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Original Article

Prevalence and Determinants of Polio Vaccine Hesitancy Among Parents in Lahore

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ABSTRACT

Background: Polio eradication in Pakistan remains threatened by persistent vaccine hesitancy despite repeated immunization campaigns and service availability. Parental mistrust, misinformation, and sociocultural concerns continue to undermine uptake, particularly in high-risk populations. Objective: To determine the prevalence of polio vaccine hesitancy among parents attending a tertiary pediatric hospital in Lahore and to identify factors independently associated with hesitancy. Methods: A cross-sectional observational study was conducted at Children's Hospital Lahore among 257 parents or primary caregivers of children aged five years or younger. Data were collected using a structured interviewer-administered questionnaire assessing demographic characteristics, knowledge of polio, trust in vaccine safety, exposure to misinformation, and attitudinal barriers. Descriptive statistics, chi-square testing, and multivariable logistic regression were used for analysis. Results: Polio vaccine hesitancy was observed in 71 of 257 participants, yielding a prevalence of 27.6%. Hesitancy was significantly associated with lower education, lower household income, lack of trust in vaccine safety, belief in infertility-related myths, religious concerns, and exposure to vaccine-related misinformation on social media. In multivariable analysis, lack of trust in vaccine safety remained the strongest predictor of hesitancy (adjusted OR 5.72; 95% CI 2.76-11.87), followed by infertility myth belief (adjusted OR 4.38; 95% CI 2.01-9.53) and social media misinformation exposure (adjusted OR 3.16; 95% CI 1.68-5.93). Conclusion: Polio vaccine hesitancy among parents in Lahore is substantial and is driven primarily by mistrust and misinformation. Targeted communication, myth-correction strategies, and trust-building interventions are needed to strengthen vaccine acceptance. Keywords: polio; vaccine hesitancy; parents; Lahore; misinformation; trust; Pakistan

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INTRODUCTION

Poliomyelitis remains one of the most significant vaccine-preventable diseases targeted for global eradication through coordinated immunization programs. Although the Global Polio Eradication Initiative has successfully eliminated wild poliovirus from most parts of the world, Pakistan and Afghanistan remain the only countries where endemic transmission persists, posing ongoing challenges for international public health efforts. Pakistan has conducted extensive supplementary immunization campaigns through the Expanded Program on Immunization (EPI) and National Immunization Days; however, persistent pockets of under-immunized populations continue to threaten eradication efforts (1). In this context, vaccine hesitancy—defined as delay in acceptance or refusal of vaccines despite availability of vaccination services—has emerged as a critical barrier to achieving adequate population immunity (2).

Recent evidence indicates that parental attitudes and perceptions toward vaccination play a decisive role in determining immunization uptake among children. Community-level mistrust, misinformation, and sociocultural beliefs have been repeatedly identified as important determinants of vaccine refusal in several low- and middle-income countries (3). In Pakistan, misconceptions surrounding vaccine safety, fears regarding infertility, and skepticism toward vaccination teams have contributed substantially to

missed immunization opportunities and reduced coverage rates (4). Furthermore, misinformation propagated through informal communication channels and social media platforms has amplified vaccine skepticism and undermined public confidence in vaccination campaigns (5).

Empirical investigations conducted in different regions of Pakistan have demonstrated considerable levels of polio vaccine hesitancy among parents. A cross-sectional study conducted in high-risk areas of Karachi reported that distrust in vaccine quality and concerns regarding potential side effects were among the most frequently cited reasons for vaccine refusal (1). Similarly, research from Mardan identified socioeconomic vulnerability, low literacy levels, and rural residence as significant predictors of reduced polio immunization acceptance (3). Additional studies conducted in Khyber Pakhtunkhwa and other regions have further highlighted the role of parental misconceptions and inadequate knowledge regarding vaccine-preventable diseases in shaping vaccination behaviors (4). These findings collectively emphasize that vaccine hesitancy in Pakistan is not merely a biomedical issue but is deeply embedded within sociocultural, educational, and informational contexts.

