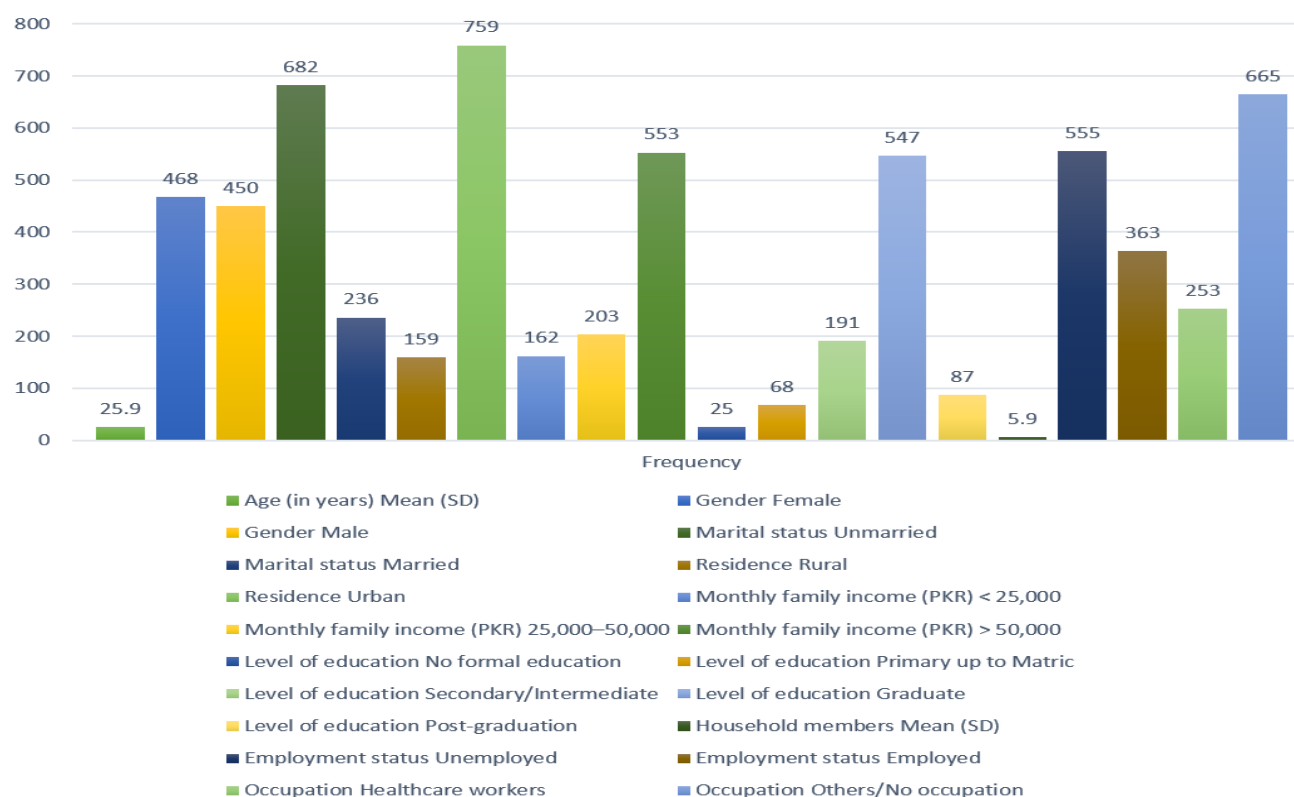
Sociodemographic characteristics of study participants ($n = 918$)

Questions/ Variables	Category	n	%
Age (years)	Mean $\pm$ SD	25.9 ± 9.6	-
Gender	Male	450	49.0
	Female	468	51.0
Marital status	Married	236	25.7
	Unmarried	682	74.3
Place of residence	Urban	759	82.7
	Rural	159	17.3
Monthly household income (PKR)	< 25,000	162	17.6
	25,000–50,000	203	22.1
	> 50,000	553	60.2
Educational level	No formal education	25	2.7
	Primary–Matriculation	68	7.4
	Secondary/Intermediate	191	20.8
	Graduate	547	59.6
	Post-graduate	87	9.5
Employment status	Employed	363	39.5
	Unemployed	555	60.5
Occupation	Healthcare worker	253	27.6
	Other / none	665	72.4
Household size	Mean $\pm$ SD	5.9 ± 3.7	-

Knowledge Regarding Typhoid and Typhoid Conjugate Vaccine

The general awareness of the vaccination, as well as typhoid prevention, was extensive. Most of the respondents were able to state that vaccination was a preventive measure (85.3%) that healthy children need to be vaccinated (90.8%) and that vaccination lowers morbidity and mortality (92.6 %). There was also a high level of awareness pertaining to typhoid prevention as 86.7% of the respondents noted that typhoid can be prevented through vaccination. But there was a relatively

lesser awareness of the typhoid conjugate vaccine (TCV) with only 54.2% aware of TCV and 52.1% aware of the government-led TCV vaccination programme (Ansar *et al.*, 2024). Mass media (35.1%) and healthcare professionals (16.2%) have been the most frequent sources of information. There was inconsistency on the age at which children should get their vaccination, with 36.5% of the respondents indicating that children between the ages of 0 and 5 years was the age at which the vaccination should be administered, and 26.0% not knowing. Most respondents properly perceived the use of booster doses, as 72.7% of them supported that boosters offer more coverage. The most recognized side effects of TCV were fever (50.3%), injection-site pain or swelling (49.3%) (Abbasi *et al.*, 2022).



Graph 1

Graphical Representation of Sample characteristics of Pakistani Population for the study of TCV Coverage

