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Original Research Article

ASSESSMENT OF KNOWLEDGE, PERCEPTION, ATTITUDES AND BARRIERS TO POLIO VACCINATION AMONG PARENTS

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Abstract: *Polio remains a significant public health challenge in Pakistan, necessitating an understanding of parental knowledge, perceptions, attitudes, and barriers to vaccination in urban and rural areas.* ***Objective:*** *To assess the knowledge, perceptions, attitudes, and barriers towards polio vaccination among parents in urban and rural regions of Pakistan.* ***Methods:*** *A descriptive cross-sectional survey was conducted from October 2019 to February 2020, involving 609 respondents (mothers and fathers) with an 87% response rate. A pretested, anonymous, self-administered questionnaire was used to evaluate participants' knowledge, perceptions, attitudes, and barriers to polio vaccination.* ***Results:*** *Participants exhibited good knowledge and positive attitudes towards polio vaccination. No significant differences were noted in awareness of polio terminology between urban and rural participants (p=0.427). A majority supported polio vaccination for all children (p=0.0001*) and recognized its importance (p=0.007*). Concerns regarding vaccine sterility (p=0.0001*) were prevalent. Barriers such as lack of knowledge (p=0.216) and distrust in medical facilities (p=0.0001) were identified.* ***Conclusion:*** *Parents in Pakistan demonstrate good knowledge and positive attitudes towards polio vaccination. However, addressing gaps in knowledge and mistrust in medical services is critical to enhancing vaccination uptake, particularly in rural areas.*

Keywords: Polio, Polio Vaccination, Knowledge and Attitudes, Barriers to Vaccination, Parental Perceptions

Introduction

Poliomyelitis (Polio) is a highly infectious viral disease caused by the Polio virus. It is a serious problem in a large part of the developing world that is continuously posing a threat to the childhood population with critical concerns for social and economic development. The disease polio is of great public health concern worldwide as it is one of the chief causes of disability, especially among young children under 5 years of age (5). One of the 3 strains of poliovirus (WVP) identified as type 2 WVP has been eradicated globally, while type 1 and type 3 continue to prevail mainly in polio-endemic areas (6). The polio virus spreads through person-to-person contact, infected faeces, and through the infected secretions from the nose and mouth. Polio may remain, asymptomatic; however, it may result in partial or full paralysis, respiratory failure, and occasionally death (2). Wild poliovirus cases have diminished by over 99% since 1988, *i.e.*, from an expected 350,000 cases in over 125 endemic nations to 33 detailed cases in 2018. In Pakistan, the number of cases declined from 306 in 2014 to 54 in 2015, 20 in 2016 and in 2017 and 12 in 2018 (10). However, in 2019 the Polio Eradication Initiative program witnessed a significant spread of the virus and supported 144 polio cases across all provinces. So far in 2020, 7 cases have been reported from different provinces (9). Over 90% of polio cases in Pakistan have been reported from four major transmission zones in Fata, Khyber-Pakhtunkhwa (K-P), Baluchistan, central Punjab and Sindh. Despite far-reaching legislative endeavours since 1994 to eradicate polio, Pakistan is as yet confronting significant difficulties in having a foolproof polio vaccination program, parental refusal and restriction of vaccination from the nearby groups (3).

In a KAP study of two highly affected areas of Pakistan, poor knowledge towards the polio vaccination campaign was observed with religious beliefs as a major barrier (2). Similarly, a few studies showed satisfactory knowledge of the masses about immunization programs, yet they were unaware of the disease (4). Another study showed that social mobilization is much needed to enhance the acceptance of immunization programs and alter the attitude of the public (1).

In recent years, Pakistan probably reported 2 – 3 confirmed cases of polio in Sindh and Khyber Pakhtunkhwa region (3). Moreover, there are reports that parents in the Khyber Pakhtunkhwa region or interior Punjab and Sindh refused to vaccinate their children (2). Probably, the notion that polio vaccination may cause polio, or it is a spy program made them averse to this program, despite the unflinching and untiring efforts of the government to vaccinate the children. Seemingly, poor knowledge, myth-driven perceptions and attitudes, and associated barriers might be the factors that contributed to the parent's unwillingness to vaccinate their children, which for sure can only be intervened after careful assessment of these factors. There is a dearth of literature evidence regarding the assessment of parental knowledge,

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perception, attitudes, and perceived barriers to this program. Thus, we aimed to conduct the study, where we wanted to evaluate the parental knowledge, perception, attitudes and posed barriers towards polio vaccination in Lahore, the second largest metropolitan city of Pakistan.

