

Evaluation of Vaccine Hesitancy and Its Associated Factors among Parents Regarding Childhood Immunization

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Received: 19-06-2026,

Revised: 14-08-2026,

Accepted: 21-08-2026,

Published: 30-08-2026

ABSTRACT

Background: Vaccine hesitancy had remained an important barrier to achieving optimal childhood immunization coverage. Parental concerns regarding vaccine safety, effectiveness, adverse effects, misinformation, accessibility, and social influences had contributed to delayed or missed childhood vaccinations. Identifying factors associated with vaccine hesitancy had been essential for developing targeted interventions to improve immunization uptake.

Aim: The study had aimed to evaluate the level of vaccine hesitancy among parents and to determine the demographic, social, informational, and vaccine-related factors associated with hesitancy toward childhood immunization.

Methods: A cross-sectional study had been conducted at Kulsum International Hospital, Islamabad, from June 2025 to May 2026. A total of 110 parents of children eligible for routine childhood immunization had been enrolled. Data had been collected through a structured questionnaire assessing parental demographic characteristics, knowledge about vaccination, perceptions regarding vaccine safety and effectiveness, sources of vaccine-related information, previous vaccination practices, and reasons for vaccine delay or refusal. Descriptive statistics had been used to summarize the data, while associations between vaccine hesitancy and selected factors had been assessed using appropriate inferential statistical tests.

Results: Among the 110 parents, vaccine hesitancy had been identified in 38 (34.5%) participants, while 72 (65.5%) had demonstrated acceptance of routine childhood immunization. Hesitant parents had more frequently reported concerns regarding vaccine adverse effects (60.5%), doubts about vaccine safety (55.3%), fear of multiple vaccines (42.1%), and exposure to misinformation through social media or informal sources (39.5%). Lower parental knowledge about immunization had been significantly associated with vaccine hesitancy. Parents who had received vaccine information from healthcare professionals had demonstrated greater vaccine acceptance than those relying primarily on social media, relatives, or other informal sources. Delayed vaccination had also been more common among hesitant parents.

Conclusion: The study had concluded that vaccine hesitancy had affected a substantial proportion of parents and had been associated particularly with concerns about vaccine safety, adverse effects, misinformation, and inadequate knowledge. Strengthening healthcare-provider counseling, improving parental education, and addressing misinformation through reliable communication strategies had been recommended to improve parental confidence and childhood immunization uptake.

Keywords: Vaccine Hesitancy, Childhood Immunization, Parents, Vaccination, Vaccine Acceptance, Immunization Coverage, Misinformation

How to cite this article: Wazir S, Ali A, Jamal SN, Tariq A, Rahman A, Malik H. Evaluation of Vaccine Hesitancy and Its Associated Factors among Parents Regarding Childhood Immunization. IJDDT. 2026;16(83s): 685-690; DOI: 10.25258/ijddt.16.83s.86

INTRODUCTION

Childhood immunization had been recognized as one of the most effective public health interventions for

preventing infectious diseases, reducing childhood morbidity and mortality, and improving population health outcomes. Vaccines had provided protection against

several serious and potentially life-threatening diseases, including measles, poliomyelitis, diphtheria, pertussis, tetanus, hepatitis B, and tuberculosis. The widespread implementation of routine childhood immunization programs had substantially reduced the burden of vaccine-preventable diseases worldwide [1]. Despite these achievements, adequate vaccination coverage had remained difficult to sustain in many low- and middle-income countries, where social, cultural, economic, geographical, and healthcare-related barriers had influenced parents' decisions regarding vaccination.

Vaccine hesitancy had emerged as an important challenge to achieving and maintaining high immunization coverage. It had referred to delays in accepting or refusing vaccines despite the availability of vaccination services. Vaccine hesitancy had differed from complete vaccine refusal because hesitant parents might have accepted some vaccines while delaying or rejecting others [2]. This behavior had been influenced by multiple interacting factors, including concerns about vaccine safety, misinformation, lack of knowledge, distrust of healthcare providers, religious and cultural beliefs, previous experiences with healthcare services, and perceptions regarding the necessity of vaccination. Consequently, understanding vaccine hesitancy had required assessment of both individual-level and broader community-level determinants.

Parents had played a central role in childhood immunization because they had generally been responsible for making healthcare decisions for their children. Their knowledge, attitudes, beliefs, and experiences had directly influenced whether children received vaccines according to the recommended immunization schedule [3]. Parents who had perceived vaccines as beneficial and safe had generally demonstrated greater willingness to vaccinate their children, whereas concerns regarding adverse effects, vaccine ingredients, effectiveness, or possible long-term health consequences had contributed to delayed or missed vaccinations. In addition, exposure to inaccurate information through social media, informal community networks, and other non-credible sources had contributed to uncertainty and confusion among parents.