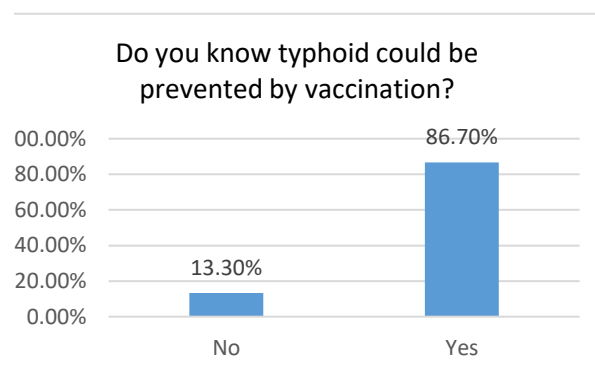
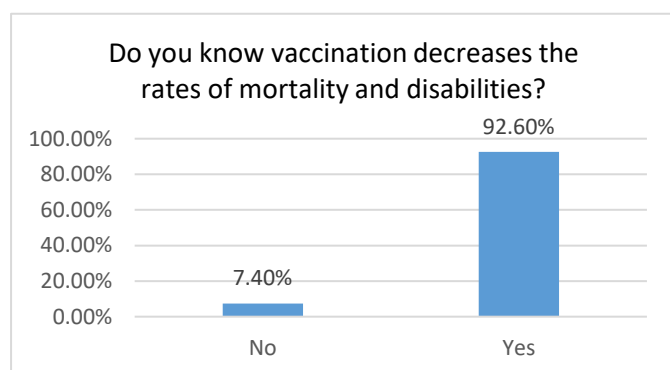
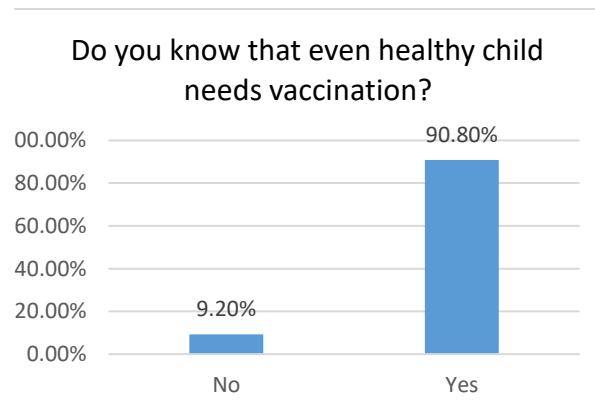
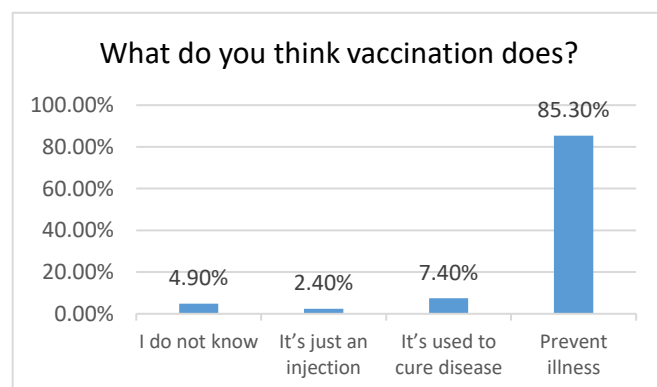
Table 2

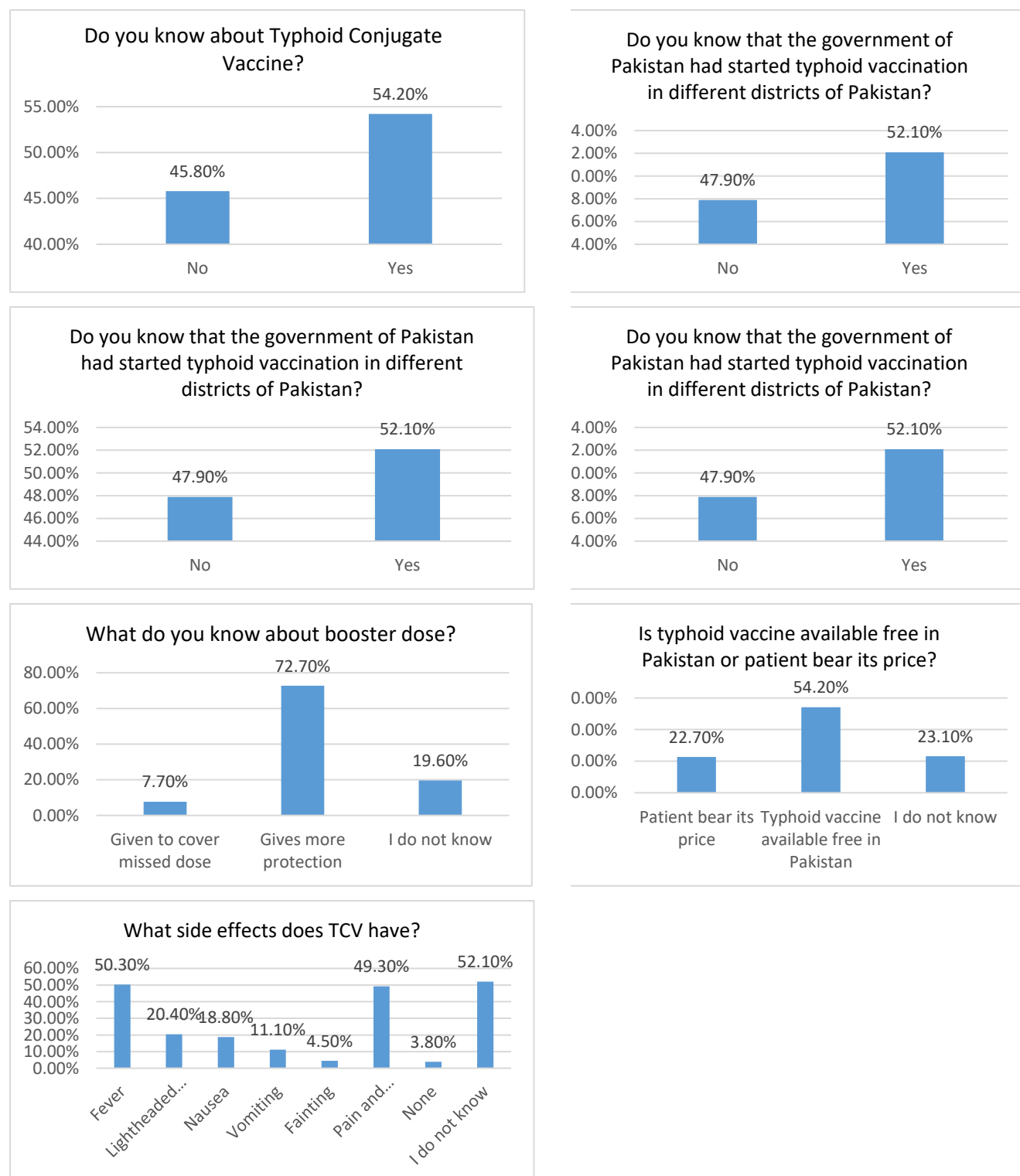
Graphical Representation of Responses

Questions/ Variables	Response	n	%
Purpose of vaccination	Prevents illness Cures disease	783	85.3
	Just an injection Do not know	68	7.4
		22	2.4
		45	4.9
Healthy child requires vaccination	Yes	834	90.8
	No	84	9.2
Vaccination reduces mortality & disability	Yes	850	92.6
	No	68	7.4
Typhoid can be prevented by vaccination	Yes	796	86.7

Awareness of TCV	No	122	13.3
	Yes	498	54.2
Awareness of government TCV program	No	420	45.8
	Yes	478	52.1
Source of information	No	440	47.9
	Mass media	322	35.1
	Doctors / nurses	149	16.2
	Friends / relatives	139	15.1
	Personal knowledge	126	13.7
Correct age for TCV	Do not know	182	19.8
	0–5 years	335	36.5
	5–13 years	246	26.8
	> 13 years	98	10.7
	Do not know	239	26.0
Understanding of booster dose	Gives more protection	667	72.7
	Covers missed dose	71	7.7
	Do not know	180	19.6
TCV cost awareness	Free in Pakistan	498	54.2
	Paid by patient	208	22.7
	Do not know	212	23.1

Knowledge regarding typhoid disease and typhoid conjugate vaccine (TCV) (n = 918)



**Graph 2**

Graphical Representation of assessment of knowledge in the participants regarding TCV