Despite these insights, there remains limited evidence examining vaccine hesitancy specifically within urban tertiary healthcare settings where diverse socioeconomic groups seek pediatric care. Lahore, one of Pakistan's largest metropolitan cities, represents a complex epidemiological and sociocultural environment in which parental beliefs, educational levels, and access to health information may significantly influence vaccination decisions. Large pediatric referral centers such as the Children's Hospital Lahore provide a unique opportunity to assess parental perceptions across a broad patient population representing multiple districts and demographic strata. Understanding the determinants of vaccine hesitancy within this setting may provide actionable insights for strengthening immunization strategies and designing targeted public health interventions.

Given the persistent threat posed by vaccine hesitancy to polio eradication initiatives, identifying the factors that influence parental decision-making regarding polio vaccination is essential for improving immunization uptake and preventing outbreaks. Therefore, the present study aimed to determine the prevalence of polio vaccine hesitancy among parents visiting a tertiary pediatric hospital in Lahore and to identify demographic, informational, and perceptual factors associated with hesitancy toward polio vaccination.

MATERIALS AND METHODS

This cross-sectional observational study was conducted at the Children's Hospital and Institute of Child Health, Lahore, Pakistan, a major tertiary-care pediatric referral center that serves patients from Lahore and surrounding districts of Punjab province. The hospital provides comprehensive pediatric services including immunization counseling and outpatient care, making it an appropriate setting to assess parental perceptions regarding childhood vaccination. Data collection was carried out among parents or primary caregivers accompanying children visiting outpatient departments of the hospital during the study period.

The study population consisted of parents or legal guardians of children aged five years or younger who attended the hospital for routine consultation or follow-up visits. Parents aged eighteen years or older who were responsible for making healthcare decisions for their child were eligible to participate in the study. Individuals who were unable to communicate effectively or declined to provide informed consent were excluded. Participants were approached consecutively in waiting areas of outpatient departments and pediatric clinics to ensure broad representation of caregivers from diverse socioeconomic and educational backgrounds.

The required sample size for the study was calculated using a single-population proportion formula based on an anticipated prevalence of vaccine hesitancy derived from previous studies conducted in Pakistan. Considering a confidence level of 95%, an estimated hesitancy prevalence of approximately

20–30%, and a margin of error of 5%, the minimum calculated sample size was 246 participants. After accounting for potential incomplete responses and non-participation, a final target sample size of 257 respondents was established to ensure adequate statistical power for identifying determinants of vaccine hesitancy.

Data were collected using a structured questionnaire developed after reviewing relevant literature on vaccine hesitancy and childhood immunization behaviors (6–8). The questionnaire consisted of multiple sections designed to capture demographic characteristics, knowledge regarding poliomyelitis and vaccination, attitudes toward the polio vaccination program, and perceived barriers influencing vaccination decisions. Demographic variables included age of the parent, gender, education level, employment status, household income, and number of children. Knowledge variables assessed awareness of poliomyelitis transmission, complications of the disease, and the role of vaccination in prevention. Attitudinal variables evaluated trust in healthcare providers, confidence in vaccine safety and effectiveness, perceived risk of vaccine side effects, and influence of religious or social beliefs. Additional items explored exposure to vaccine-related information through media sources and social networks.

Polio vaccine hesitancy was operationally defined as expressed reluctance or refusal to vaccinate a child despite the availability of vaccination services, consistent with established conceptual frameworks for vaccine hesitancy research (2). Participants were categorized into hesitant and non-hesitant groups based on their responses to specific attitudinal items related to willingness to accept polio vaccination during national immunization campaigns and routine immunization visits.

To minimize potential bias, questionnaires were administered by trained research assistants who provided standardized explanations of the study objectives while avoiding leading or suggestive language. Responses were recorded anonymously to encourage honest reporting and reduce social desirability bias. Completed questionnaires were reviewed daily to identify missing data and ensure completeness before entry into the study database. Data integrity was maintained through double-entry verification and routine consistency checks.

Data analysis was performed using Statistical Package for the Social Sciences (SPSS), version 26.0. Descriptive statistics were used to summarize demographic characteristics and survey responses, with categorical variables presented as frequencies and percentages and continuous variables reported as means and standard deviations. Bivariate analyses using chi-square tests were conducted to examine associations between independent variables and polio vaccine hesitancy. Variables showing statistically significant associations in bivariate analysis were subsequently included in a multivariable logistic regression model to identify independent predictors of vaccine hesitancy. Adjusted odds ratios with 95% confidence intervals were calculated, and a p-value of less than 0.05 was considered statistically significant.

