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PREVALENCE OF VACCINE HESITANCY AMONG PARENTS OF CHILDREN UNDER FIVE: A CROSS-SECTIONAL STUDY

Original Article

Bakhtawar Sikander[1]*, Muhammad Abdullah Avais[2], Hafzah Shah[3], Muhammad Abrar[4], Nizza Haider[5], Rimal Rashid[6], Muhammad Arif[7]

[1]College of Public Health, Ziauddin University, Karachi Campus, Pakistan.
[2]Head of Programs, AGAHE, Lahore, Pakistan.
[3]Post-Doctorate Scholar, King's College London, United Kingdom.
[4]MBBS, Bolan Medical College Quetta; Master in Public Health, Alhamd Islamic University, Quetta, Pakistan.
[5]Senior Lecturer, Rehman College of Nursing (RCN), Peshawar, Pakistan.
[6]Medical Officer, Department of Paediatric Gastroenterology, Dow University Hospital, Karachi, Pakistan.
[7]Pediatrician (B-18), District Headquarters (DHQ) Hospital Sohbatpur, Health Department Balochistan, Pakistan.

Corresponding Author: Bakhtawar Sikander, College of Public Health, Ziauddin University, Karachi Campus, Pakistan, Bakhtawar.Sikandar@gmail.com

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ABSTRACT

Background: Vaccine hesitancy remains a significant barrier to achieving optimal immunization coverage among young children, particularly in low- and middle-income countries. Parents' decisions in early childhood are pivotal for protecting against vaccine-preventable diseases, yet concerns over safety, misinformation, and trust continue to impact uptake.

Objective: To assess the prevalence of vaccine hesitancy and identify its key contributing factors among parents of children under five in the Lahore region of Pakistan.

Methods: A cross-sectional study was conducted over eight months in five public health facilities in Lahore. A total of 472 parents of children under five were selected using multistage systematic sampling. Data were collected through a validated, interviewer-administered questionnaire adapted from the WHO-SAGE Vaccine Hesitancy Scale. Descriptive statistics, chi-square tests, and multivariate logistic regression were performed using SPSS v26 to identify factors independently associated with vaccine hesitancy.

Results: The prevalence of vaccine hesitancy was found to be 33.7%. The leading factors reported were social media misinformation (73.6%), concerns about vaccine side effects (68.6%), and lack of adequate information (59.1%). Multivariate analysis revealed that social media misinformation (AOR: 3.26; 95% CI: 2.12–5.03), low education (AOR: 2.41; 95% CI: 1.58–3.67), and low income (AOR: 1.89; 95% CI: 1.21–2.95) were significant independent predictors of hesitancy.

Conclusion: Vaccine hesitancy among parents in Lahore is influenced by misinformation, socio-economic disadvantage, and trust issues. Targeted communication strategies and public education are essential to address concerns and enhance vaccine confidence at the community level.

Keywords: Child, Developing Countries, Health Knowledge, Immunization Programs, Pakistan, Parents, Patient Acceptance of Health Care, Socioeconomic Factors, Vaccination Refusal, Vaccine Hesitancy.

INTRODUCTION

Vaccine hesitancy has emerged as a critical challenge to global public health, particularly in the context of childhood immunization. Despite the proven efficacy and safety of vaccines in preventing infectious diseases and reducing child mortality, a growing number of parents are expressing doubts, delaying, or even refusing vaccination for their children (1). This phenomenon is especially concerning for children under five years old, who are among the most vulnerable to vaccine-preventable illnesses such as measles, pertussis, and rotavirus. Understanding the prevalence of vaccine hesitancy among parents of young children and the factors influencing this behavior is essential for designing effective public health interventions (2). The World Health Organization (WHO) identified vaccine hesitancy as one of the top ten threats to global health in 2019. Defined as the delay in acceptance or refusal of vaccines despite availability of vaccination services, vaccine hesitancy is complex and context-specific, varying across time, place, and vaccines. Parental hesitancy is particularly influential, as decisions made during early childhood set the course for future health outcomes (3). While high-income countries have received significant attention regarding this issue, low- and middle-income countries are increasingly experiencing similar challenges, influenced by a mix of sociocultural, economic, and informational factors. Several studies have attempted to dissect the multifaceted nature of vaccine hesitancy, identifying themes such as mistrust in the healthcare system, misinformation spread through social media, and philosophical or religious beliefs (4,5). For instance, some parents fear adverse effects from vaccines, question the necessity of immunizations for diseases they rarely encounter, or feel overwhelmed by the number of vaccines recommended within a short span of time. In other cases, hesitancy may stem from broader societal distrust, where past medical injustices or perceptions of pharmaceutical profiteering fuel reluctance. In countries with fragmented healthcare systems, inconsistent messaging from authorities may further erode public confidence in immunization programs (6,7).