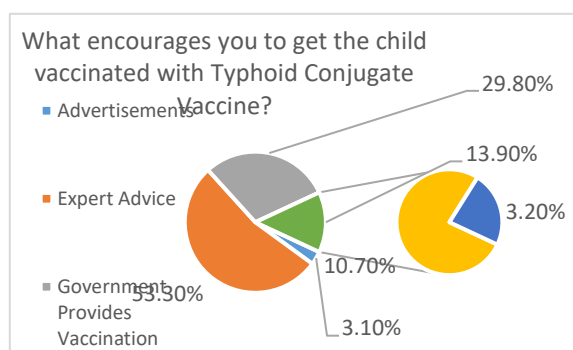
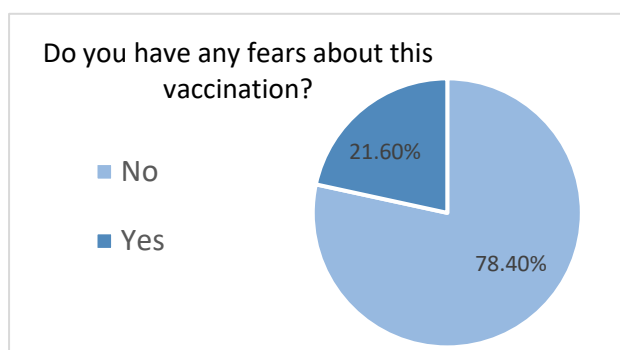
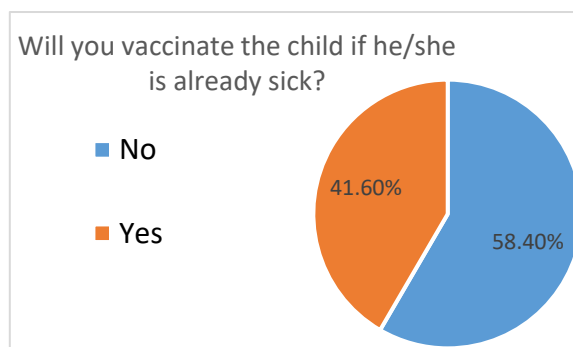
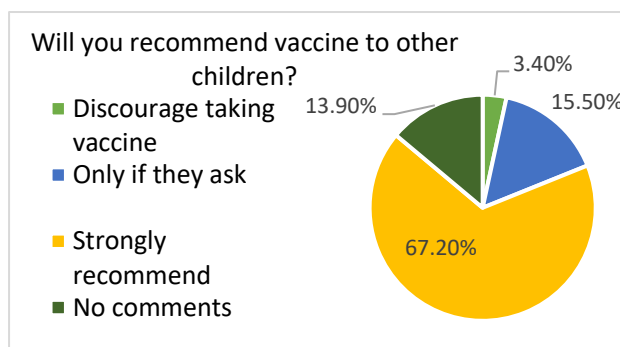
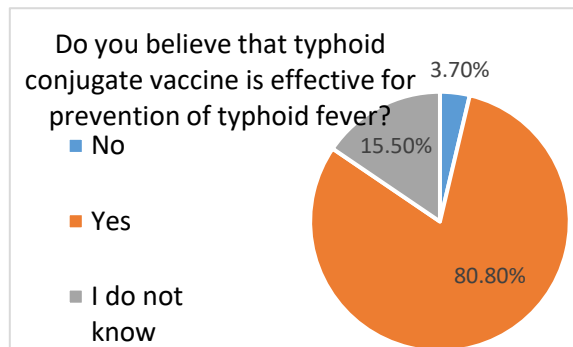
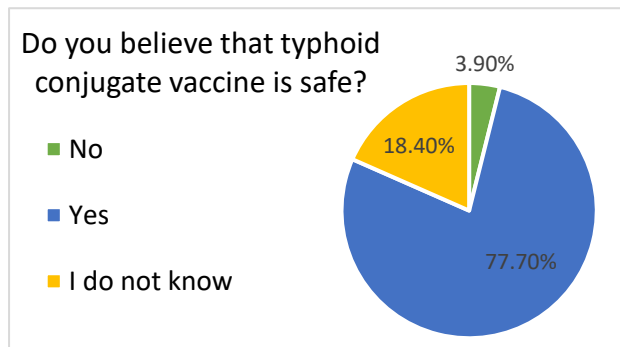
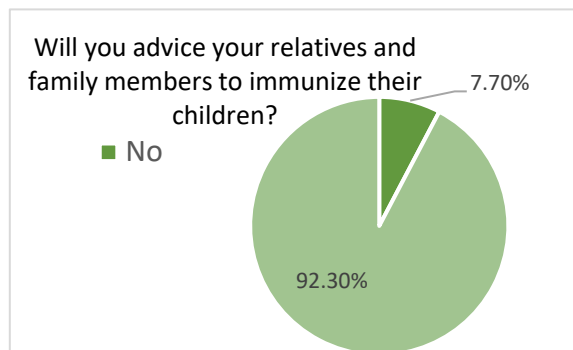
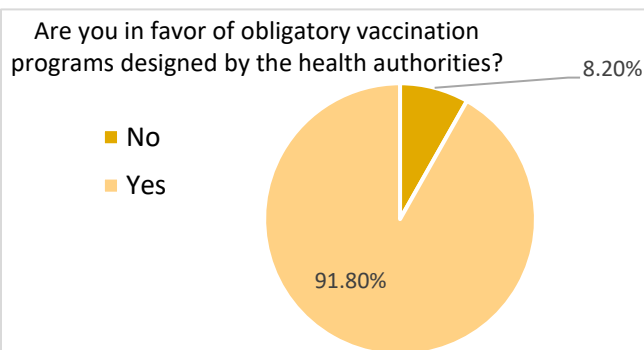
Attitudes Toward Typhoid Conjugate Vaccination

