



ASSESSMENT OF CHILDHOOD IMMUNIZATION COVERAGE AND ASSOCIATED RISK FACTORS AMONG PEDIATRIC PATIENTS

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Abstract

Background:

Childhood immunization is one of the most effective public health interventions for preventing infectious diseases, reducing childhood morbidity, and lowering mortality rates. Despite the availability of national immunization programs, incomplete and delayed vaccination remains a major concern in many developing countries. Several socioeconomic, educational, and healthcare-related factors influence immunization coverage among pediatric populations.

Objective: To assess childhood immunization coverage and identify associated risk factors among pediatric patients attending healthcare facilities

Methodology: A cross-sectional descriptive study was conducted among parents of pediatric patients attending healthcare centers. Data was collected using a structured questionnaire including demographic characteristics, immunization status, parental knowledge, socioeconomic factors and healthcare accessibility. Immunization status was assessed according to the national Expanded Program on Immunization (EPI) schedule. Statistical analysis was performed to determine factors associated with incomplete immunization.

Results: The study demonstrated that a significant proportion of children were fully immunized, while some were partially immunized or non-immunized. Factors significantly associated with incomplete immunization included low parental education, low socioeconomic status, lack of awareness regarding vaccination schedules, rural residence, limited healthcare access, and fear of vaccine side effects. Children whose parents received counseling from healthcare professionals showed better immunization compliance.

Keywords: Childhood immunization, vaccination coverage, immunization status, parental education, socioeconomic status, vaccine awareness

Introduction

Childhood immunization is widely recognized as one of the most effective, safe, and cost-efficient public health interventions for preventing infectious diseases and improving child survival[1]. Vaccination has significantly reduced the global burden of vaccine-preventable diseases and has contributed substantially to the decline in childhood morbidity, disability, and mortality over the past several decades. According to the World Health Organization (WHO), immunization prevents an estimated 3–5 million deaths annually by protecting children against life-threatening infectious diseases such as tuberculosis, poliomyelitis, diphtheria, pertussis, tetanus, hepatitis B, measles, pneumococcal disease, and *Haemophilus influenzae* type b infections[2,3]. The success of immunization programs has led to the eradication of smallpox globally and substantial reductions in the incidence of polio and measles in many regions of the world.

Vaccination not only protects individual children but also contributes to community protection through herd immunity. High immunization coverage reduces disease transmission within communities and protects vulnerable populations who cannot be vaccinated due to age, medical conditions, or immunocompromised states. Consequently, immunization plays a vital role in achieving global public health goals, including the Sustainable Development Goals (SDGs) related to child health and well-being. The WHO and United Nations Children's Fund (UNICEF) continue to emphasize the importance of universal immunization coverage as a key strategy for reducing preventable childhood deaths and improving population health outcomes.

Despite remarkable progress in global immunization efforts, incomplete vaccination coverage remains a significant public health concern, particularly in low- and middle-income countries. Millions of children worldwide continue to miss one or more recommended vaccine doses each year, leaving them vulnerable to infectious diseases[4]. Inadequate immunization coverage contributes to recurrent outbreaks of vaccine-preventable diseases, increased healthcare expenditures, and avoidable childhood mortality. According to recent global estimates, nearly 20 million infants fail to receive essential vaccines annually, with the majority residing in resource-limited settings where healthcare access remains inadequate.

Several factors influence childhood immunization coverage. Socioeconomic determinants such as parental education, household income, employment status and living conditions have been consistently associated with vaccination uptake. Parents with higher educational attainment are generally more likely to understand the benefits of vaccination, adhere to immunization schedules and seek preventive healthcare services for their children[5,6]. Conversely, low literacy levels and poor health awareness may contribute to delayed or incomplete immunization. Economic constraints may also affect transportation to healthcare facilities, resulting in missed vaccination appointments despite the availability of free vaccination services.

Healthcare accessibility is another important determinant of immunization status. Geographic distance from healthcare facilities, inadequate transportation, vaccine stock shortages, long waiting times and limited availability of trained healthcare personnel can hinder vaccine utilization. Children living in rural and underserved areas often face greater barriers to accessing immunization services compared with those residing in urban regions. Furthermore, weaknesses in healthcare infrastructure and immunization delivery systems contribute to disparities in vaccine coverage[7].