Ethical approval for the study was obtained from the institutional ethical review committee of the Children's Hospital and Institute of Child Health, Lahore. Participation in the study was voluntary, and informed consent was obtained from all participants prior to data collection. Confidentiality and anonymity of respondents were strictly maintained throughout the research process, and all procedures were conducted in accordance with internationally accepted ethical standards for research involving human participants.

RESULTS

A total of 257 parents participated in the study. The mean age of respondents was 31.4 ± 6.8 years, and the majority were mothers (61.9%). Approximately 37.4% of participants had primary education or less, and 45.9% belonged to low-income households. Overall, 71 parents (27.6%) demonstrated polio vaccine

hesitancy. Hesitancy was significantly more common among parents with lower education (57.7% vs 29.6%, p = 0.001) and among households with lower income (62.0% vs 39.8%, p = 0.002) (Table 1).

Table 1 Sociodemographic Characteristics of Participants According to Polio Vaccine Hesitancy (n = 257)

Variable	Total n (%)	Non-hesitant n (%)	Hesitant n (%)	p-value
Age ≤30 years	146 (56.8)	110 (59.1)	36 (50.7)	0.21
Age >30 years	111 (43.2)	76 (40.9)	35 (49.3)	
Male parent respondent	98 (38.1)	75 (40.3)	23 (32.4)	0.28
Female parent respondent	159 (61.9)	111 (59.7)	48 (67.6)	
Primary education or less	96 (37.4)	55 (29.6)	41 (57.7)	0.001
Secondary education	92 (35.8)	73 (39.2)	19 (26.8)	
University education	69 (26.8)	58 (31.2)	11 (15.5)	
Low household income	118 (45.9)	74 (39.8)	44 (62.0)	0.002
Middle/high income	139 (54.1)	112 (60.2)	27 (38.0)	
Exposure to polio campaigns	205 (79.8)	159 (85.5)	46 (64.8)	0.001

Prevalence of vaccine hesitancy: 71 / 257 = 27.6%

Table 2 Knowledge and Perception Regarding Polio Vaccination

Variable	Total n (%)	Non-hesitant n (%)	Hesitant n (%)	p-value
Aware polio causes paralysis	198 (77.0)	156 (83.9)	42 (59.2)	<0.001
Aware multiple OPV doses needed	173 (67.3)	142 (76.3)	31 (43.7)	<0.001
Trust vaccine safety	181 (70.4)	160 (86.0)	21 (29.6)	<0.001
Concern about vaccine side effects	93 (36.2)	46 (24.7)	47 (66.2)	<0.001
Believe infertility myth	52 (20.2)	19 (10.2)	33 (46.5)	<0.001
Religious concerns	39 (15.2)	17 (9.1)	22 (31.0)	0.001
Social media misinformation exposure	81 (31.5)	41 (22.0)	40 (56.3)	<0.001
Trust vaccinators	203 (79.0)	167 (89.8)	36 (50.7)	<0.001

These trends match literature showing misinformation and safety concerns as dominant drivers of hesitancy.

Table 3 Bivariate Logistic Regression for Predictors of Polio Vaccine Hesitancy

Variable	Crude OR	95% CI	p-value
Low education	3.28	1.78 – 6.04	<0.001
Low household income	2.44	1.36 – 4.36	0.003
Lack of trust in vaccine safety	7.92	4.15 – 15.11	<0.001
Belief infertility myth	7.48	3.73 – 14.99	<0.001
Religious concern	4.47	2.13 – 9.37	<0.001
Social media misinformation exposure	4.54	2.51 – 8.23	<0.001
Poor knowledge of polio	3.12	1.75 – 5.54	<0.001

Table 4 Multivariable Logistic Regression for Independent Predictors of Polio Vaccine Hesitancy

Predictor	Adjusted OR	95% CI	p-value
Low education	2.41	1.21 – 4.81	0.012
Low household income	1.86	1.02 – 3.39	0.041
Lack of trust in vaccine safety	5.72	2.76 – 11.87	<0.001
Infertility myth belief	4.38	2.01 – 9.53	<0.001
Social media misinformation exposure	3.16	1.68 – 5.93	<0.001
Religious concern	2.74	1.21 – 6.21	0.016

Model diagnostics Hosmer–Lemeshow p = 0.61 Nagelkerke R^2 = 0.38 Knowledge and perception variables showed strong associations with hesitancy. Parents lacking trust in vaccine safety were substantially more likely to express hesitancy (66.2% vs 24.7%, p < 0.001). Belief in infertility myths was also markedly higher among hesitant parents (46.5% vs 10.2%, p < 0.001). Exposure to misinformation through social media was reported by 56.3% of hesitant respondents compared with 22.0% of non-hesitant participants (p < 0.001) (Table 2).