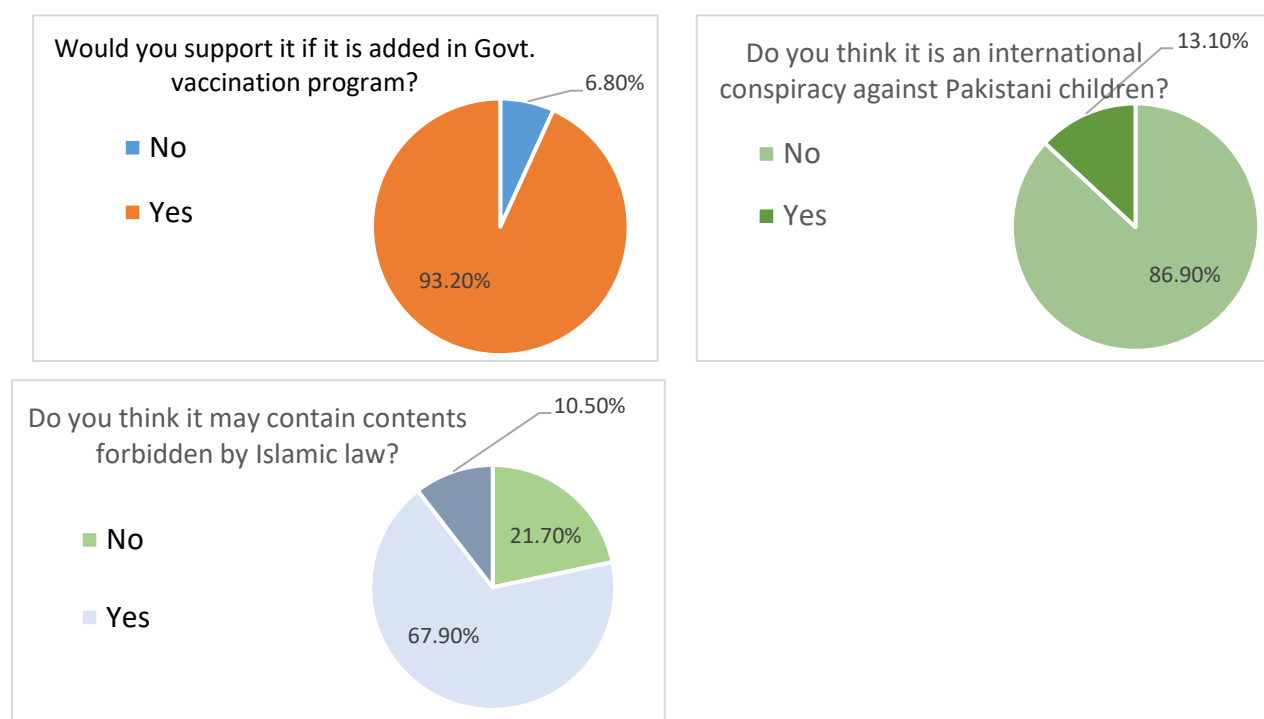
Attitudes toward TCV were largely positive. More than three-quarters of contributors believed that TCV is safe (77.7%) and effective (80.8%), and 91.8% supported compulsory vaccination programs executed by health authorities. A high proportion reported readiness to promote vaccination within their social circles, with 92.3% willing to recommend family and friends and 67.2% strongly recommending vaccination for children. Expert advice was the most powerful motivating factor (53.3%). Notwithstanding overall positive attitudes, 21.6% expressed fear regarding TCV, and 13.1% perceived vaccination as a conspiracy. Notably, 67.9% thought that TCV might contain ingredients forbidden under Islamic law, highlighting the perseverance of religious concerns.

Table 3

Attitudes toward typhoid conjugate vaccination (n = 918)

Questions/ Variables	Response	n	%
Support mandatory vaccination programs	Yes	843	91.8
	No	75	8.2
Advise others to vaccinate children	Yes	847	92.3
	No	71	7.7
Belief that TCV is safe	Yes	713	77.7
	No	36	3.9
	Do not know	169	18.4
Belief that TCV is effective	Yes	742	80.8
	No	34	3.7
	Do not know	142	15.5
Recommendation behavior	Strongly recommend	617	67.2
	Only if asked	142	15.5
	Discourage	31	3.4
	No comment	128	13.9
Fear regarding vaccination	Yes	198	21.6
	No	720	78.4
Motivation for vaccination	Expert advice	489	53.3
	Government provision	274	29.8
	Self-experience	98	10.7
	Advertisements	28	3.1
	Will not vaccinate	29	3.2
Perceived conspiracy	Yes	120	13.1
	No	798	86.9
Religious concerns (halal content)	Yes	623	67.9
	No	199	21.7
	Do not know	96	10.5



**Graph 3**

Graphical Representation for assessment of the attitude of participants towards TCV Vaccine across the population of Pakistan

Vaccination Practices and Health-Seeking Behavior

Of all respondents 42.4% (n = 389) reported children. Among them, 22.7% had vaccinated their children can be said to have followed the EPI schedule, including TCV. Intention to accept a booster dose was also high (83.1%). The majority participants reported to use healthcare professionals to give information on vaccination related matters, such as how to deal with the side effects (58.1%), missed vaccinations (91.7%), and how to schedule future vaccinations (92.0 %). The power of family level was high with 90.3% indicating that family restrictions or norms influenced the decision to vaccinate.

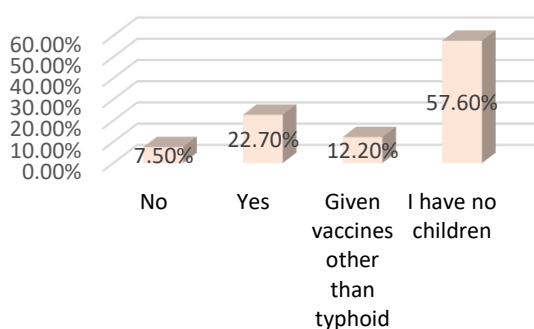
Table 4

Vaccination practices and health-seeking behavior (n = 918)

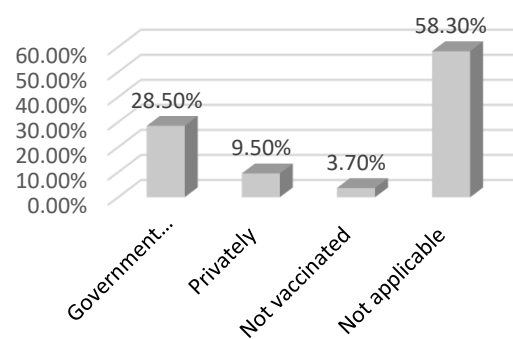
Questions/ Variables	Response	n	%
Children vaccinated per EPI (including TCV)	Yes	208	22.7
	Other vaccines only	112	12.2
	Not vaccinated	69	7.5
	No children	529	57.6
Source of vaccination	Government campaign	262	28.5
	Private	87	9.5
	Not applicable	535	58.3
Willingness to take booster dose	Yes	763	83.1
	No	155	16.9
Family restrictions on vaccination	Yes	829	90.3
	No	89	9.7

Action if side effects occur	Consult doctor	533	58.1
	Give fever meds at home	197	21.5
	Believe vaccine is working	115	12.5
	Stop vaccination	26	2.8
	Do not know	187	20.4
Contact for missed dose	Doctor	842	91.7
	Nurse	16	1.7
	Pharmacist	21	2.3
	Family/friends	14	1.5
	Self	25	2.7

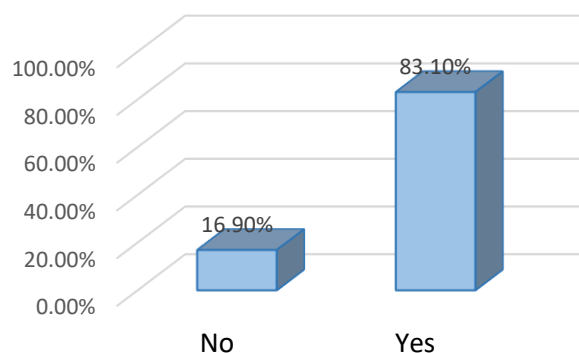
Have you given your children the obligatory vaccines including typhoid vaccine?