Methodology

The Human Ethical Committee University College of Pharmacy, University of the Punjab, Lahore, approved the study, reference number 100/UCP/2019. Informed Verbal consent was obtained from all the participants.

A descriptive, cross-sectional study was conducted by sampling respondents from Lahore and the rural areas of Shakargarh, Pasrur, and beleaguering rural areas of Lahore. The data was for a period of 5 months starting from October 2019 to February 2020. Data was collected from both the parents, i-e., the mother, and father.

A total of 609 subjects including both mother and father from urban and rural areas were enrolled in the study using convenient sampling. The sampling frame consisted of parents having children ≤ 5 years of age.

Inclusion criteria: Parents, mothers, and fathers, having children ≤ 5 years of age, irrespective of race, ethnicity, education, social class, religion and willingness to participate in the study were included in the study.

Exclusion criteria: Parents having children above 5 years, who have completed their children's vaccination course and are not willing to participate in the study were excluded from the study.

Data collection was done using a comprehensive instrument of measure designed after an extensive literature review (2) (7) (8). The questionnaire was sent to subject experts/academicians for content validation; thereafter their expert opinion was incorporated to make the questionnaire simpler and more objective driven. A total of 700 questionnaires were distributed to homes at 9:30 AM and collected back at 5:00 PM. Out of the total, only 609 questionnaires were found complete, and incomplete forms were not included in the final data. The questionnaire was outlined into the following 5 sections.

Section 1: Basic demographics, such as age, gender, marital status, no of children less than 5 years of age, Religion, maternal and paternal education, residence (urban or rural), and vaccination status.

Section 2: Knowledge was assessed using 14 questions about polio related to the polio causes, risk factors, incubation period, transmission, prevention, curable or not, repetition of vaccine, polio campaign in their area, answerable in two options; correct or incorrect.

Section 3: Perception was assessed using 11 statements using an ordinal scale; strongly agree, Agree, Disagree, and strongly disagree.

Section 4: attitudes were evaluated using 9 questions using two options, i-e., agree or disagree.

Section 5: 15 questions regarding misconception, religion, accessibility, influences, and finances were asked on the nominal scale; Yes or No.

The data were analyzed using SPSS (IBM, version 22) unless otherwise reported. Descriptive analysis was performed to estimate the percentages and frequencies employing cross-tabulation. Associations of dependent variables including knowledge, attitude, perception, and barriers encountered towards polio vaccination and independent variables, such as demographics were estimated using Pearson's Chi-square. An alpha value of equal or less than 0.05 was considered significant.

Results

Data regarding the demographic distribution of parents based on habitation are summarized in Table 1. Data suggested that based on urban and rural habitation, the frequency distribution of gender (p=0.43) and vaccination status (p=0.182) were not significantly different. Moreover, 95% of parents hailing from rural areas had 1 -2 children compared to 87% of parents belonging to urban areas (p=0.005). Regarding maternal education (ME) and paternal education (PE), more than 60% of parents from urban areas (**ME;** 61.5%, **PE;** 64.4%, p=0.0001) had college/university education, while the frequency of primary education was higher in parents from rural areas (**ME;** 33.7%, **PE;** 36.2%, p=0.0001) (Table 1).

Data regarding the knowledge of parents based on habitation are summarized in Table **2**. Data suggested that based on urban and rural habitation, the participants were aware of the terminology of polio as the frequency distribution was not significantly different (p = 0.427). Similarly, the majority of parents from both areas (**Rural;** 87.9%, **Urban;** 83.9%) knew that lack of immunisation is a risk factor (p= 0.188). Moreover, 89.3% of parents hailing from urban areas knew that polio is caused by the virus compared to 45.7% of parents belonging to rural areas (p= 0.0001). Furthermore, 49.8% of parents from urban areas answered that polio is not curable compared to 64.8% of parents belonging to rural areas (p= 0.0001). 71.4% of parents hailing from rural areas wrongly believed that polio drops should not be given to children with mild illnesses compared to 53.2% of parents from urban areas (p= 0.0001). Regarding transmission of polio, 53.7% of parents from urban areas had the knowledge that polio can be transmitted through contaminated water and food compared to 43.2% of parents from rural areas (p= 0.016).