Parental knowledge, attitudes, and beliefs regarding vaccination significantly influence immunization practices. Misconceptions about vaccine safety, fear of adverse effects, cultural beliefs, religious concerns and vaccine hesitancy has emerged as major challenges to achieving optimal immunization coverage. The rapid spread of misinformation through social media platforms and informal communication channels has further complicated efforts to improve vaccine acceptance[8]. Parents who lack accurate information about vaccine benefits and schedules may be less likely to ensure timely immunization of their children. In contrast, counseling and education

provided by healthcare professionals have been shown to improve parental confidence in vaccines and increase compliance with recommended vaccination schedules.

The Expanded Program on Immunization (EPI), launched by the World Health Organization aims to provide universal access to essential vaccines for all children. Many countries, including Pakistan and other developing nations, have adopted EPI strategies to ensure that vaccines are available free of cost through public healthcare facilities. Although significant improvements in vaccination coverage have been achieved through these programs, disparities persist across different geographic regions, socioeconomic groups, and healthcare settings[9,10].

In developing countries, vaccine-preventable diseases continue to pose a major threat to child health. Outbreaks of measles, polio, and other infectious diseases frequently occur in areas with low vaccination coverage. Children who are partially immunized or completely unimmunized are at substantially higher risk of developing severe infections, complications, hospitalization, long-term disability, and death. Furthermore, incomplete immunization undermines efforts to eliminate vaccine-preventable diseases and places additional strain on healthcare systems.

Numerous studies conducted worldwide have identified factors associated with incomplete immunization. Research from South Asia, Africa, and other low-resource settings has consistently demonstrated associations between poor parental education, low household income, rural residence, inadequate healthcare access, lack of maternal awareness and incomplete vaccination status. Studies have also highlighted the positive impact of healthcare worker counseling, reminder systems, community outreach programs, and parental education initiatives on improving immunization coverage. Understanding these factors within specific populations is essential for designing targeted interventions that address local barriers to vaccination[11].

Assessment of immunization coverage serves as an important indicator of healthcare system performance and public health effectiveness. Evaluating vaccination status among pediatric patients can provide valuable insights into existing gaps in immunization services and identify populations at greater risk of under-vaccination. Such information is critical for policymakers, healthcare providers, and public health authorities seeking to strengthen immunization programs and achieve national vaccination targets.

Therefore, the present study was conducted to assess childhood immunization coverage among pediatric patients attending healthcare facilities and to identify the demographic, socioeconomic, educational, parental healthcare-related factors associated with incomplete immunization. The findings of this study contribute to the development of evidence-based public health strategies aimed at improving vaccine uptake, enhancing parental awareness, reducing barriers to immunization, and ultimately preventing vaccine-preventable diseases among children.

Methodology

A cross-sectional descriptive study was conducted over a period of 12 months, following ethical approval, to assess childhood immunization coverage and associated risk factors among pediatric patients. The study was carried out in the pediatric outpatient departments and immunization centers of selected healthcare facilities. The study population comprised of parents accompanying children aged less than five years who attended these facilities during the study period. Data were collected using a structured questionnaire administered through face-to-face interviews. Information obtained included child demographic variables such as age, gender, residence, and family size. Parental characteristics recorded were mother's education, father's education, occupation, and household income. Healthcare access variables included distance to the nearest health facility, availability of vaccination services, counseling received from healthcare workers and parental awareness regarding vaccines. Immunization status of each child was determined from the available vaccination records and categorized as fully immunized, partially immunized, or non-immunized based on the national Expanded Programme on Immunization schedule.

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board of Jinnah Postgraduate Medical Centre. Written informed consent was obtained from all participants. Confidentiality and anonymity were maintained throughout the study.