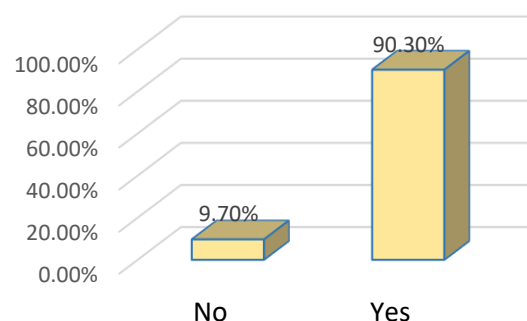
Was the vaccine from Government Campaign or taken privately?

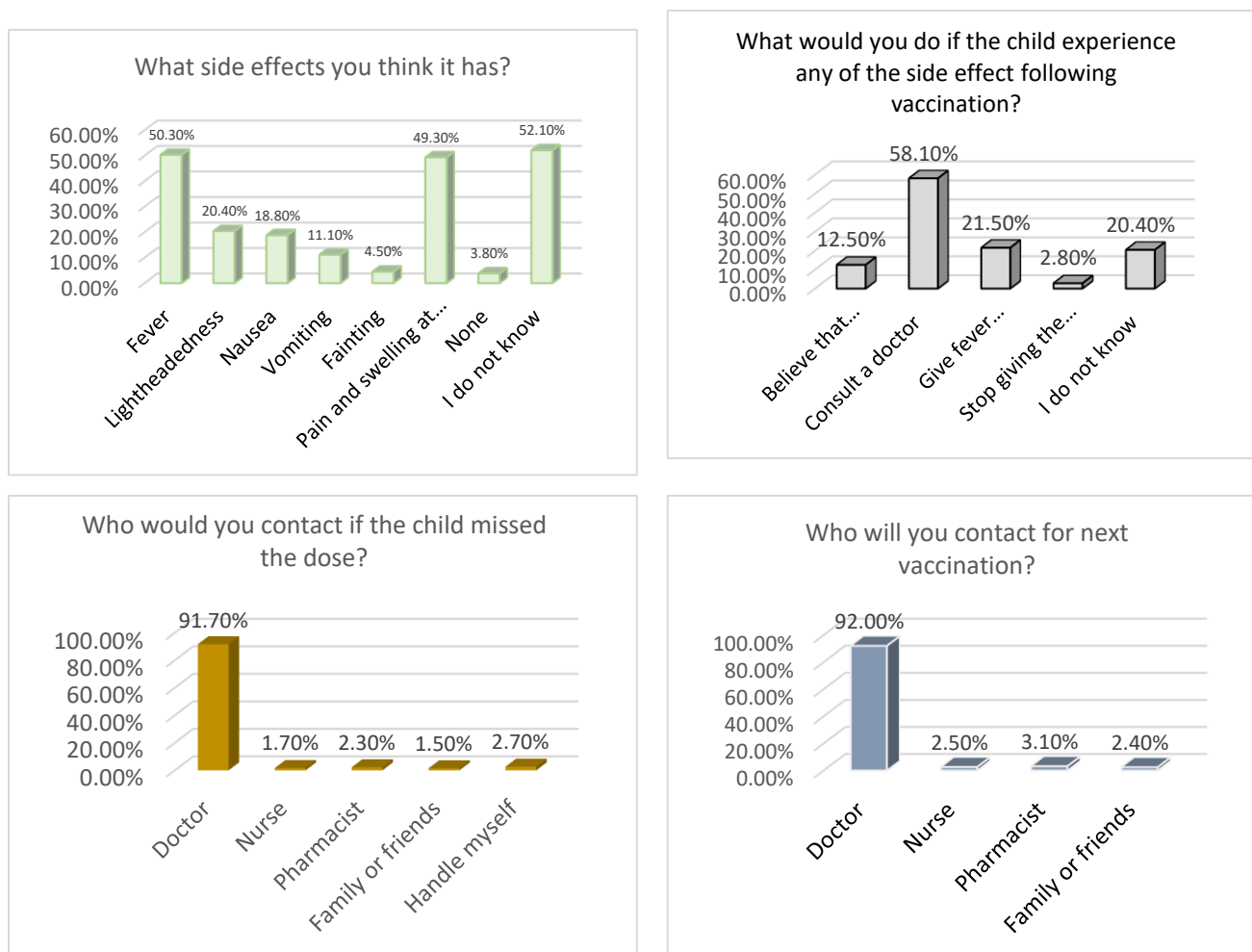


Would you comply with a booster dose?



Do you have family restrictions regarding this vaccine?



**Graph 4**

Graphical Representation for the assessment of practices of participants towards TCV across the population of Pakistan

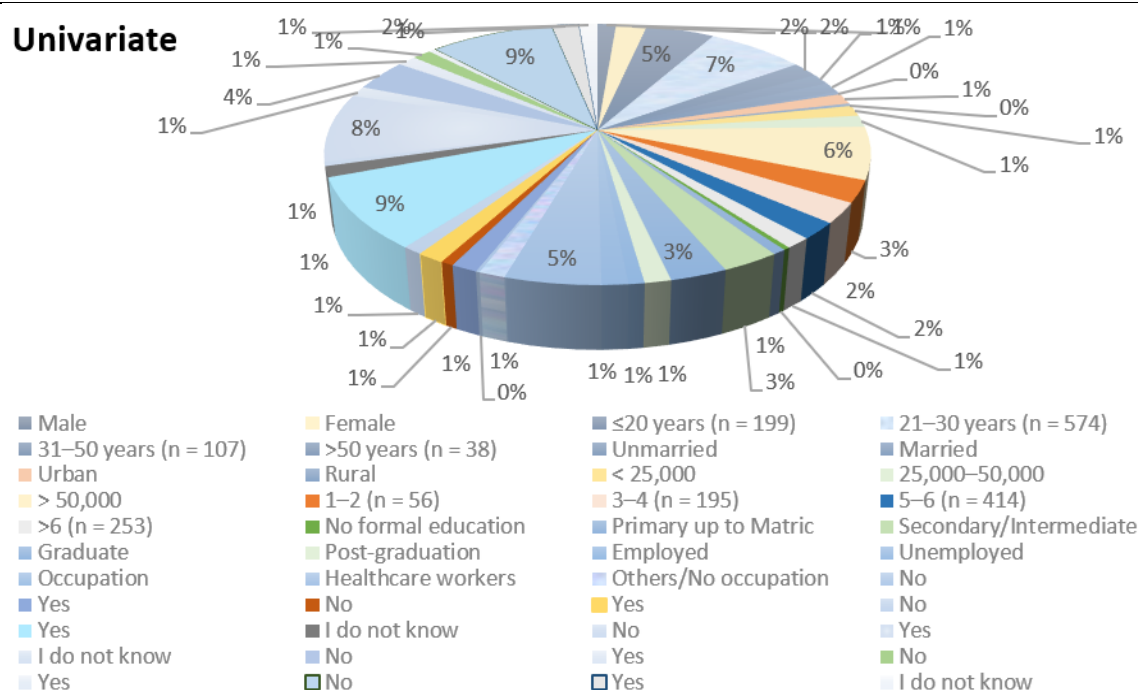
Factors Associated with Willingness to Receive a TCV Booster Dose

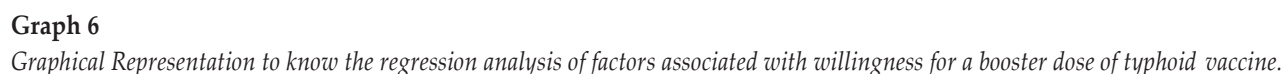
The results of univariate analysis showed that the female gender, younger age, urban living, high level of income, and positive attitudes towards the TCV were significantly related to the determination to get a booster dose. After the covariate-adjusted results of a multivariate logistic regression model, household income, marital status, and perceptions of vaccine efficacy were statistically significant as predictors.