Data regarding the perception of parents based on habitation are summarized in Table 03. Data suggested that based on urban and rural habitation, the participants thought that polio was a very serious disease (p=0.66). About 75% of parents hailing from urban areas and 95% of parents belonging to rural areas said that the problem is not severe in their region(p=0.0001**). The majority of parents belonging to urban and rural areas (**Urban;**85%, **Rural;** 90%) with frequency (p=0.0001**) agreed that all children should receive the polio vaccine. 52% parents of from urban areas agreed while 70% parents of from rural areas disagreed that polio vaccination has some sterility issues(p=0.0001**). With the frequency (p=0.099) parents belonging to urban and rural areas agreed that communities should actively participate in controlling polio in Pakistan. 94% of parents of urban and 96% of parents of rural areas agreed that vaccination must be given according to schedule. Most parents 75% belonging to urban areas and 82% parents of rural areas with the frequency (p=0.196) disagreed that polio has severe side effects.

Data regarding the attitude of parents based on habitation is summarised in Table 04. Data suggests that the attitude of urban and parents of rural habitats (p=0.007*) suggests that the polio vaccine is important, People from both areas, frequency (p=0.001*) said that the vaccine is safe. The role

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of the vaccines in the maintenance of child health (p=0.001*) is not significantly different. Parents residential in both areas (p=0.0001*) emphasize that vaccines should be given according to schedule. The majority of people from urban and rural areas (p=0.001*) suggest that vaccines are important in the prevention of infectious diseases. The parent's attitude toward the role of the vaccines in lessening the mortality rate and side effects of medicine was almost the same (p=0.0001*). Most of the parents disagreed frequently (p=0.023) that side effects of the vaccine can cause death.

Data regarding barriers to polio vaccination based on habitation is summarised in Table 05. Data suggested that based on urban and rural habitation, the frequency distribution of religious beliefs (p=0.663) and misconceptions about vaccines (p=0.901) were not significantly different. The majority of parents belonging to urban and rural areas (Urban =57.1%, Rural=51.8%) with a frequency distribution of (p=0.216) revealed that the primary reason for non-vaccination was the lack of knowledge. 59.5% parents of from urban areas and 38.7% parents of from rural areas with a frequency distribution of (p=0.0001**) revealed that the secondary reason for non-vaccination was the lack of trust in medical facilities.

Table 1: Demographic distribution based on Parent's habitation

Characteristics	Urban *n*= 410 (%)	Rural *n*= 199 (%)	P-value*
Age:			
18-30	273(66.4%)	102(51.1%)	
31-40	117(28.5%)	89(44.6%)	0.004*
41-51	20(4.8%)	8(4%)	
Gender			
Male	131 (32.0)	70 (35.2)	0.427
Female	279 (68.0)	129 (64.8)	
No of Children			
1-2	360 (87.8)	189 (95.0)	0.005*
>2	50 (12.2)	10 (5.0)	
Maternal Education			0.0001**
Primary	24 (5.9)	67 (33.7)	
Secondary	51 (12.4)	54 (27.1)	
Higher Secondary	83 (20.2)	31 (15.6)	
College/university	252 (61.5)	47(23.6)	
Paternal Education			0.0001**
Primary	23 (5.6)	72 (36.2)	
Secondary	50 (12.2)	51 (25.6)	
Higher Secondary	73 (17.8)	40 (20.1)	
College/university	264 (64.4)	36 (18.1)	
Vaccination status			
Vaccinated	353 (86.1)	177 (88.9)	0.182
Partially vaccinated	46 (11.2)	21 (10.6)	
Non-vaccinated	11 (2.7)	1 (0.5)	