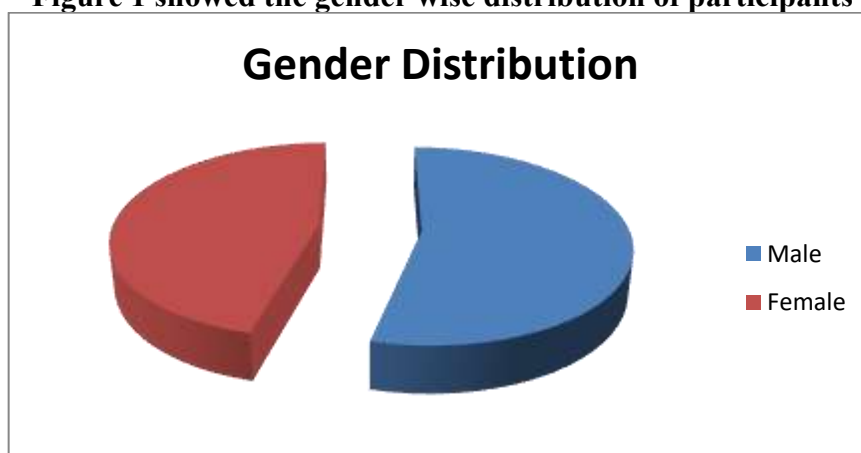
Statistical Analysis

Data were entered and analyzed using SPSS version 22. Descriptive statistical methods were used to summarize the demographic characteristics of participants, immunization status of children, parental knowledge regarding vaccination, socioeconomic variables and healthcare accessibility factors. Continuous variables such as the age of children and parents were expressed as **mean $\pm$ standard deviation (SD)**, while categorical variables including gender, residence, educational status, socioeconomic status, immunization status, and healthcare access indicators were presented as **frequencies and percentages**. Multivariate logistic regression analysis was performed to identify independent predictors of incomplete immunization. A p-value less than 0.05 was considered statistically significant.

Results

A total of **350 parents** of pediatric patients participated in the study. The demographic analysis demonstrated that most children were between **12–24 months of age (28.9%)**, followed by those older than 36 months (25.1%). Male children constituted **54.0%** of the sample, while females represented **46.0%**.

Figure 1 showed the gender wise distribution of participants



The majority of participants resided in **urban areas (62.3%)**, whereas **37.7%** belonged to rural communities. Regarding socioeconomic status, nearly half of the families belonged to the **middle-income group (48.9%)**, while **34.0%** were from low socioeconomic backgrounds (Table 1).

Table 1. Demographic Characteristics of Study Participants (n = 350)

Variable	Frequency (n)	Percentage (%)
Age of Child (Months)		
<12 months	82	23.4
12–24 months	101	28.9
25–36 months	79	22.6
>36 months	88	25.1
Residence		
Urban	218	62.3
Rural	132	37.7
Socioeconomic Status		

Low	119	34.0
Middle	171	48.9
High	60	17.1

Assessment of parental educational status revealed that **45.4% of mothers** and **48.9% of fathers** had completed secondary education. However, a considerable proportion of mothers (**21.7%**) had no formal education, which may have influenced vaccination-related knowledge and practices. Higher educational attainment among parents appeared to be associated with improved adherence to vaccination schedules (Table 2).

Table 2. Educational Status of Parents

Educational Level	Mothers n (%)	Fathers n (%)
No formal education	76 (21.7)	52 (14.9)
Primary education	85 (24.3)	71 (20.3)
Secondary education	159 (45.4)	171 (48.9)
Graduate and above	30 (8.6)	56 (16.0)

Evaluation of vaccination records demonstrated that **74.3% of children were fully immunized**, while **21.4% were partially immunized** and **4.3% were non-immunized** according to the national EPI schedule. Although overall vaccination coverage was satisfactory, nearly one-fourth of children had not completed recommended immunizations, indicating persistent gaps in vaccine uptake (Table 3).

Table 3. Immunization Coverage Among Children

Immunization Status	Frequency (n)	Percentage (%)
Fully Immunized	260	74.3
Partially Immunized	75	21.4
Non-Immunized	15	4.3
Total	350	100

Among children with incomplete immunization, the most commonly reported reason was **lack of awareness regarding vaccination schedules (31.1%)**, followed by **fear of vaccine side effects (24.4%)**. Other barriers included forgetting vaccination dates, long distance to healthcare facilities, financial difficulties, and cultural misconceptions. These findings highlight the importance of parental education and effective healthcare communication (Table 4).

Table 4. Reasons for Incomplete Immunization (n = 90)

Reason	Frequency (n)	Percentage (%)
Lack of awareness	28	31.1
Fear of side effects	22	24.4
Forgetting vaccination dates	14	15.6
Distance from healthcare facility	11	12.2
Financial constraints	8	8.9
Religious/cultural beliefs	7	7.8

A statistically significant association was observed between **maternal education and immunization status ($p < 0.001$)**. Children of mothers with secondary or higher education showed substantially higher vaccination completion rates compared with children of mothers who had no formal education. This suggests that maternal literacy plays a crucial role in understanding immunization schedules and healthcare recommendations (Table 5).