In addition to individual-level beliefs and perceptions, community and societal influences play a significant role. Peer influence, cultural norms, and local leadership stances on vaccination can either reinforce or counter vaccine hesitancy. The rise of digital platforms has amplified both credible information and misinformation, often leaving parents confused or misinformed about vaccine safety and efficacy (8). Studies have shown that exposure to anti-vaccine narratives online can significantly increase doubts, even among those initially supportive of immunization. This underscores the need for clear, consistent, and evidence-based communication strategies targeting parents in all demographic groups (9,10). While extensive research exists on general vaccine attitudes, fewer studies have specifically focused on parents of children under five, a group that faces unique decision-making pressures. These parents often navigate a complex healthcare landscape while managing emotional and financial stressors, which can affect their trust and compliance with medical recommendations. Moreover, caregivers of young children are frequently targeted by online communities promoting natural or alternative lifestyles, which often discourage routine vaccinations (11). The combination of these factors creates a critical period during which parental choices can either uphold or undermine herd immunity within communities.

Importantly, vaccine hesitancy does not exist on a binary scale but rather as a continuum. Some parents may simply have questions or prefer to delay certain vaccines, while others might completely refuse all vaccinations. Recognizing this gradient is vital for tailoring interventions that are empathetic and responsive to varying concerns. Interventions that adopt a judgment-free approach, respect parental autonomy, and provide clear, accessible information tend to be more successful in shifting attitudes (12,13). This further highlights the need for healthcare providers to receive training in communication strategies that promote trust and facilitate informed decision-making. Despite growing awareness of this issue, the literature reveals a lack of context-specific data that can inform targeted interventions. Much of the existing research is either outdated or too generalized, failing to capture the nuanced factors that influence vaccine decisions in different populations. In particular, there remains a gap in understanding the current prevalence and driving forces of vaccine hesitancy among parents of children under five in diverse settings. Addressing this gap is crucial to safeguard the health of future generations. To contribute meaningfully to this field of inquiry, this study seeks to assess the prevalence of vaccine hesitancy among parents of children under five years of age and identify the primary factors influencing their vaccination decisions. By shedding light on both the scale and underlying causes of this public health concern, the study aims to inform more effective, culturally appropriate strategies to reduce hesitancy and promote vaccine uptake in early childhood.

METHODS

This cross-sectional study was conducted to determine the prevalence of vaccine hesitancy and to identify its associated factors among parents of children under five years of age in the Lahore region of Pakistan. The study was carried out over a period of eight months, from August 2024 to March 2025. The selection of Lahore as the study setting was based on its diverse urban and peri-urban population,

which allows for a comprehensive understanding of vaccine attitudes across different socioeconomic and educational backgrounds. This setting also reflects a mix of healthcare accessibility and exposure to vaccine-related information, making it a representative location for exploring vaccine hesitancy in a metropolitan context. Participants included parents or primary caregivers of children aged less than five years, recruited from outpatient pediatric departments of three major public-sector hospitals and two large community health centers in Lahore. A multistage sampling strategy was employed, beginning with the random selection of healthcare facilities, followed by systematic sampling of every third eligible parent attending well-baby or immunization clinics. Inclusion criteria specified that participants must be aged 18 years or older, able to communicate in Urdu or English, and the primary decision-maker regarding the child's healthcare (14). Parents of children with diagnosed immunodeficiency or chronic conditions requiring altered immunization schedules were excluded to maintain consistency in vaccine recommendations across participants. Sample size estimation was calculated using the Cochran formula for prevalence studies. Assuming a conservative estimate of 50% prevalence for vaccine hesitancy (as there is limited local data), a 95% confidence interval, and a margin of error of 5%, the minimum required sample size was calculated to be 384. To account for potential non-response or incomplete questionnaires, the final sample size was increased by 20%, resulting in a target of 460 participants. A total of 472 parents consented and were included in the final analysis, achieving a response rate of 96.5%.