Table 2: Participant's knowledge based on Parent's Habitation

Knowledge Questions	Urban n= 410 (%)	Rural n= 199 (%)	P-value*
Polio is caused by a virus.			
Correct	366 (89.3)	91 (45.7)	0.0001**
Incorrect	44 (10.7)	108 (54.3)	
Have you ever heard of a disease called polio?			
Correct	385 (93.9)	190 (95.5)	
Incorrect	25 (6.1)	9 (4.5)	0.427
Travel to polio-affected areas is a risk factor			
Correct	249 (60.7)	75 (37.7)	
Incorrect	161 (39.3)	124 (62.3)	0.0001**
The incubation period for polio infection is 3-6 days	193 (47.1)	22 (11.1)	
Correct	217 (52.9)	177 (88.9)	0.0001**
Incorrect			
Lack of immunisation is a risk factor			
Correct	344 (83.9)	175 (87.9)	
Incorrect	66 (16.1)	24 (12.1)	0.188
Polio can be transmitted through direct person-to-person contact			

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Correct	112 (27.3)	45 (22.6)	
Incorrect	298 (72.7)	154 (77.4)	0.213
Polio can be transmitted through contaminated water, food			
Correct	220 (53.7)	86 (43.2)	
Incorrect	190 (46.3)	113 (56.8)	0.016
The patient should be promptly isolated upon diagnosis to avoid transmission.			
Correct	159 (38.8)	23 (11.6)	0.0001**
Incorrect	251 (61.2)	176 (88.4)	
Polio is curable			
Correct	206 (50.2)	70 (35.2)	0.0001**
Incorrect	204 (49.8)	129 (64.8)	
Repetition of polio vaccine is necessary for full protection			
Correct	344 (84.1)	155 (77.9)	0.061
Incorrect	65 (15.9)	44 (22.1)	
Immunisation is the most effective way of preventing polio			
Correct	364 (88.8)	189 (95.0)	0.013
Incorrect	46 (11.2)	10 (5.0)	
Polio drops should not be given to children with mild illness			
Correct	192 (46.8)	57 (28.6)	
Incorrect	218 (53.2)	142 (71.4)	0.0001**
Polio can cause the death of a patient			
Correct	183 (44.6)	71 (35.7)	0.036
Incorrect	227 (55.4)	128 (64.3)	
Have you ever heard about polio vaccine campaigns in your area this year?			
Correct	355 (86.6)	193 (97.0)	0.0001*
Incorrect	55 (13.4)	6 (3.0)	

Table 3: Parent's Perception towards Polio vaccination

QUESTIONS	Urban n=410(%)	Rural n=199(%)	P-value*
Polio is a serious disease.			
Strongly Agree	300(73.2)	154(77.4)	
Agree	98(23.9)	40(20.1)	**0.066**
Disagree	4(1.0)	5(2.5)	
Strongly Disagree	8(2.0)	0(0.0)	
The problem of polio is very severe in your area	31(7.6)	2(1.0)	
Strongly Agree	81(19.8)	15(7.5)	**0.0001****
Agree	231(56.3)	173(86.9)	
Disagree	67(16.3)	9(4.5)	
Strongly Disagree			
Polio vaccines are not capable of inducing the transmission of infection			
Strongly Agree	70(17.1)	13(6.5)	
Agree	131(32.0)	131(65.8)	**0.0001****
Disagree	169(41.2)	33(16.6)	
Strongly Disagree	39(9.5)	22(11.1)	
Infected children should not be brought to public places due to the risk of infection transmission.	41(10.0)	17(8.5)	
Strongly Agree	85(20.7)	19(9.5)	**0.0001****
Agree	170(41.5)	129(64.8)	
Disagree	114(27.8)	34(17.1)	
Strongly Disagree			