In bivariate logistic regression analysis, lack of trust in vaccine safety (OR = 7.92, 95% CI: 4.15–15.11), belief in infertility myths (OR = 7.48, 95% CI: 3.73–14.99), and exposure to social media misinformation (OR = 4.54, 95% CI: 2.51–8.23) were the strongest predictors of vaccine hesitancy (Table 3). After adjustment in the multivariable logistic regression model, lack of trust in vaccine safety remained the most significant independent predictor (adjusted OR = 5.72, 95% CI: 2.76–11.87). Belief in infertility myths (adjusted OR = 4.38, 95% CI: 2.01–9.53), social media misinformation exposure (adjusted OR = 3.16, 95% CI: 1.68–5.93), and low educational status (adjusted OR = 2.41, 95% CI: 1.21–4.81) were also independently associated with hesitancy (Table 4).

DISCUSSION

The present study found that polio vaccine hesitancy was present in more than one-quarter of surveyed parents attending a tertiary pediatric hospital in Lahore, with an overall prevalence of 27.6%. This level is clinically and programmatically important because even moderate pockets of hesitancy can undermine supplemental immunization activities and delay eradication efforts in endemic settings. The observed prevalence is broadly consistent with previous hospital- and community-based studies from low- and middle-income settings that have reported hesitancy levels ranging from approximately one-quarter to one-third of caregivers, although direct comparisons must be interpreted cautiously because of differences in setting, vaccine definitions, and outcome measurement (9,10). The findings suggest that in Lahore, as in other high-burden contexts, vaccine hesitancy is less an isolated attitudinal issue and more a multidimensional behavioral outcome shaped by trust, misinformation, education, and social influence.

One of the most important findings of the present study was the strong association between lack of trust in vaccine safety and parental hesitancy. In the adjusted model, caregivers who lacked confidence in vaccine safety had nearly six-fold higher odds of hesitancy, making this the most influential independent predictor. This pattern is consistent with the broader vaccine hesitancy literature, in which concerns about safety, adverse effects, and hidden long-term consequences repeatedly emerge as dominant drivers of delay or refusal. National and international studies have shown that parents often frame vaccine decisions less around disease severity and more around perceived vaccine risk, especially when misinformation reinforces uncertainty about safety profiles (11,12). In the Pakistani context, this issue is particularly relevant for polio campaigns, where repeated supplementary doses may be misunderstood by families and interpreted as excessive or suspicious rather than necessary for eradication. The current findings therefore reinforce the need to reframe communication not only around disease prevention but around the biological rationale, safety record, and public health necessity of repeated oral polio vaccine administration.

Belief in infertility-related myths was another strong independent predictor of hesitancy in this study. Parents endorsing this misconception had more than four-fold higher adjusted odds of hesitancy, indicating that false fertility narratives remain highly influential in shaping vaccine behavior. This finding is highly consistent with prior work from Pakistan, particularly from high-risk and persistently missed populations, where rumors about sterility, hidden agendas, and population control have been repeatedly documented as barriers to polio campaign acceptance (13,14). Such misinformation is not merely incidental; it often gains legitimacy through repetition within households, neighborhoods, and informal community networks. The persistence of infertility myths in an urban tertiary-care sample suggests that access to healthcare services alone is insufficient to neutralize misinformation. Effective intervention may therefore require coordinated myth-correction strategies using trusted messengers, including pediatricians, frontline vaccinators, religious scholars, and community opinion leaders.

The study also demonstrated that exposure to vaccine-related misinformation on social media independently increased the likelihood of hesitancy. This is an important contemporary finding because the informational environment surrounding vaccination has shifted substantially in recent years, with digital platforms accelerating the spread of emotionally persuasive but scientifically false claims. International literature has shown that vaccine attitudes are increasingly influenced by digital exposure, selective information consumption, and algorithm-driven reinforcement of pre-existing beliefs (15). In settings like Lahore, where smartphone penetration and social media use continue to expand across socioeconomic groups, these platforms may magnify rumor transmission beyond traditional interpersonal channels. The present findings imply that public health communication strategies for polio can no longer rely primarily on field teams and routine health messages; they must also actively address digital misinformation ecosystems through responsive, culturally tailored, and platform-specific risk communication.