Data were collected using a structured, interviewer-administered questionnaire developed specifically for this study. The instrument was informed by the World Health Organization's Strategic Advisory Group of Experts (SAGE) Vaccine Hesitancy Scale and adapted to the local context through expert consultations and pilot testing. The final version consisted of four sections: sociodemographic characteristics, child's immunization history, attitudes and beliefs about vaccines, and factors influencing vaccine decision-making. Items assessing hesitancy included a mix of Likert-scale responses and dichotomous questions, covering themes such as safety concerns, trust in healthcare providers, religious or cultural beliefs, and exposure to misinformation (15,16). Prior to formal data collection, the questionnaire was piloted among 30 participants to assess clarity, comprehension, and cultural appropriateness. Minor adjustments were made based on participant feedback and internal consistency testing, with Cronbach's alpha for the hesitancy scale items reaching 0.82, indicating acceptable reliability. Interviewers were trained healthcare professionals who received standardized training on questionnaire administration, participant engagement, and ethical protocols to minimize interviewer bias and ensure consistency.

Data were entered and analyzed using SPSS version 26. Descriptive statistics were used to summarize participant characteristics and prevalence rates. Mean and standard deviation were calculated for continuous variables, while frequencies and percentages were presented for categorical data. To identify associations between vaccine hesitancy and potential influencing factors, bivariate analyses using chi-square tests were performed for categorical variables. Independent t-tests were used for continuous variables where appropriate, given that the data followed a normal distribution as verified through the Shapiro-Wilk test. Variables with p-values less than 0.20 in bivariate analyses were entered into a multivariate logistic regression model to adjust for potential confounders and to determine independent predictors of vaccine hesitancy. Odds ratios with 95% confidence intervals were reported, and a p-value of less than 0.05 was considered statistically significant. Ethical approval for the study was obtained from the Institutional Review Board of the relevant institute. All participants were provided with verbal and written information about the study's purpose, procedures, confidentiality, and voluntary nature of participation. Informed written consent was obtained prior to inclusion in the study. Participants were assured that refusal to participate would not affect the medical care of their children. Data confidentiality was strictly maintained, with anonymized data stored on password-protected devices accessible only to the research team.

RESULTS

Out of 472 parents surveyed, the mean age was 31.4 years (SD ± 6.2), with females comprising 58.9% of the sample. A majority of participants reported urban residency (73.3%), and the educational attainment showed that 44.7% had received tertiary-level education, while 19.7% had only primary education or less. In terms of income distribution, 30.5% of respondents earned less than 30,000 PKR per month, and 38.8% fell into the middle-income bracket (30,000–60,000 PKR). The overall prevalence of vaccine hesitancy among parents of children under five was 33.7% (n = 159), while 66.3% (n = 313) were categorized as non-hesitant. This classification was based on validated responses from the adapted WHO SAGE Vaccine Hesitancy Scale, where hesitant respondents either delayed or refused one or more recommended vaccines without medical contraindications. Among the hesitant group, concern about side effects was the most commonly endorsed factor, reported by 68.6% (n = 109). Social media influence followed closely, with 73.6% (n = 117) citing exposure to vaccine-related misinformation as a major contributor. Other notable concerns included lack of information (59.1%), distrust in vaccine manufacturers (54.1%), and religious beliefs (26.4%). Previous negative experiences with vaccination, either personal or community-based, were cited by 23.9% (n = 38). Multivariate logistic regression analysis was conducted to determine independent