The willingness to receive a boosters dose was less likely in married people (adjusted odds ratio (aOR) = 0.56; $p = 0.038$). On the other hand, respondents whose household income is greater than PKR50000 per month were found to be much more likely to accept a booster dose (aOR = 2.85; $p < 0.001$) (Hashmi *et al.*, 2021). Individuals who had doubts about the protective effectiveness of TCV had a significantly smaller willingness to take a booster shot (aOR = 0.20; $p = 0.011$).

Table 5*Logistic regression analysis of factors associated with willingness to receive a TCV booster dose*

Variable	Category	COR (95% CI)	p-value	aOR (95% CI)	p-value
Gender	Male	1.00	-	1.00	—
	Female	1.65 (1.16–2.35)	0.005	1.13 (0.74–1.74)	0.573
Marital status	Unmarried	1.00	—	1.00	—
	Married	0.29 (0.20–0.41)	<0.001	0.56 (0.33–0.97)	0.038
Residence	Urban	1.00	—	1.00	—
	Rural	0.26 (0.17–0.38)	<0.001	0.67 (0.40–1.12)	0.130
Monthly income (PKR)	<25,000	1.00	—	1.00	—
	25,000–50,000	1.09 (0.69–1.71)	0.709	0.83 (0.50–1.37)	0.461
	>50,000	4.92 (3.14–7.71)	<0.001	2.85 (1.89–4.30)	<0.001
Negative belief about TCV protection	Negative	0.39 (0.18–0.83)	0.017	0.20 (0.06–0.69)	0.01
	Positive	1.00 (reference)	-	1.00 (reference)	-

Univariate**Graph 5***Graphical Representation to know the regression analysis of factors associated with willingness for a booster dose of typhoid vaccine*



It has been shown that typhoid conjugate vaccine (TCV) can cause a significant decrease in morbidity and mortality rates of the disease in question caused by the bacteria called *Salmonella typhi* and especially in regions where the extensively-drug-resistant forms of the latter proliferate. Regular use of TCV abates antimicrobial resistance and prevents improper use of antibiotics. The current study looked at the knowledge, attitudes and practices of the Pakistani population towards TCV. Most of the respondents (85.3%) indicated that vaccines prevent illnesses, a finding that is consistent with those of Sankar et al., who established that 91.86% indicated that vaccines are protective (Abenova *et al.*, 2023). The awareness of TCV was seen to be 54.2% only, which is less than the reported figures by Hanif et al., who reported that 75% of the sample population in Sindh, Pakistan had knowledge of TCV. This difference can be explained by the fact that the location of the study by Hanif et al. was close to the local vaccination centers, which might have increased the awareness of the community about the vaccine (Madiha *et al.*, 2025).

The proportion of the positive attitude towards TCV was significant, and 77.7% of the respondents felt that the vaccine is safe, and 80.8% believed that the vaccine is effective. Memon et al. reported similar perceptions as they found that 75.7% in the

survey considered that TCV is safe, and 87% out of the survey considered it effective. On the other hand, a considerable number of the participants expressed concern, citing the fact that TCV may include items that are forbidden by Islam law (67.9%), have concerns with the vaccine itself (21.6%), or were referring to being a part of an international conspiracy against Pakistan (13.1%) (Ullah *et al.*, 2026). Similar concerns were reported by Memon *et al.*, who noted that people believed that TCV is an international conspiracy targeting Pakistani children (73.5%), harmful (24.3%), and even possibly having harmful constituents (11.4%). Interestingly, 92% of the respondents would take the vaccine so long as their issues were properly handled. In the past, religious leaders have spread the notion that polio vaccination causes infertility; on the topic of the COVID-19 vaccine, rumors circulated that vaccination would either cause the population to become sterile or cause death in 2 years. The same trends of misinformation are also noted in terms of other vaccines whereby TCV has been alleged to contain poisonous chemicals and be dangerous in terms of their long-term health effects (Butt *et al.*, 2024).

The advice of the experts (53.3%) and the vaccine delivery through the governmental initiatives (29.8%) became the key factors that motivated the participants to vaccinate their kids. This is in line with Tahir *et al.* who found out that mandatory vaccination (48.06%) and physician recommendation (39.37%) were the major forces behind the COVID-19 vaccination uptake. Health-care workers (HCWs) are least disputable information providers and can be regarded the most persuasive source of information about disease prevention and treatment, especially in the case of immunization, the benefits of vaccination, and the currently existing vaccine myths in the community (Hussain *et al.*, 2026). Based on this, the communication between HCWs and the general population should be effective to ensure the development of vaccination acceptance and persuasion of people to vaccinate themselves and others. Most of the respondents said that they would consult a doctor on a missed dose of a vaccine (58.1%), side effects related to the vaccines (91.7%) and a follow-up vaccine (92.0%), which is in line with Sankar *et al.* who reported that 70.2% would see a doctor and 29% would see a nurse in the case of a missed dose (Shan *et al.*, 2021).

Those who had higher incomes, a higher level of education, and had smaller families were more willing to take a TCV booster dose. High income seems to increase the capacity to pay medical attention and to utilize the accessible health-care services, thus being useful in the maintenance of health and prevention of illnesses. Similarly, advanced educational levels will also help those levels to be health literate and reduce the level of misconception, providing a good attitude towards disease prevention, treatment, and willingness to vaccination. Other factors that predict vaccine acceptance encompass older age, increased perceived threat of diseases and positive vaccine attitudes. In their turn, socio-demographic subgroups with low education and income reflected a lower level of vaccination enthusiasm, which supports the importance of developing subgroups-specific policies that would help to address social inequality and advance equitable access to vaccines (Baig *et al.*, 2023).

CONCLUSION

Pakistan is a country with a high level of awareness of the advantages of vaccination and the need to take booster shots. Nevertheless, there appears to be a large gap in knowledge on the existence of Typhoid Conjugate Vaccine (TCV) which is administered by the government and its ability to counter oppose typhoid fever. Although there seems to be a positive attitude towards vaccination, the existence of certain misconceptions based on the religious and national beliefs that should be overcome. The fact that individuals are ready to follow the protocol of booster dosing with TCV is a positive indicator that they clearly understand the significance of the complete set of vaccinations as the best way to prevent the disease. To increase the awareness of the population and counteract the misinformation, there is an urgent need to unite healthcare authorities, media, and governmental bodies to plan seminars and campaigns at the local and national rates. The use of different types of media, such as electronic and print media, can go a long way in dispelling myths about immunization, teaching the masses about the disease, its transmission and the importance of vaccines in the process of protecting the population and save lives. These combined efforts can be used to narrow the knowledge-practice gap and positively influence the increase in vaccination rates and improved population outcomes through the creation of a broad discussion and promoting informed decision-making.