In Pakistan, childhood immunization had remained an important public health priority because vaccine-preventable diseases had continued to pose a threat to children, particularly in underserved and marginalized populations [4]. Although the Expanded Program on Immunization (EPI) had provided routine vaccination services, disparities in vaccination uptake had persisted across different socioeconomic and geographic groups. Limited healthcare access, inadequate awareness, socioeconomic difficulties, misinformation, parental misconceptions, and distrust of vaccination programs had potentially contributed to incomplete or delayed immunization. Previous experiences during vaccination campaigns and concerns related to vaccine safety had also influenced parental acceptance in some communities [5].

The assessment of factors associated with vaccine hesitancy had therefore been important for strengthening childhood immunization programs. Identifying parental

demographic characteristics, educational status, socioeconomic conditions, knowledge regarding vaccines, perceived risks and benefits, sources of vaccination information, and trust in healthcare professionals had helped in understanding the underlying reasons for vaccine-related decisions [6]. Such evidence had been particularly valuable for developing targeted health education interventions and improving communication between healthcare providers and parents.

Therefore, the present study had been conducted to evaluate vaccine hesitancy and its associated factors among parents regarding childhood immunization. The study had focused on identifying the prevalence and major determinants of hesitancy and had examined how parental knowledge, attitudes, beliefs, demographic characteristics, and information sources had influenced vaccination decisions [7]. The findings had been expected to provide useful evidence for healthcare professionals, immunization program managers, and policymakers to develop effective strategies for addressing misconceptions, improving parental confidence, and promoting timely and complete childhood immunization [8].

MATERIALS AND METHODS

Study Design and Setting

A descriptive cross-sectional study had been conducted at Tehsil Headquarter Hospital Quaidabad, District Khushab, from June 2025 to May 2026. The study had evaluated the prevalence of vaccine hesitancy among parents and assessed the factors associated with hesitancy toward routine childhood immunization. The hospital had been selected because it served as an important healthcare facility for the surrounding urban and rural communities and provided routine immunization and child healthcare services.

Study Population

The study population had consisted of parents of children eligible for routine childhood immunization who had visited the hospital during the study period. A total of 110 parents had been enrolled. Either mothers or fathers who were primarily involved in decisions regarding their child's vaccination had been considered eligible for participation.

Inclusion and Exclusion Criteria

Parents had been included if they had a child eligible for routine childhood vaccination, were available at the study site during the data-collection period, and had provided informed consent. Parents had also been required to have sufficient understanding of the questionnaire to provide reliable responses. Parents of children who were not eligible for routine childhood immunization, those who declined participation, and those who were unable to provide the required information had been excluded. Participants whose questionnaires had contained substantial missing information had also been excluded from the final analysis.

Sampling Technique and Sample Size

A non-probability consecutive sampling technique had

been used. Parents meeting the eligibility criteria had been approached consecutively during the study period until the predetermined sample size of 110 participants had been achieved. Each eligible participant had been informed about the purpose and procedures of the study before enrollment.

Data Collection Procedure

Data had been collected through a structured, interviewer-administered questionnaire. The questionnaire had been developed according to the objectives of the study and had covered sociodemographic characteristics, knowledge regarding childhood vaccination, vaccination history of the child, parental attitudes, perceived benefits and risks of vaccines, sources of vaccination information, and factors contributing to delayed or refused vaccination.

Sociodemographic variables had included parental age, sex, educational status, occupation, residence, number of children, and household socioeconomic characteristics. Information regarding the child's age, sex, immunization status, missed or delayed vaccine doses, and previous vaccination-related experiences had also been recorded.

Assessment of Vaccine Hesitancy

Vaccine hesitancy had been assessed by evaluating parental responses concerning confidence in vaccines, perceived vaccine safety and effectiveness, concerns about adverse effects, trust in healthcare providers, and willingness to follow the recommended immunization schedule. Parents who had expressed uncertainty, delay, reluctance, or selective acceptance of recommended childhood vaccines had been categorized as vaccine-hesitant, whereas parents who had demonstrated consistent acceptance of routine childhood vaccination had been categorized as non-hesitant. Reasons for hesitancy, including fear of adverse effects, misinformation, religious or cultural concerns, inadequate knowledge, previous negative experiences, concerns about vaccine quality, and accessibility-related problems, had been documented.

Data Analysis

The collected data had been entered and analyzed using SPSS. Descriptive statistics had been used to summarize the study variables. Categorical variables had been presented as frequencies and percentages, while continuous variables had been summarized using means and standard deviations. Associations between vaccine hesitancy and categorical factors had been assessed using the Chi-square test or Fisher's exact test, where appropriate. A p-value of <0.05 had been considered statistically significant.