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All children should receive the polio vaccine.			
Strongly Agree	309(75.4)	127(63.8)	**0.0001****
Agree	59(14.4)	53(26.6)	
Disagree	33(8.0)	4(2.0)	
Strongly Disagree	9(2.2)	15(7.5)	
Polio vaccination has some sterility issues.			
Strongly Agree	77(18.8)	28(14.1)	**0.0001****
Agree	138(33.7)	31(15.6)	
Disagree	141(34.4)	75(37.7)	
Strongly Disagree	54(13.2)	65(32.7)	
Polio vaccines should be appropriately stored to be effective			
Strongly Agree	266(64.9)	124(62.3)	**0.210**
Agree	117(28.5)	66(33.2)	
Disagree	20(4.9)	9(4.5)	
Strongly Disagree	7(1.7)	0(0.0)	
Communities should actively participate in controlling polio in Pakistan			
Strongly Agree	316(77.1)	165(82.9)	
Agree	80(19.5)	29(14.6)	**0.099**
Disagree	10(2.4)	1(0.5)	
Strongly Disagree	4(1.0)	4(2.0)	
People with polio are less productive than non-disabled ones			
Strongly Agree	144(35.1)	36(18.1)	
Agree	138(33.7)	83(41.7)	**0.0001***
Disagree	102(24.9)	23(11.6)	
Strongly Disagree	26(6.3)	57(28.6)	
Vaccination must be given according to schedule			
Strongly Agree	303(73.9)	115(57.8)	**0.0001***
Agree	86(21.0)	78(39.2)	
Disagree	16(3.9)	2(1.0)	
Strongly Disagree	5(1.2)	4(2.0)	
Vaccines have severe side effects.			
Strongly Agree	45(11.0)	17(8.5)	
Agree	56(13.7)	17(8.5)	**0.196**
Disagree	195(47.6)	104(52.3)	
Strongly Disagree	114(27.8)	61(30.7)	

Table 4: Parent's Attitude towards polio vaccine

QUESTIONS	Urban n=410(%)	Rural n=199(%)	P-value*
Vaccine is important			
Agree	391(95)	198(99.5)	**0.007***
Disagree	19(4.6)	1(0.5)	
Vaccine is safe			
Agree	381(92.9)	197(99)	**0.001***
Disagree	29(7.1)	2(1)	
Vaccines maintain child health.			
Agree	379(92.4)	197(99)	**0.001***
Disagree	31(7.6)	2(1)	
Recommend others to vaccinate their child.			
Agree	384(93.7)	197(99)	
Disagree	26(6.3)	2(1)	**0.003***
Vaccinations must be given according to the schedule			
Agree	383(93.)	196(98.5)	
Disagree	27(6.6)	1(0.5)	**0.0001****
Vaccination is effective in the prevention of infectious diseases			
Agree	368(89.8)	194(97.5)	

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Disagree	42(10.2)	5(2.5)	**0.001***
Vaccination reduces the mortality rate.			
Agree	326(79.5)	189(95)	**0.0001****
Disagree	84(20.5)	10(5)	
Vaccines have severe side effects.			
Agree	120(29.3)	20(10.1)	**0.0001****
Disagree	290(70.7)	179(89.9)	
Side effects cause death.			
Agree	140(34.2)	87(43.7)	**0.023**
Disagree	269(65.8)	112(56.3)	

Table 5: Barriers for non-vaccination

QUESTIONS	Urban n=410(%)	Rural n=199(%)	P-value*
Religious beliefs			
Yes	189(46.1)	88(44.2)	**0.663**
No	221(53.9)	111(55.8)	
Misconceptions about vaccines			
Yes	200(48.8)	96(48.2)	**0.901**
No	210(51.2)	103(51.8)	
Lack of knowledge			
Yes	234(57.1)	103(51.8)	**0.216**
No	176(42.9)	96(48.2)	
Non-compliant spouse			
Yes	181(44.1)	25(12.6)	**0.0001****
No	229(55.9)	174(87.4)	
Lack of trust in medical facilities			
Yes	244(59.5)	77(38.7)	
No	166(40.5)	122(61.3)	**0.0001****
Do not want to expose the child to needles			
Yes	182(44.4)	24(12.1)	**0.0001****
No	228(55.6)	175(87.9)	
Accessibility problems			
Yes	173(42.2)	66(33.2)	**0.075**
No	236(57.6)	133(66.8)	
Influence of family and friends			
Yes	153(37.3)	18(9.0)	**0.0001****
No	257(62.7)	181(91.0)	
Influence of traditional healers			
Yes	167(40.7)	10(5.0)	**0.0001****
No	243(59.3)	189(95.0)	
Influence of physicians/doctors			
Yes	144(35.1)	7(3.5)	**0.0001****
No	266(64.9)	192(96.5)	
Fear of side effects			
Yes	201(49.0)	60(30.2)	**0.0001****
No	209(51.0)	139(69.8)	
Vaccines are not considered effective.			
Yes	119(29.0)	47(23.6)	**0.160**
No	291(71.0)	152(76.4)	
Lack of time			
Yes	116(28.3)	3(1.5)	**0.0001****
No	294(21.7)	196(98.5)	
Financial Issues			
Yes	99(24.1)	0(0.00)	**0.0001****
No	311(75.9)	199(100.0)	
No vaccinator came to the house.			
Yes	127(31.0)	4(2.0)	**0.0001****
No	283(69.0)	195(98.0)	