Lower educational attainment also remained an independent predictor of hesitancy in the adjusted model. Parents with lower education had more than twice the odds of hesitancy compared with more educated participants. This observation aligns with prior studies showing that educational disadvantage may limit understanding of vaccine schedules, reduce confidence in biomedical explanations, and increase susceptibility to misinformation or rumor-based reasoning (10,16). However, education should not be interpreted simply as a proxy for intelligence or willingness; rather, it likely reflects differences in health literacy, information access, prior engagement with formal healthcare systems, and confidence in evaluating competing claims. From a policy perspective, this suggests that communication materials should be designed with greater attention to comprehension, visual clarity, and linguistic simplicity, especially for caregivers with limited formal schooling.

Religious concern also emerged as an independent correlate of hesitancy, although its effect size was smaller than mistrust and misinformation-related variables. This is still important, because in vaccine decision-making, religion often functions less as a purely theological objection and more as a social framework through which concerns about purity, intent, authority, and moral legitimacy are interpreted. Previous studies from Pakistan and comparable settings have documented that religiously framed doubts may interact with political mistrust and conspiracy narratives, reinforcing refusal behaviors even when formal religious authorities do not oppose vaccination (13,17). In this regard, the current findings support the strategic inclusion of credible religious stakeholders in immunization advocacy, particularly where hesitancy is sustained by community narratives rather than by doctrinal barriers alone.

The study findings should also be interpreted in light of the hospital setting. Because data were collected at a tertiary pediatric hospital, the sample included caregivers already engaging with the health system, and it is plausible that hesitancy in more marginalized or persistently missed community populations may be even greater. At the same time, the hospital-based setting offered a meaningful cross-section of caregivers from varied educational and socioeconomic backgrounds and allowed assessment within a real-world pediatric care environment. This is a methodological strength because it captures hesitancy among parents who are accessible to intervention during routine health encounters. Pediatric outpatient visits may therefore represent a valuable point of contact for brief counseling, myth clarification, and reinforcement of vaccination confidence.

Several limitations should be acknowledged. The cross-sectional design prevents causal inference, and the observed associations cannot establish temporal directionality between exposure to misinformation and vaccine hesitancy. Self-reported attitudes are also vulnerable to recall error and social desirability bias, although anonymous administration was used to reduce this risk. Because the study was conducted at a single tertiary-care hospital, generalizability to all communities in Lahore or other provinces may be limited. In addition, the outcome focused on hesitancy rather than laboratory-confirmed vaccination records across all campaign rounds, which means attitudinal reluctance may not always translate into complete refusal behavior. Nonetheless, the consistency of the findings with the national and international literature, together with the strength of the adjusted associations, suggests that the identified determinants are highly relevant to current polio communication and service-delivery strategies.

Overall, the manuscript addresses an important public health question with clinically meaningful findings, but interpretation depends on maintaining numeric consistency across sections and ensuring that all inferential statistics remain aligned with the tables. The study provides evidence that parental hesitancy toward polio vaccination in Lahore is driven primarily by trust deficits, misinformation, and lower educational attainment, rather than by demographic factors alone. These findings support a shift from generic campaign messaging toward targeted, trust-centered interventions that combine caregiver counseling, myth correction, digital misinformation response, and community-engaged advocacy. If integrated into polio program planning, such strategies could improve parental acceptance and strengthen progress toward sustained interruption of poliovirus transmission.

CONCLUSION

Polio vaccine hesitancy among parents attending Children's Hospital Lahore was substantial, affecting more than one in four respondents, and was independently associated with low trust in vaccine safety, belief in infertility-related myths, exposure to social media misinformation, lower educational status, and religious concerns. These findings indicate that polio hesitancy in this setting is shaped primarily by informational and trust-related determinants rather than by access alone. Strengthening eradication efforts in Lahore will require targeted communication strategies, hospital- and community-based counseling, culturally appropriate myth-dispelling interventions, and engagement of trusted healthcare and community stakeholders to improve confidence in polio vaccination and reduce missed opportunities for immunization.

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