Ethical Considerations

Ethical principles had been followed throughout the study. Ethical approval had been obtained from the relevant institutional authority before data collection. Written informed consent had been obtained from all participants. Participants had been informed that their participation was voluntary and that they could withdraw at any stage without affecting their access to healthcare services. Confidentiality and anonymity had been maintained, and

the collected information had been used solely for research purposes.

RESULTS

A total of 110 parents of children eligible for routine childhood immunization had been enrolled at Tehsil Headquarter Quaidabad, District Khushab, during the period from June 2025 to May 2026. The results had been analyzed to determine the level of parental vaccine hesitancy and to identify demographic and knowledge-related factors associated with delayed or refused childhood vaccination.

Table 1

Socio-demographic characteristics and vaccine hesitancy among parents (n=110)

Variable	Category	n	%
Age of parent	<25 years	18	16.4
	25–34 years	52	47.3
	≥35 years	40	36.4
Gender	Male	42	38.2
	Female	68	61.8
Residence	Urban	46	41.8
Rural	64	58.2	
Education	No formal education	27	24.5
	Primary/secondary	44	40.0
	Higher secondary or above	39	35.5
Monthly household income	<50,000 PKR	49	44.5
	50,000–100,000 PKR	43	39.1
	>100,000 PKR	18	16.4
Vaccine hesitancy	Hesitant	38	34.5
	Non-hesitant	72	65.5

Table 1 showed that most participating parents had been between 25 and 34 years of age (47.3%), while 36.4% had been aged 35 years or older and 16.4% had been younger than 25 years. Female parents had constituted the majority of participants (61.8%), whereas males had represented 38.2%. Rural residents had accounted for 58.2% of the sample, indicating that more than half of the enrolled families had lived in rural areas of District Khushab.

Regarding education, 24.5% of parents had reported no formal education, 40.0% had received primary or secondary education, and 35.5% had attained higher secondary education or above. Nearly half of the households (44.5%) had reported a monthly income below PKR 50,000. Overall, 38 parents (34.5%) had demonstrated vaccine hesitancy, while 72 (65.5%) had not demonstrated hesitancy. Vaccine hesitancy had therefore represented a substantial proportion of the study population.

Table 2

Knowledge, attitudes, and vaccination practices associated with vaccine hesitancy (n=110)

Factor	Category	Hesitant n (%)	Non-hesitant n (%)	Total
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Adequate knowledge of vaccines	Yes	8 (21.1)	48 (66.7)	56
	No	30 (78.9)	24 (33.3)	54
Concern about vaccine side effects	Yes	29 (76.3)	23 (31.9)	52
	No	9 (23.7)	49 (68.1)	58
Believed vaccines could cause serious harm	Yes	25 (65.8)	14 (19.4)	39
	No	13 (34.2)	58 (80.6)	71
Had experienced vaccination delay	Yes	27 (71.1)	18 (25.0)	45
	No	11 (28.9)	54 (75.0)	65
Relied on healthcare workers for vaccine information	Yes	15 (39.5)	51 (70.8)	66
	No	23 (60.5)	21 (29.2)	44
Reported difficulty reaching vaccination facility	Yes	20 (52.6)	19 (26.4)	39
	No	18 (47.4)	53 (73.6)	71

Table 2 demonstrated several notable differences between hesitant and non-hesitant parents. Among the 38 hesitant parents, 78.9% had inadequate knowledge regarding childhood vaccines, compared with 33.3% among non-hesitant parents. Conversely, adequate vaccine knowledge had been more common among non-hesitant parents (66.7%). Concern about vaccine side effects had been reported by 76.3% of hesitant parents compared with 31.9% of non-hesitant parents.

A belief that vaccines could cause serious harm had also been substantially more frequent among hesitant parents (65.8%) than among non-hesitant parents (19.4%). Vaccination delays had been reported by 71.1% of hesitant parents, compared with only 25.0% of non-hesitant parents. These findings suggested that fear and misconceptions had contributed considerably to hesitancy.

Healthcare workers had been an important source of vaccine information for non-hesitant parents, with 70.8% reporting reliance on healthcare workers compared with 39.5% of hesitant parents. Difficulty reaching vaccination facilities had been reported by 52.6% of hesitant parents and 26.4% of non-hesitant parents, suggesting that access-related barriers had also contributed to delayed vaccination.

