

Awareness and Acceptability of Parents towards the Typhoid Conjugate Vaccine: A Cross-Sectional Study from a Tertiary Hospital in Lahore, Pakistan

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Abstract

We evaluated awareness and acceptability of the newly introduced Typhoid Conjugate Vaccine (TCV) among parents in Lahore, Pakistan. In this cross-sectional hospital-based study, 290 parents of children aged 9 months to 15 years admitted to the Pediatric Department of Mayo Hospital were recruited consecutively. Data was collected through interviews using a predesigned questionnaire and the validated Parental Attitude to Childhood Vaccinations (PACV) tool. About 70% of parents were aware of TCV, 55.5% had vaccinated their children, and 71% of the unvaccinated were willing to vaccinate. Only 16.9% showed hesitancy, and 38.2% knew the correct dosage. Vaccination was higher among female children, parents with higher education, urban residents, and those receiving physician guidance. Hesitancy was linked to misbeliefs about TCV contents and political motives. Overall, parental awareness and acceptability were high, but actual vaccination rates were lower than expected, indicating a need to address barriers to timely immunization.

Introduction

Typhoid fever is an acute systemic illness caused primarily by *Salmonella typhi*, which spreads through the fecal-oral route (1). As per the Global Burden of Disease report in 2017, there were over 10 million cases of typhoid fever globally with more than a hundred thousand deaths (2); incidence is even higher across low- and middle-income countries such as Pakistan due to poor sanitation and open defecation practices (3,4).

With the recent emergence of extensively drug-resistant (XDR) Typhi strains, prevention is becoming the centerpiece in the fight against typhoid (5). In 2018, World Health Organization prequalified the Typhoid Conjugate Vaccine (TCV) to better combat the disease (6). Compared to former vaccines, TCV bestows longer-lasting immunity, requires fewer doses, and can be administered to children from 6 months of age (7). Due to the exceptionally high burden of disease, Pakistan was among the first countries to formally introduce TCV into its routine immunization schedule, first in 2019 in the province of Sindh, followed by Punjab in 2021 (4).

In some districts, Pakistan's parental vaccine refusal rate is as high as 27.9% i.e. nearly a third of the parents in these areas are averse to having their children vaccinated, and only around two-thirds of Pakistan's children are fully vaccinated (8,9). These subpar vaccination rates further dwindled during the coronavirus pandemic, and the ensuing travel decline, redirection of healthcare resources, and general apprehension all decreased parents' compliance with the EPI schedule (10). As TCV has recently been introduced in Punjab, studies about the awareness and acceptability of this vaccine among parents in this area are scarce (11). It seems that perception of the general population in Pakistan about the vaccine is fair (12).

We conducted this study in a large tertiary care hospital in the provincial capital i.e., Lahore to evaluate the awareness and assess the level of acceptability regarding TCV among parents. We hoped to highlight the problems faced by the mass vaccination campaign conducted in Punjab so that improvements might be made to enhance the coverage of the Typhoid conjugate vaccine with more suitable outcomes.

Materials and Methods

We conducted a cross-sectional study among parents of children admitted to the Pediatrics Department, Mayo Hospital Lahore, from August 2021 to November 2021. We estimated a sample size of 290 participants using a 95% confidence level, 5% absolute precision, and expected percentage of awareness as 75% (11).

We implemented a non-probability consecutive sampling method. Supervisors trained and guided the interviewers on the correct way to approach the participants provided the hospital setting of the study. Informed verbal consent was obtained from all participants to account for illiterate participants, consent form was both in English and translated to Urdu. Consent form is available in supplementary material. Abstinence at any point after obtaining oral consent was allowed. Consent for publication was obtained and the participants were assured that their privacy and confidentiality will be maintained while communicating the findings of this research in peer-reviewed academic journals.