Table 5. Association Between Maternal Education and Immunization Status

Maternal Education	Fully Immunized n (%)	Incomplete Immunization n (%)	p-value
No formal education	40 (52.6)	36 (47.4)	0.003
Primary education	56 (65.9)	29 (34.1)	0.009
Secondary education	136 (85.5)	23 (14.5)	0.978
Graduate and above	28 (93.3)	2 (6.7)	<0.001

Residence was also significantly associated with immunization coverage. Urban children demonstrated a significantly higher proportion of complete vaccination (**81.7%**) compared with rural children (**62.1%**) ($p = 0.002$). Limited healthcare accessibility and lower awareness levels in rural settings may explain these differences (Table 6).

Table 6. Association Between Residence and Immunization Status

Residence	Fully Immunized n (%)	Incomplete Immunization n (%)	p-value
Urban	178 (81.7)	40 (18.3)	0.01
Rural	82 (62.1)	50 (37.9)	0.002

Analysis of healthcare accessibility showed that most participants (**67.4%**) lived within 5 km of a healthcare facility. Furthermore, **78.3%** reported receiving vaccination counseling from healthcare providers, while **84.3%** possessed vaccination cards. These factors likely contributed to improved compliance with routine immunization schedules

Discussion

The present study demonstrated that although a substantial proportion of children were fully immunized, a considerable number remained partially immunized or non-immunized. These findings indicate persistent gaps in vaccine coverage despite the availability of national immunization services[12]. The immunization coverage observed in this study is consistent with findings reported in many studies showed that vaccination coverage ranging from 70–80% in South Asian populations. Similar findings were also reported by studies conducted in Pakistan, India, and Bangladesh where incomplete vaccination remained a significant public health concern. Maternal education emerged as a strong determinant of childhood immunization. Children of educated mothers were significantly more likely to complete vaccination schedules. This findings of many researches demonstrated that maternal literacy improves health-seeking behavior, awareness regarding vaccination schedules, and compliance with immunization recommendations[13-15].

Socioeconomic status was another important predictor. Families with limited financial resources showed lower immunization coverage, which may be explained by transportation barriers, limited healthcare access, and reduced exposure to health education programs. Similar associations have been reported in studies from low-income countries where poverty significantly affected vaccine uptake. Rural residence was significantly associated with incomplete immunization[16]. This finding supports previous studies showing that rural communities often face geographical barriers, inadequate healthcare infrastructure, and shortages of trained healthcare providers. Consequently, children living in rural areas are more likely to miss scheduled vaccinations[17].

The study further demonstrated that parental knowledge and awareness strongly influenced immunization practices. Parents who understood vaccine benefits and schedules were more likely to ensure complete vaccination of their children. Similar findings were reported by previous investigations which identified lack of awareness as one of the most important causes of vaccine defaulting[18,19]. Fear of vaccine side effects was another significant factor associated with incomplete immunization. Vaccine hesitancy has become an increasing concern globally and has been recognized by the WHO as a threat to public health. Misconceptions regarding vaccine safety often discourage parents from completing vaccination schedules.

Healthcare counseling showed a positive effect on immunization compliance[20]. Parents who received counseling from healthcare professionals demonstrated significantly higher vaccination completion rates. Similar findings have been reported in multiple international studies emphasizing the importance of communication between healthcare workers and caregivers.

The results of this study suggest that improving parental education, strengthening counseling services, enhancing healthcare accessibility, and implementing community-based awareness campaigns may substantially increase childhood immunization coverage.

Conclusion

The study demonstrated that although most children were fully immunized, incomplete immunization remains a significant public health issue. Low parental education, poor socioeconomic status, rural residence, limited healthcare access, lack of awareness regarding vaccination schedules, and fear of vaccine side effects were significant risk factors for incomplete immunization. Healthcare counseling was strongly associated with improved vaccination compliance. Strengthening public health education programs, expanding immunization services in underserved areas and promoting parental awareness are essential strategies for improving childhood immunization coverage with reduced vaccine-preventable diseases.

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