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Discussion

To the best of our knowledge, the findings reported in this study give a first insight into the knowledge, perception, attitudes, and barriers towards polio vaccination among the urban and rural areas of Pakistan. Data suggested that the parents from urban areas had college/university education, while the frequency of primary education was higher in parents from rural areas. Overall parents from both areas exhibited good knowledge about polio. The results showed that participants from both areas were aware of the terminology of polio and its existence as a disease. These results were comparatively better than other knowledge questions. Parents knew that lack of immunisation was a risk factor. However, the parents from rural areas have less knowledge that polio is caused by a virus. The current study also explored areas where knowledge gaps were identified such as the incubation period of the virus, the possibility of curing polio, the administering of polio drops in patients with mild illness and the possibility of death from polio. However, the results are comparatively better than a study conducted in Quetta and Peshawar divisions in Pakistan (3). The probable reason for this discrepancy could be due to the intensification of polio campaigns in the past few years in Pakistan as the referenced study was conducted in 2014.

Data regarding the perception of participants suggested that the problem of polio is not severe either in rural or urban areas. This shows that the parents are regularly participating in polio vaccination campaigns. Parents from both areas agreed that all children should receive polio vaccine. A vast majority of parents from both areas strongly agreed that communities should actively participate in controlling polio in Pakistan and they also believed that vaccination must be given according to schedule. These parents agreed that the polio vaccine is free of side effects. This indicates that even the people belonging to rural areas with the majority having primary education are mostly aware of polio and actively participate in polio vaccination campaigns.

Data demonstrated that the majority of people in urban and rural habitation had positive attitudes regarding polio vaccination. People from both categories suggested that vaccines are important and safe. Parents and residents of both areas emphasize that vaccines should be given according to schedule. Furthermore, the data collected revealed that vaccines are significant for maintaining child health and preventing infectious diseases. The parent's attitude toward the role of vaccines in lessening the mortality rate and severe side effects of vaccines was almost the same. These findings were in the same line with the results done in Egypt during the year 2015 about mothers' knowledge, attitude, and practice towards children's obligatory vaccination. (7). The majority of the people from both urban and rural habitation revealed that the side effects of vaccines do not cause death.

In the case of barriers, the majority of people from both urban and rural habitation revealed that the main reason for non-vaccination was lack of knowledge although mass media campaigns remained the most common sources of vaccine-related information. This finding was similar to the study conducted in 2013 at pediatric outpatient clinics of the Civil Hospital (CHK) and the National Institute of Child Health (NICH) about the reasons for non-vaccination in pediatric patients visiting tertiary care centres in polio-prone countries (8). In our study, the majority of the population is Muslim and although Islamic literary sources (Quran and Hadith) encourage any efforts made for the improvement of health, most religious leaders harbour a disagreement against vaccination and seem to fulfil their agenda. Religious taboos and misconceptions about vaccines carry mediocre importance about the under-vaccinated population of both areas. Furthermore, the secondary reason for non-vaccination was a lack of trust in medical facilities followed by accessibility problems, the influence of family, friends and traditional healers, fear of side effects and financial issues. The findings of this study represent the Lahore, Shakargarh, Pasrur, and Shahdara divisions of Pakistan which may not account for the broader Pakistani population. The participants were approached randomly to collect data, hence they may not account for the differences within the population.

Conclusion

The findings of this study showed good knowledge and positive attitudes of participants towards polio vaccination. Lack of knowledge and lack of trust in medical facilities were reported as the major barriers towards polio vaccination. Special attention should be given to further educating the people of rural areas to enhance their acceptability of polio vaccines. Interventions should be customized to build up people's trust in medical facilities so that more people will get their children vaccinated.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-100/UCP/2019)
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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

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Coordination of collaborative efforts.
Study Design, Review of Literature.
AHMAD IBNE YOUSAF (Academic Officer)
Conception of Study, Development of Research Methodology Design, Study Design, Review of manuscript, final approval of manuscript.
Conception of Study, Final approval of manuscript.
SAIF ULLAH KHAN
Manuscript revisions, critical input.
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