The questionnaire was translated into the local language Urdu to overcome the language barrier. This translation was verified by a professor of the Urdu language. The questionnaire was then pretested on ten individuals using the respondent debriefing method who gave extensive feedback regarding their understanding of the questions. Their confusion between covid vaccination and TCV prompted improvements. A special reminder was added in the consent form that the vaccine in question was TCV, not the covid vaccine, to ensure no confusion between the two. The improved questionnaire was retested to screen for remaining problems. The final questionnaire was retested to screen for remaining problems. Patients/guardians having at least one child aged between 9 months and 15 years were interviewed face-to-face based on this final questionnaire.

Data collection procedure:

Awareness of TCV was determined by whether the parents were aware that the TCV was available for their child, while acceptability was determined through modified PACV tool where a parent was considered to believe the vaccine was acceptable if they were determined to be non-hesitant by the tool. We included twenty-four questions in our questionnaire. Some of these were extracted from the PACV (parental attitude about childhood vaccine) Survey tool and were modified and adapted to be specific to only the TCV vaccine. PACV is a validated tool used to assess the attitude of parents regarding childhood vaccination (13). Most of these questions were taken from the "beliefs about vaccine safety and efficacy" section of

the tool. The PACV questionnaire is a general tool used to determine the overall hesitancy of parents toward scheduled vaccines. We had to change some of the questions to make them a better fit to determine parental hesitancy towards a single vaccine, which is the Typhoid Conjugate Vaccine. Out of the nine questions, the first eight were structured on a Likert scale, while the last question had only three possible responses i.e., Yes/No/I Don't Know.

The questionnaire itself was divided into five domains:

1. General biodata of the interviewee and their child.
2. Awareness and general knowledge parents have about TCV.
3. Vaccination status of their child and related questions regarding the source of vaccination, the primary source of their information, and intention to vaccinate their child.
4. The fourth section consisted of 9 questions modified from the PACV survey.
5. Ancillary questions which represent common misconceptions and beliefs held by most people in our culture.

Data analysis procedure:

Data obtained was analyzed using SPSS version 26.0. The qualitative data like gender, income, education, etc. was summarized as percentages and proportions. The scores obtained in section IV based on the PACV tool were summarized as the mean (SD). Bivariate analysis was conducted to measure the correlation between vaccination status, awareness, acceptability, willingness to get vaccinated, and dosage of the vaccine with other independent variables. The chi-square test was used to establish these relations. Fisher's exact test was applied where the sample size was 5 or lower. Results were considered significant when the p-value was less than 0.050.

Results

Population characteristics:

Our study had 290 parents, 242 (83.5%) of whom were mothers and had a daughter (60.3%) currently receiving care from Mayo Hospital, Lahore. Most of the parents were aged between 30 to 39 years (48.3%), had four or more children (43.8%), had received no formal education (41%), earned less than 50,000 PKR (93%), and were urban residents (74.8%). Further details are mentioned in Table 1.

Awareness:

Two hundred and four (70.3%) out of 290 participants were aware that the government recently introduced a new typhoid vaccine (TCV). Out of these 204, 82 (40.2%) had received this information via mass media, 65 (31.9%) via physicians, 23 (11.3%) via friends/family, and 34 (16.7%) through school consent forms for TCV vaccination. (Table 2)

Vaccination status:

One hundred and sixty-one (55.5%) participants had gotten their children vaccinated against Typhoid. (Table 2) Out of the 129 (44.5%) participants with unvaccinated children, 92 (71.3%) were willing to get their children vaccinated, 18 (14%) were unsure regarding this decision and 19 (14.7%) were against getting their child vaccinated. Most children (87, 54%) had their shot as part of government-sponsored door-to-door community campaigns, 48 (29.8%) had gotten vaccinated in school, 25 (15.5%) in hospital vaccination centers and only one (0.6%) had gotten vaccinated in a private clinic.

Willingness to get the child vaccinated:

Of the 129 (44.5%) participants with unvaccinated children, 92 (71.3 %) were willing to get their child vaccinated, 19 (14.7%) openly refused while 18 (14.0%) were unsure.(table 2)

Acceptability:

According to the PACV tool, 241 (83.1%) out of the 290 participants were non- hesitant about TCV while 49 (16.9%) were hesitant. (Table 2) Individual parts of responded to PACV tool are mentioned in Table 3.