predictors of vaccine hesitancy. After adjusting for confounding variables, social media misinformation emerged as the strongest predictor with an adjusted odds ratio (AOR) of 3.26 (95% CI: 2.12–5.03, $p < 0.001$). Low educational attainment was also significantly associated with higher hesitancy (AOR = 2.41; 95% CI: 1.58–3.67, $p = 0.001$), along with low monthly income (AOR = 1.89; 95% CI: 1.21–2.95, $p = 0.004$). Distrust in vaccine manufacturers remained a statistically significant predictor (AOR = 2.13; 95% CI: 1.31–3.44, $p = 0.002$). Urban residence, in contrast, showed no statistically significant association with hesitancy (AOR = 0.82; 95% CI: 0.54–1.26, $p = 0.329$). The results of this study highlight the multifactorial nature of vaccine hesitancy in the local context. While hesitancy was present in roughly one-third of the sample, it was predominantly driven by safety concerns, informational gaps, and mistrust—often amplified by digital platforms. These findings underscore the importance of targeted, evidence-based strategies to mitigate misinformation and build public trust in vaccination programs.

Table 1: Demographics of Study Participants (n = 472)

Variable	Value
Total Participants	472
Mean Age (years)	31.4 ± 6.2
Gender	
Female (%)	278 (58.9%)
Gender - Male (%)	194 (41.1%)
Education	
Primary or less (%)	93 (19.7%)
Secondary (%)	168 (35.6%)
Tertiary (%)	211 (44.7%)
Monthly Income	
< 30,000 PKR (%)	144 (30.5%)
30,000–60,000 PKR (%)	183 (38.8%)
> 60,000 PKR (%)	145 (30.7%)
Residence	
Urban (%)	346 (73.3%)
Rural/Peri-urban (%)	126 (26.7%)

Table 2: Prevalence of Vaccine Hesitancy

Vaccine Hesitancy Status	Frequency (n)	Percentage (%)
Hesitant	159	33.7%
Non-Hesitant	313	66.3%

Table 3: Factors Influencing Vaccine Hesitancy Among Hesitant Parents (n = 159)

Factor	Hesitant Respondents Endorsing (n)	Percentage of Hesitant (%)
Concern about side effects	109	68.6%
Distrust in vaccine manufacturers	86	54.1%
Religious beliefs	42	26.4%
Lack of information	94	59.1%
Previous negative experience	38	23.9%
Social media influence	117	73.6%

Table 4: Logistic Regression Analysis of Factors Associated with Vaccine Hesitancy

Variable	Adjusted OR	95% CI	p-value
Low education level	2.41	1.58–3.67	0.001
Low monthly income	1.89	1.21–2.95	0.004
Social media misinformation	3.26	2.12–5.03	<0.001
Distrust in manufacturers	2.13	1.31–3.44	0.002
Urban residence	0.82	0.54–1.26	0.329