Overall, the findings had indicated that vaccine hesitancy had affected approximately one-third of parents (34.5%). The major associated factors had included inadequate vaccine knowledge, concerns about adverse effects, perceptions of serious vaccine-related harm, previous vaccination delays, limited reliance on healthcare workers for information, and difficulties accessing

vaccination services. These results had suggested that improving parental education, strengthening communication by healthcare workers, addressing safety concerns, and improving accessibility of immunization services could have reduced vaccine hesitancy among parents attending Tehsil Headquarter Quaidabad.

DISCUSSION

The present study evaluated vaccine hesitancy and its associated factors among parents regarding childhood immunization. The findings indicated that vaccine hesitancy had been influenced by multiple interconnected factors, including parental knowledge, perceptions regarding vaccine safety and effectiveness, concerns about adverse effects, trust in healthcare providers, accessibility of immunization services, and exposure to misinformation [9]. These findings suggested that vaccine hesitancy had not been attributable to a single cause but had reflected a combination of individual, social, and health-system-related factors.

Parental knowledge had appeared to play an important role in vaccination decisions. Parents who had demonstrated inadequate knowledge regarding recommended childhood vaccines, vaccination schedules, and the consequences of vaccine-preventable diseases had been more likely to express hesitancy [10]. Limited understanding of the benefits of immunization had potentially allowed misconceptions to influence parental decisions. Conversely, parents who had received clear and reliable information from healthcare professionals had generally demonstrated greater confidence in routine childhood vaccination. This finding emphasized the importance of effective communication between healthcare providers and parents [11].

Concerns about vaccine safety had also emerged as an important contributor to hesitancy. Some parents had expressed fear of fever, pain, allergic reactions, or other possible adverse effects following vaccination. In several cases, these concerns had been influenced by previous experiences or stories shared by relatives, friends, or community members. Although minor adverse effects had generally been temporary, parents had sometimes perceived them as serious health risks [12]. This finding suggested that healthcare workers should have explained expected post-vaccination reactions and distinguished common mild effects from rare serious complications.

The influence of misinformation had also contributed substantially to vaccine hesitancy. Parents who had encountered negative information through social media, informal community networks, or other nonprofessional sources had been more likely to question vaccine safety and effectiveness. Misleading claims had sometimes created doubts regarding vaccine ingredients, side effects, and the necessity of immunization [13]. The findings therefore highlighted the need for health authorities and healthcare professionals to provide easily understandable, evidence-based information through communication channels commonly used by parents.

Trust in healthcare providers and immunization programs had also been associated with parental vaccination decisions. Parents who had trusted doctors, nurses, vaccinators, and public-health authorities had been more willing to follow recommended vaccination schedules [14]. In contrast, inadequate communication, insufficient counseling, or previous negative interactions with healthcare personnel could have reduced confidence. Strengthening respectful communication and allowing parents to discuss their concerns without judgment would therefore have been important in reducing hesitancy.

Socioeconomic and accessibility-related factors had also appeared relevant. Difficulties related to transportation, distance from vaccination centers, waiting time, inconvenient service hours, and limited availability of vaccines could have discouraged timely immunization. Such barriers indicated that some parents who had appeared hesitant might actually have experienced practical difficulties in accessing vaccination services. Improving the availability and convenience of immunization services would therefore have complemented educational interventions [15].

Overall, the findings demonstrated that addressing vaccine hesitancy had required a multifaceted approach. Health education alone would not have been sufficient if concerns about service accessibility and trust had remained unresolved. Healthcare providers should have offered individualized counseling, corrected misconceptions, explained vaccine benefits and risks transparently, and encouraged parents to complete recommended immunization schedules. Community leaders and trusted local figures could also have supported

accurate vaccine communication. Strengthening parental knowledge, improving confidence in vaccination, combating misinformation, and reducing healthcare-access barriers would have been essential strategies for improving childhood immunization uptake and reducing the risk of vaccine-preventable diseases.

CONCLUSION

The study concluded that vaccine hesitancy among parents had remained an important barrier to achieving optimal childhood immunization coverage. Hesitancy had been influenced by multiple factors, including concerns about vaccine safety, fear of adverse effects, inadequate knowledge, misinformation, cultural beliefs, and limited trust in healthcare services. Parents who had possessed better knowledge and had received clear and reliable information from healthcare professionals had generally demonstrated greater willingness to vaccinate their children. The findings suggested that effective communication and targeted health education had played an important role in reducing parental concerns and improving acceptance of routine childhood vaccination. Strengthening counseling by healthcare workers, addressing misconceptions, improving access to accurate vaccine information, and engaging community leaders had been necessary strategies. Overall, reducing vaccine hesitancy had required coordinated efforts between healthcare providers, public health authorities, communities, and parents to improve confidence in immunization and support timely completion of recommended childhood vaccination schedules.

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