Dosage:

Out of 204 (70.3%) participants who were aware of TCV, 78 (38.2%) knew the correct dosage of the vaccine, while 111 (54.4%) admitted to being unaware of the correct dosage. (Table 2) Moreover, 15 (7.4%) of the participants answered wrongly about the correct dose.

Bivariate Analysis:

Upon analysis, it was found that fathers were significantly more aware ($p=0.03$) of the TCV vaccine as compared to mothers (Table 2). Of the 161 currently vaccinated children, positive vaccination status was significantly related to the child being female ($p=0.007$), belonging to a household with more than 2 children ($p=0.03$ general number of children, $p=0.014$ for re-coded value), having parents who had completed high school as part of their education ($p=0.004$), living in urban areas ($p=0.009$) and had received information from physicians ($p=0.000$), and school consent forms ($p=0.002$). (Refer to Table 2)

Parents with no formal education (118, 40.7%) were significantly more likely to be willing to get their child vaccinated ($p=0.001$). Households with a monthly income of less than 50,000 Pakistani Rs (17, 5.9%) were surer about their decision regarding the vaccine in terms of wanting or refusing the shot for their child, while parents with households earning more than 50,000 were more unsure and less likely to outright refuse ($p<0.05^*$). Parents that sourced their information from mass media ($p=0.033^*$) and friends and family ($p=0.009^*$) were more willing to get their children vaccinated.

We found fathers were significantly more accepting of TCV (0.031) as compared to mothers. Parents below 50 years of age were also more accepting ($p=0.016^*$), while those who got information from friends and family were significantly more hesitant ($p=0.016^*$). Parents holding beliefs such as TCV having family planning aspects ($p=0.000$), religious/political aspects ($p=0.000$), containing haram contents ($p=0.000$), and being a conspiracy against Pakistani children ($p=0.000$), were significantly more hesitant. (Table 4)

Out of 78, 33 participants (50.8%) who got their information regarding TCV from physicians were right about the correct dosage of the vaccine. Only a quarter (21, 25.6%) of people who used mass media as their main source of information knew the correct dose, while 59 (72%) of people falling in this category were unfamiliar with it. ($p=0.000$) (Table 2).

Discussion

Our research revealed several interesting findings. Although only half of the participants had had their children vaccinated, majority indicated that they would be willing to have their child vaccinated should the vaccine become available to them. Additionally, upon administration of the modified PACV survey, only a minority of the participants were found to be hesitant regarding TCV. This indicates that the main barrier perhaps was not vaccine hesitancy but either the lack of awareness or the unavailability of the vaccine itself.

We found a higher level of awareness about TCV among fathers. This could be attributed to the significantly younger age of mothers ($p=0.011$) in our sample. Studies show that mothers, especially younger in age or uneducated, have a greater probability for vaccine refusal (8,14,15). Maternal education and awareness, as well as women empowerment is correlated with higher child immunization rates (16–18), which also shows that societal pressure and gender inequality might overrule maternal awareness in backward areas (19).

The number of parents who knew the accurate dosage of TCV was staggeringly low. Apart from a likely vaccine related ignorance, this finding could also be related to the advent of the COVID–19 pandemic. The TCV campaign occurred close to the pandemic and the COVID vaccination campaigns, (the introduction occurred in February 2021 while COVID-19 pandemic and vaccine introduction occurred between 2020 to 2021) which could have created confusion among the general populace. This knowledge gap leaves a greater chance of children being over-immunized which might cause minor side effects such as fever, erythema, and injection site pain (20).

Plenty of research exists about pediatric sex discrimination in healthcare seeking behavior of parents. Generally, the preference if present, is towards the male offspring receiving vaccinations over female offspring. (21,22). Yet peculiarly, most of the unvaccinated children in our setting were males. Whereas other studies find female children, especially among poor Muslim households, to be vastly unvaccinated when compared to their male counterparts (18,23). This contradictory result might be due to the in-hospital setting of our study.