LIMITATIONS

However, this study would be limited in some way. First, convenient sampling was employed in which there would be the

possibilities of selection bias. It was an e-survey and individuals who had access to the Internet participated in the study. Secondly, there would be a recall bias in this study. Thirdly, our sample was more educated, rich and urban than the rest of the population in Pakistan. Finally, although the responses were anonymous since it was a self-reported study, the respondents might have been under pressure to embrace the positive attitudes and perceptions that were acceptable to society. This research paper requires further studies that will target the population living in rural areas and low education levels (Maryam *et al.*, 2025).

RECOMMENDATIONS

It is time to stop referring to typhoid fever as the disease of the past or only poor people because it is a preventable disease that can be cured with the help of vaccines. Although investing in Water, Sanitation, and Hygiene (WASH) infrastructural development is a key factor in the battle against typhoid and other enteric diseases, we recognize that there are some challenges likely to exist in investing in this area; the cost is high, the development may take time, and the infrastructure may not be perfect. Single dose of Typhoid Conjugate Vaccine (TCV) has been shown to be safe, well-tolerated, and even effective in infants as young as 9 months of age and has indicated its potential effect on a diverse range of environments.

The distribution of TCVs across the board and in large numbers is the most important in the fight against the spread and the devastating impact of the typhoid fever. We support the need to prevail innovation and flexibility in the definition of the burden of the disease to make sure that effective strategies are conducted. Nevertheless, setbacks due to the global COVID-19 pandemic do not justify the need to stop working hard to enable the implementation of TCV in endemic countries. This introduction may be made as a standalone event or as an integrated health service to more than just prevent typhoid fever and drug-resistant infections, but also health equity at a global level. Through these efforts, with these initiatives being of priority, we will be able to aim at the eradication of typhoid fever, and global health conditions will be better.

DECLARATION

Ethical Considerations: This study strictly adhered to the Declaration of Helsinki and relevant national and institutional ethical guidelines. All procedures performed in this study were consistent with the ethical standards of the Declaration of Helsinki. The study was conducted according to ethical and clinical standards for research. The research was conducted in close compliance with the ethical guidelines and the review committee of the Fatima Memorial Institute of Medical Sciences in Lahore gave the approval (Ref: IRB/22/13).

Conflict of Interest: The author declares no conflicts of interest.

Consent for Publication: The author allows the publication of his research work.

Funding Source: There was no funding source.

Acknowledgements: The author would like to thank everyone who helped in conducting the research.

Authors' Contributions: The research work is attributed to the single author Muhammad Dawood Khan.

Use of Artificial Intelligence (AI)- Assisted Technology for Manuscript Preparation: No AI tools were used for data extraction, statistical analysis, result interpretation, or the generation of original scientific content. All analyses were conducted by the authors, and they take full responsibility for the integrity and accuracy of the manuscript; however, we used AI for our questionnaire alignments, yet no AI was involved in conducting the test for the analysis.

Similarity Index/ Plagiarism: The similarity index was checked, and it is well below the threshold value of 19%, whereas each source is less > 5%.

REFERENCES

- Abbasi, F. H., Shaikh, A. A., Mehraj, J., Raza, S. M., Rasool, S., Bullo, U. F., ... & Chandio, S. A. (2022). Vaccine hesitancy and perceptions of the community about polio in high-risk areas of Karachi, Sindh, Pakistan. *Vaccines*, 11(1), 70.
- Abenova, M., Shaltynov, A., Jamedinova, U., & Semenova, Y. (2023). Worldwide child routine vaccination hesitancy rate among parents of children aged 0–6 years: a systematic review and meta-analysis of cross-sectional studies. *Vaccines*, 12(1),

31.

- Ambreen, A., Zahoor, M. A., Rasool, M. H., & Khurshid, M. (2026, January). Geographic and Behavioral Determinants of Typhoid and Antimicrobial Resistance in Children Across Urban, Rural, and Nomadic Populations of Punjab, Pakistan. In *Healthcare* (Vol. 14, No. 1, p. 124). MDPI.
- Ansar, F., Azzam, A., Rauf, M. S., Ajmal, Z., Ullah, G. A., Rauf, S., ... & Rauf, S. (2024). Global analysis of RTS, S/AS01 malaria vaccine acceptance rates and influencing factors: a systematic review. *Cureus*, 16(5).
- Baig, U., Muslim Mehdi, S., & Iftikhar, N. (2023). A pattern of antibiotic drug resistance of *Salmonella* Typhi and *Salmonella* Paratyphi among children with enteric fever in a tertiary care hospital in Lahore, Pakistan. *Croatian Medical Journal*, 64(4), 256-264.
- Batool, R., Qureshi, S., Haq, Z., Yousafzai, M. T., Salam, R. A., Ali, R., ... & Qamar, F. N. (2023). Coverage survey of typhoid conjugate vaccine among children aged 6 months to 15 years in an urban slum settlement of Lyari Town Karachi, Pakistan. *Plos one*, 18(8), e0289582.
- Batool, R., Yousafzai, M. T., Qureshi, S., Muhammad, S., Qazi, I., Sadaf, T., ... & Qamar, F. N. (2023). Parental acceptance of typhoid conjugate vaccine for children aged 6 months to 15 years in an outbreak setting of Lyari Town Karachi, Pakistan. *Vaccine*, 41(37), 5376-5382.
- Butt, M., Durrani, S., & Ullah, Z. (2024). Prevalence of Typhoid Fever in Loralai District, Balochistan, Pakistan: A Case Study of Two Hospitals. *Siazga Research Journal*, 3(3), 277-283.
- Delali, D. K., Adenku, L. Y., Kwametukui, S., Zotorglo, S., Abubakari, A. R., Mohammed, B. Y., ... & Amu, H. (2026). Understanding public knowledge, attitudes, and practices on typhoid fever and its prevention in the Hohoe Municipality, Ghana: a cross-sectional study. *Discover Public Health*, 23(1), 440.
- Hashmi, F. K., Khadka, S., Khan, M. H. M., Khan, S. U., Saeed, H., Islam, M., ... & Mansoor, H. U. H. (2021). Antimicrobial Dispensing Sans Legitimate Prescription from Community Pharmacies in Lahore, Pakistan: Implications for Antimicrobial Resistance.
- Hussain, I., Majeed, N., Khan, A. J., Khan, A., Umer, M., Ansari, U., ... & Soofi, S. B. (2026). A Scalable Polio-EPI Synergy Model for Urban Immunization: Coverage Gains Following Workforce Integration in Lahore, Pakistan. *Vaccines*, 14(2), 167.
- Jamil, H., Nohri, A. R., Sama, G., Malik, N. A., & Naveed, S. (2025). Knowledge, Attitudes, And Practices Towards Multidrug-Resistant Typhoid in Pediatric Population in Pakistan. *Insights-Journal of Life and Social Sciences*, 3(3), 7-16.
- Joseph, J., Devarashetty, V., Reddy, S. N., & Sushma, M. (2015). Parents' knowledge, attitude, and practice on childhood immunization. *Int J Basic Clin Pharmacol*, 4(6), 1201-7.
- Khan, M. I. (2010). Typhoid fever: Epidemiology, risk factors, and the effectiveness of Vi capsular polysaccharide vaccine in children in Karachi, Pakistan. Johns Hopkins University.
- Kurkuri, S. N., Vayalil, M. P., Kumar, S., & Gopi, A. (2025). Parental perspectives on typhoid vaccination: knowledge, awareness, and acceptance in Mysuru district: a cross-sectional study. *International Journal of Community Medicine and Public Health*, 12(10), 4652.
- Lubanga, A. F., Bwanali, A. N., Moyo, C., Kamanga, W., Chrispin, E., Kambili, F., ... & Nyirenda, T. (2026). Typhoid knowledge, prevention practices, and vaccine awareness in high-risk communities of Lilongwe, Malawi. *Transactions of The Royal Society of Tropical Medicine and Hygiene*, 120(6), 623-632.
- Madiha, Shahzadi, A., & Ashiq, Z. (2025). Community engagement: the missing piece in solving the puzzle of XDR-typhoid spread in Pakistan. *Journal of Public Health Policy*, 46(3), 645-652.
- Maryam, S., Saleem, Z., Haseeb, A., Qamar, M. U., Amir, A., Almarzoky Abuhussain, S. S., ... & Godman, B. (2025). Progress on the global research agenda for antimicrobial resistance in human health in Pakistan: Findings and implications. *Infection and Drug Resistance*, 3795-3828.
- Memon, M. H., Saeed, F., Iqbal, M., & Khan, M. A. (2020). Opinion of parents regarding conjugate typhoid vaccine. *Annals Of Abbasi Shaheed Hospital and Karachi Medical & Dental College*, 25(3), 144-150.
- Nizamuddin, S., Ching, C., Kamal, R., Zaman, M. H., & Sultan, F. (2021). Continued outbreak of ceftriaxone-resistant