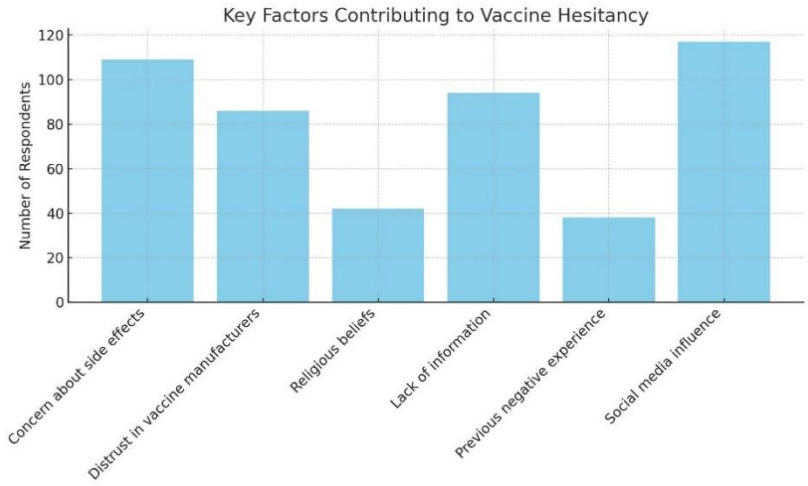

Figure 1 Key Factors Contribution to Vaccine Hesitancy

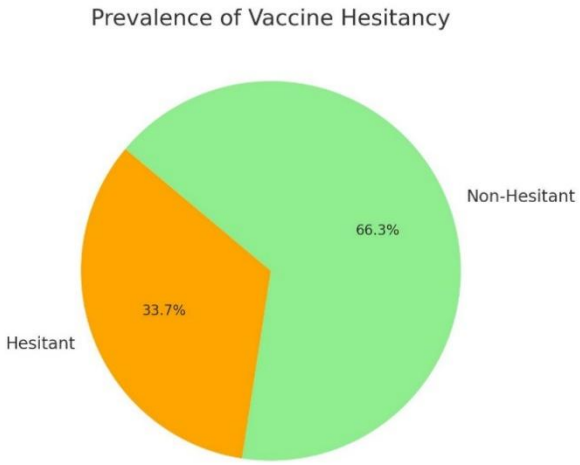

Figure 2 Prevalence of Vaccine Hesitancy

DISCUSSION

The findings of this study reinforce the growing recognition that vaccine hesitancy among parents of young children is not a marginal phenomenon, but a public health concern rooted in a complex interplay of socio-demographic, cognitive, and informational factors. With a hesitancy prevalence of 33.7%, this study situates parental hesitancy in the Lahore region above global pooled estimates of 21.1% reported in recent meta-analyses (14), and higher than regional estimates in India and Turkey, which ranged from 13.8% to 28% (15,16). One of the most consistent patterns identified was the strong association between exposure to misinformation through social media and elevated levels of hesitancy. This aligns with findings from other contexts where misinformation has emerged as a dominant driver of vaccine refusal (17). The adjusted odds ratio of 3.26 in the current study for misinformation exposure highlights the urgency for digital health literacy interventions. Moreover, the influence of education and income level was reaffirmed, as lower educational attainment and limited household income both significantly predicted hesitancy, a pattern echoed in multiple global studies (18-20). Interestingly, the present study did not find a statistically significant relationship between urban residence and vaccine hesitancy, diverging from studies that suggest urban populations, especially those with access to online platforms, are more susceptible to anti-vaccine narratives (21). This may reflect a more uniform penetration of digital content across urban and peri-urban boundaries in Lahore, necessitating broader geographical targeting of information campaigns. The significant role of trust—particularly in vaccine manufacturers—also resonates with international findings, where distrust in pharmaceutical motives and safety concerns were frequently reported barriers to vaccine uptake (22,23).

This study carries several strengths. It employed a structured and validated tool to assess vaccine hesitancy, ensuring comparability with international literature. The relatively large and diverse sample from multiple urban health centers in Lahore enhances the representativeness of the findings. Moreover, the inclusion of multivariate analyses allowed for the identification of independent predictors, strengthening the study's analytical depth. Nonetheless, limitations must be acknowledged. As a cross-sectional study, the temporal relationship between predictors and hesitancy could not be established. Self-reported measures are susceptible to response bias, particularly on sensitive issues like immunization behavior. Despite high response rates, social desirability may have influenced the underreporting of vaccine refusal. Furthermore, the exclusion of rural populations limits the generalizability of findings to all regions of Pakistan. Future research should incorporate longitudinal designs to examine how hesitancy evolves over time, particularly in response to policy changes or public health crises. There is also a need to explore the influence of healthcare providers' communication styles on parental decisions, as positive provider-parent interactions have shown potential in countering hesitancy (24). Finally, future studies should delve deeper into the digital landscape, assessing the specific types of content and platforms contributing to vaccine doubts. The findings underscore the necessity for a multi-pronged response that goes beyond factual correction. Public health efforts should integrate culturally tailored messaging, active engagement with digital influencers, and partnerships with trusted community

leaders. These strategies, coupled with equitable access to vaccines and transparent communication from authorities, are essential to address the trust deficit and foster a climate of vaccine confidence.

CONCLUSION

This study highlights a substantial prevalence of vaccine hesitancy among parents of children under five in the Lahore region, driven primarily by misinformation, low educational attainment, and distrust in vaccine manufacturers. These findings underscore the urgent need for targeted, culturally relevant interventions that prioritize digital literacy, community trust-building, and equitable healthcare communication to improve early childhood immunization coverage and strengthen public health resilience.

AUTHOR CONTRIBUTION

Author	Contribution
Bakhtawar Sikander*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Muhammad Abdullah Avais	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Hafzah Shah	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Muhammad Abrar	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Nizza Haider	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Rimal Rashid	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Muhammad Arif	Contributed to study concept and Data collection Has given Final Approval of the version to be published

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