Interestingly, the greater number of vaccinated children belonged to parents with a high school education, whereas completely uneducated parents were the most willing to get their child vaccinated. This finding contradicts prior research which shows that higher parental education levels are associated with greater vaccination acceptance (8,15,24). This may point towards a lack of accessibility rather than a lack of acceptability. In our sample, the uneducated cohort predominantly belonged to rural areas where, due to a higher disease burden, the population is conceivably more familiar with the disease process and consequences. Inaccessibility is a huge hindrance in vaccine uptake, especially in rural areas (25,26).

Our results found that vaccination adverse effects are a major concern of the parents. Fear of adverse effects of vaccination is a common reason for parental vaccine refusal (14,27). However, evidence for the side effects of TCV thus far is limited to mild symptoms such as fever and local reactogenicity (28). Such misapprehensions need to be addressed and parents need to be reassured to ensure maximal participation of parents.

Our results reflect the role of social media in increasing vaccine hesitancy as well. Parents whose primary source of information was not a physician were much more hesitant towards the vaccine. Particularly, those gaining information from mass media were prone to contrary opinions such as: children are getting more shots than necessary, and natural immunity is better than vaccinations. The spread of misguided sentiments and misinformation through social media regarding vaccination is well known (28–30). On the bright side, parents have greater confidence in information dispensed by healthcare providers (31–34). Thus there needs to be more physician and healthcare provider involvement in spreading awareness about vaccines.

Vaccine hesitancy due to religious misinterpretation is a major concern in Muslim communities worldwide (35–37). Political mistrust also appears to negatively impact vaccination campaigns (33), and conspiracy theories have historically been a major hurdle in mass vaccination (30,38). We found, refreshingly, that only a minor number of participants had religious misgivings, misconceptions about haram content, or suspicions of conspiracy, however those that did hold these beliefs were far more likely to be hesitant about the vaccine.

Our study is the one of the first to explore the awareness and acceptability of parents towards TCV in Punjab, Pakistan after its introduction in 2021. Since we used a researcher administered questionnaire, our findings are reasonably objective regardless of the academic or technological proficiency of the participants. Most of our participants belong to the high risk, lower- and middle-income population which is also the primary focus of vaccination campaigns. Furthermore, we collected data soon after the conclusion of the TCV campaign, (the campaign took place from February 2021 to March 2021 and was followed by an introduction of the TCV to the EPI schedule while we collected our data from August to November 2021) so the information was relatively fresh in the participants' minds. However, the study is not without its limitations. Since this is a study conducted in a single hospital with the sample population limited to the main city and its surroundings, it may not be representative of more remote settings. Majority of the results were obtained from an urban population thus they should be generalized to the whole of the country. The study might be subject to social desirability bias and recall bias. It should be noted that the interviewees were all parents of children currently admitted to the hospital, implying that most were relatively amenable to medical care and had some degree of trust in the medical system of Pakistan.

Our findings have various critical implications. Parental cooperation is crucial in achieving maximal vaccine coverage. The widespread reach of social media and mass media should be utilized for disseminating authentic information and campaign promotions (39,40). Healthcare providers should be encouraged to establish robust communication with the community. The support of our religious leaders and scholars is quite helpful in dispelling religious misconceptions regarding vaccination.

The findings also bring to attention some important questions. The religious and political misconceptions regarding vaccination need deeper investigation, as do the parental demographics associated with higher vaccine refusal. The extent to which the covid pandemic and the subsequent onslaught of misinformation and vaccine hesitancy damaged the perception of other vaccines such as TCV still remains unknown. We need more high-powered and diverse studies, especially as vaccination efforts continue.

Conclusion

Awareness and acceptability of Typhoid Conjugate Vaccine among parents is quite reassuring. However, the reported vaccination status of pediatric population is unsatisfactory. Vaccine hesitancy is mainly associated with misinformation and misguided religious or political beliefs. Future efforts should be centered around uncovering the basis of this disparity to maximize the timely benefit of the vaccine.