- Salmonella enterica serotype Typhi across Pakistan and assessment of knowledge and practices among healthcare workers. *The American journal of tropical medicine and hygiene*, 104(4), 1265.
- Qamar, F. N., Batool, R., Qureshi, S., Ali, M., Sadaf, T., Mehmood, J., ... & Yousafzai, M. T. (2020). Strategies to improve coverage of typhoid conjugate vaccine (TCV) immunization campaign in Karachi, Pakistan. *Vaccines*, 8(4), 697.
- Rahu, M. A., Baloch, N., Perveen, S., Malhi, P., & Shah, W. (2026). Knowledge and Cultural Influences on Childhood Immunization Among Caregivers in a Rural Setting of Umerkot, Sindh, Pakistan: A Cross-Sectional Study. *Women and Children Nursing*.
- Ravi, N., & Ayando, O. D. (2024). Risk perception, behavior, and knowledge of typhoid fever diagnosis, treatment, and vaccination: insights from patients in Kano, Nigeria. *medRxiv*, 2024-11.
- Rostkowska, O. M., Peters, A., Montvidas, J., Magdas, T. M., Rensen, L., Zgliczyński, W. S., ... & Pelzer, B. W. (2021). Attitudes and knowledge of European medical students and early graduates about vaccination and self-reported vaccination coverage—multinational cross-sectional survey. *International Journal of Environmental Research and Public Health*, 18(7), 3595.
- Saeed, M., Waheed, H., Rahman, A., Hamza, M., & Javed, B. (2025). Antibiotic Resistance Patterns in Pediatric Typhoid Cases in Combined Military Hospital Peshawar. *Indus Journal of Bioscience Research*, 3(6), 1010-1013.
- Shafiq, Y., Khowaja, A. R., Yousafzai, M. T., Ali, S. A., Zaidi, A., & Saleem, A. F. (2017). Knowledge, attitudes and practices related to tetanus toxoid vaccination in women of childbearing age: A cross-sectional study in peri-urban settlements of Karachi, Pakistan. *Journal of infection prevention*, 18(5), 232-241.
- Shan, H., Maqbool, S., Hassan, U., & Noor, A. (2021). Public awareness and understanding about spread of antimicrobial resistance linked with food chain. *Isra Medical Journal*, 13(3).
- Siddiqi, D. A., Abdullah, S., Dharma, V. K., Khamisani, T., Shah, M. T., Setayesh, H., ... & Chandir, S. (2022). Assessment of vaccination service delivery and quality: a cross-sectional survey of over 1300 health facilities from 29 districts in Sindh, Pakistan conducted between 2017–18. *BMC Health Services Research*, 22(1), 727.
- Tahir, M. J., Saqlain, M., Tariq, W., Waheed, S., Tan, S. H., Nasir, S. I., ... & Ahmed, A. (2021). Population preferences and attitudes towards COVID-19 vaccination: a cross-sectional study from Pakistan. *BMC public health*, 21(1), 1759.
- Tahir, M. J., Zaman, M., Saffi, J., Asghar, M. S., Tariq, W., Ahmed, F., ... & Ahmed, A. (2023). Knowledge, attitudes, and practices of the general population of Pakistan regarding typhoid conjugate vaccine: findings of a cross-sectional study. *Frontiers in public health*, 11, 1151936.
- Ullah, K., Mbaeyi, C., Saleem, J., Ishaq, M., Safdar, M. R., Pervaiz, A., ... & Mehmood, A. (2026). Understanding Motivating Factors for COVID-19 Vaccination in Families Defaulting from Childhood Immunization: A Mixed-Methods Study in Pakistan. *Pediatric Reports*, 18(1), 24.
- Virk, F. N., Tariq, A., Riaz, L., Javed, A., Jamal, A., & Adil, M. (2026). Risk factors of multi drug resistance enteric fever among pediatric patients in Lahore. *Infectious Diseases Journal of Pakistan*, 35(1), 50-55.

Submit your Manuscript to Multidisciplinary Publishing Institute (SMC-Private) limited journals and benefit form:



Convenient online submission.

Rigorous peer review.

Open Access: Articles freely available online.

High visibility in the field.

Retaining the joint copyright to the article.

Submit your next manuscript @ <https://mdpip.com/>

Note: Open Access Public Health and Health Administration Review is recognized by the Higher Education Commission of Pakistan in the Y category in 2024-2025. The journal is under evaluation by the Pakistan Medical and Dental Council (PM&DC) and ISI Web of Science.

Disclaimer/ Publisher's Note: The statements, opinions, and data contained in all publications in this journal are solely those of the individual author(s) and not of the Multidisciplinary Publishing Institute (SMC-Private) Limited and/ or the editor(s). Multidisciplinary Publishing Institute (SMC-Private) Limited and the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions, or products referred to in the content.