Declarations

Funding Declaration: This research received no funding from any funding agency in the public, commercial or not-for-profit sectors

Ethics Declaration: The study proposal has been reviewed and approved by the Institutional review board of King Edward medical university, Lahore, Pakistan. The study also adheres to the ethical guidelines for human participation as specified by the IRB of KEMU.

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Tables

Table 1: Sociodemographic characteristics of the participants

N=290

Characteristics	Number (n=290)	Frequency (%)
Gender of child		
Male	115	39.7
Relationship to the child		
Father	48	16.5
Age of parent		
Below 18 years	5	1.7
18-29 years	116	40
30-39 years	140	48.3
40-49 years	25	8.6
50 or above	4	1.4
Number of children in the household		
1	29	10
2	68	23.4
3	66	22.8
4 or above	127	43.8
Education		
No formal education	118	40.7
Primary school	68	23.4
High school	56	19.3
Higher Secondary	28	9.7
Higher Education	20	6.9
Household income		
<15,000 PKR	134	46.2
15,000 – 49,999 PKR	137	47.2
50,000 – 99,999 PKR	17	5.9
>100,000 PKR	2	0.7
Residence		
Urban	217	74.8
Rural	73	25.2

Table 2 Population Characteristics with Correct Responses N= 290

	Are you aware of the Typhoid vaccine i.e., Typhoid Conjugate vaccine that was recently introduced by the government?		How many doses of TCV are recommended?		Has your child been immunized with TCV?		If your child has not been vaccinated, will you be willing to get them vaccinated?		Acceptability – Are you hesitant to get your child vaccinated for TCV?	
	Yes (n=204)	p-value	One (n=78)	p-value	Yes(n=161)	p-value	Yes(n=92)	p-value	Non-hesitant (n=241)	p-value
CHARACTERISTICS										
Gender				0.868				0.139	143 (81.7%)	0.436
Male	122 (69.7%)	0.772	47(38.5%)		86(49.1%)	0.007	61(68.5%)		98 (85.2%)	
Female	82 (71.3%)		31(37.8%)		75 (65.2%)		31(77.5%)			
Parent's Relationship				0.207*				0.288*		0.031
Father	40(83.3%)	0.03*	19(47.5%)		27 (56.3%)	0.911	18(85.7%)		45 (93.8%)	
Mother	164(67.8%)		59(36%)		134(55.4%)		74(68.5%)		196(81%)	
Age of parent				0.493*						0.053*
< 18 years	4(80%)	0.286*	0(0%)		2 (40%)	0.902*	3(100%)	0.751*	4 (80%)	
18-29 years	74(63.8%)		28(37.8%)		62(53.4%)		37(68.5%)		94(81%)	
30-39 years	104(74.3)		41(39.4%)		81(57.9%)		42(71.2%)		120(85.7%)	
40-49 years	18(72.0%)		8(44.4%)		14(56%)		9(81.8%)		22(88%)	
50 or above	4(100%)		1(25%)		2(50%)		1(50%)		1(25%)	
Number of children in the household		0.014*		0.296*				0.541*		0.344*
1	24(82.8%)		12(50%)		15 (51.7%)	0.003	11(78.6%)		22(75.9%)	
2	38(55.9%)		10(26.3%)		29(42.6%)		29(74.4%)		56(82.4%)	
3	51(77.3%)		21(41.2%)		49(74.2%)		10(58.8%)		59(89.4%)	
4 or above	91(71.7%)		35(38.5%)		68(53.5%)		42(71.2%)		104(81.9%)	
Level of education of the parent		0.080						0.001*		0.996*
None				0.692*		0.004				
Primary	83(70.3%)		27(32.5%)		69 (58.5%)		44(89.8%)		98(83.1%)	
High school	41(60.3%)		19(46.3%)		28(41.2%)		21(52.5%)		56(82.4%)	
Higher secondary	41(73.2%)		15(36.6%)		40(71.4%)		10(62.5%)		46(82.1%)	
Higher education	25(89.3%)		12(48%)		17(60.7%)		9(81.8%)		24(85.7%)	
	14(70%)		5(35.7%)		7(35%)		8(61.5%)		17(85.0%)	

Household income								0.143*	0.506*
<15,000	91 (67.9%)	0.157*	36(39.6%)	0.290*	73 (54.5%)	0.356*	47(77%)	112(83.6%)	
15,000-49,999	100(73.0%)		35(35%)		80 (58.4%)		38(66.7%)	115(83.9%)	
50,000-99,999	13(76.5%)		7(53.8%)		8 (47.1%)		5(55.6%)	12(70.6%)	
>100,000	0(0%)		0		0(0%)		2(100%)	2(100%)	
Residence								0.883	0.810
Urban	155(71.4%)	0.486	59(38.1%)	0.736*	130(59.9%)	0.00	61(70.1%)	181(83.4%)	
Rural	49(67.1%)		19(38.8%)		31(42.5%)		31(73.8%)	60(82.2%)	
Source of information								0.017*	0.012*
Mass Media				0.000*		0.000			
Physicians			21(25.6%)		42(51.2%)		33(82.5%)	77(86.5%)	
Friends/Family									
School			33(50.8%)		58(89.2%)		4(57.1%)	58(90.6%)	
Consent Forms			10(43.5%)		10(41.7%)		9(64.3%)	15(62.5%)	
			14(41.2%)		31(91.2%)		1(33.3%)	27(77.1%)	

* Fischer's exact test was used

Table 3: PACV tool result

N=290

Individual PACV components	Strongly disagree		Disagree		Not sure		Agree		Strongly agree	
	Number	Frequency	Number	Frequency	Number	frequency	Number	Frequency	Number	Frequency
Do you believe the information you receive about the vaccine?	17	5.9	34	11.7	21	7.2	103	35.5	115	39.7
Do you believe children are already getting more shots than are good for them and they don't need a new one?	136	49.6	68	23.4	14	4.8	46	15.9	26	9.0
Do you think it is better for your child to develop immunity by getting sick than to get a shot?	151	52.1	67	23.0	14	4.8	25	8.6	33	11.4
Do you believe that the disease TCV prevents is very severe?	22	7.6	16	5.5	31	10.7	77	26.6	144	49.7
	Not at all concerned		Not that concerned		Not sure		Somewhat concerned		Very Concerned	
	Number	Frequency	Number	Frequency	Number	Frequency	Number	Frequency	Number	Frequency
How concerned are you that your child might have a serious side effect from the TCV shot?	111	38.3	77	26.6	13	4.5	52	17.9	37	12.7
How concerned are you that TCV might not be safe?	135	46.6	77	26.6	10	3.4	42	14.5	26	9.0
How concerned are you that TCV might not prevent the disease?	139	47.9	76	26.2	16	5.5	40	13.8	19	6.6

	Not hesitant at all		Not that hesitant		Not sure		Somewhat hesitant		Very hesitant	
	Number	Frequency	Number	Frequency	Number	Frequency	Number	Frequency	Number	Frequency
Overall, how hesitant about the TCV shot would you consider yourself to be?	178	7.9	42	14.4	5	1.7	42	14.5	23	61.4
	Yes			No			I don't know			
	Number		Frequency		Number		Frequency		Number	
Do you know of anyone who has had a bad reaction to a TCV shot?	44	15.2			226	77.9			20	6.9

Table 4: Relationship of Vaccine Acceptability with Miscellaneous Beliefs N= 290

	Acceptability		p-value
	Non-hesitant (n=241)	Hesitant (n=49)	
MISCELLANEOUS BELIEFS			
Family Planning aspects			
Yes	21(52.5%)	19(47.55%)	0.000
Religious and political aspects			
Yes	19(50%)	19(50%)	0.000
Conspiracy against children			
Yes	22(59.5%)	15(40.5%)	0.000
Haram contents			
Yes	17(56.7%)	13(43.3%)	0.000

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [3.TCVSupplementarymaterial.docx](#)