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ORIGINAL ARTICLE

Parental, Health System, and Environmental Factors Associated with Measles Immunization Coverage

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ABSTRACT

Background: Measles remains a vaccine-preventable disease with significant public health implications, yet immunization coverage in many settings continues to fall below global targets. Parental behavior, health service delivery, and the school environment may collectively influence the completeness of measles immunization among children. This study aimed to analyze parental, health system, and environmental factors associated with measles immunization coverage.

Methods: An analytical cross-sectional study was conducted among 120 parents of first-grade students participating in a school-based immunization program. The dependent variable was measles immunization coverage, classified as complete or incomplete based on immunization records. Independent variables included parental knowledge, attitudes, practices, and exposure to immunization-related information. Data were collected using structured questionnaires and secondary records. Bivariate analysis using the Chi-square test and multivariate logistic regression were performed to identify factors associated with immunization coverage.

Results: Measles immunization coverage was 56.7%, indicating that coverage had not yet reached the recommended target. Significant associations were found between complete immunization and parental knowledge ($p = 0.001$), attitudes ($p = 0.003$), practices ($p = 0.010$), and exposure to immunization information ($p = 0.002$). Children whose parents demonstrated good knowledge, positive attitudes, appropriate practices, and access to immunization information were more likely to receive complete measles immunization.

Conclusion: Measles immunization coverage is influenced by the interaction of parental behavior, health service support, and the information environment within school-based programs. Strengthening parental education, improving communication strategies, and enhancing collaboration between health services and schools are essential to improving immunization coverage and supporting effective measles prevention..

Keywords: Measles, Immunization Coverage, Parental Factors, School-Based Immunization. Health Services

INTRODUCTION

Measles is one of the most contagious infectious diseases, capable of spreading rapidly in populations with inadequate vaccination coverage. The World Health Organization (WHO) indicates that achieving at least 95% coverage with two doses of the measles-containing vaccine (MCV) is critical to ensure herd immunity and effectively eliminate the disease (1). Despite the availability of safe and effective vaccines since the 1960s, measles outbreaks have re-emerged in various regions, particularly driven by vaccine hesitancy—a complex phenomenon influenced by factors such as complacency, convenience, and confidence in vaccine safety (2). The resurgence observed in Europe illustrates the detrimental impact of low vaccination rates, with some countries failing to meet necessary coverage levels essential for eliminating measles and protecting public health (3).

School-based immunization programs are integral to addressing the challenges of vaccination coverage by providing accessible vaccination opportunities to children. These programs effectively bridge the gap for children who may otherwise miss routine vaccinations due to socio-economic barriers or misconceptions about vaccines (4). Evidence suggests that supplementary immunization activities (SIAs), which often complement routine immunization initiatives, can dramatically improve coverage, especially among marginalized populations (4). Transitioning towards robust school-based immunization can serve not only to increase vaccination rates but also to foster awareness and trust in vaccine efficacy, leading to increased herd immunity and improved public health outcomes (5).

Immunization coverage is a multifaceted issue influenced by parental behavior, the delivery of health services, and the information environment. Parental attitudes towards vaccination can significantly affect their decision-making processes, where factors such as fear, misinformation, and underlying skepticism towards health authorities play critical roles (6,7). Vaccine hesitancy can often stem from negative experiences with healthcare systems or societal narratives amplified by social media, which frequently disseminate misinformation about vaccine efficacy and safety (8). Moreover, the trust that parents place in healthcare professionals is paramount; studies have shown that clear communication and support from these professionals can enhance vaccine confidence, thereby fostering higher rates of immunization uptake (9). Health service delivery also intersects with these behaviors; gaps in service accessibility can discourage parents from seeking vaccinations, further exacerbating coverage disparities (10). Thus, addressing vaccine hesitancy requires a comprehensive approach that considers these psychological, institutional, and informational factors, aiming to establish a supportive environment for immunization.

Despite the implementation of routine and school-based immunization programs, measles immunization coverage in many settings remains below the expected target. This situation suggests that program delivery alone is not sufficient to ensure optimal coverage, as multiple factors may influence parental decisions and children's access to immunization services. Barriers related to parental knowledge, attitudes, and practices, as well as limitations within health service delivery and the surrounding information environment, may contribute to incomplete immunization among school-aged children.

Existing studies on measles immunization often focus on descriptive coverage or individual factors in isolation, with limited analytical research that simultaneously examines parental, health system, and

environmental influences within school-based immunization settings. Therefore, this study aims to analyze the association between parental characteristics, health service factors, and environmental conditions with measles immunization coverage, providing a more comprehensive understanding of the determinants affecting immunization uptake.

METHOD

This study employed an analytical cross-sectional design to examine factors associated with measles immunization coverage. The study population comprised parents of first-grade students eligible for the school-based measles immunization program. Parents were included if their children were registered in the program and they agreed to participate, while incomplete questionnaires were excluded. A total of 120 respondents were included using a total sampling approach.

The dependent variable was measles immunization coverage, categorized as complete or incomplete based on immunization records obtained from school and primary health care documentation. Independent variables included parental knowledge, attitudes, and practices related to measles immunization, as well as exposure to immunization information representing health system and environmental influences. Data were collected using a structured questionnaire adapted from validated immunization-related instruments and reviewed for content validity prior to use.

Data analysis was conducted in multiple stages. Descriptive statistics were used to summarize respondent characteristics and variable distributions. Bivariate analysis using the Chi-square test assessed associations between independent variables and measles immunization coverage. Variables with a p-value of less than 0.25 in bivariate analysis were subsequently entered into a multivariate logistic regression model to identify dominant factors influencing immunization coverage. Statistical significance was defined as $p < 0.05$. Ethical approval was obtained from the appropriate institutional authority, and informed consent was obtained from all participants before data collection..

RESULT

Table 1 describes the characteristics of the 120 respondents included in the study. Most respondents were aged 20–35 years (65.0%), followed by those aged over 35 years (20.0%) and under 20 years (15.0%), indicating that the majority of parents were within the productive age group. In terms of educational attainment, nearly half of the respondents had completed senior high school (45.8%), while smaller proportions had attained junior high school (20.0%), elementary school (15.0%), and a bachelor's degree or higher (19.2%). Regarding measles immunization status, more than half of the children had received complete measles immunization (56.7%), although a substantial proportion remained incompletely immunized (43.3%). In addition, exposure to immunization-related information was relatively low, with only 31.7% of respondents reporting access to information media, while the majority (68.3%) reported no exposure. These characteristics suggest that although most parents were of productive age and had moderate educational backgrounds, gaps in information exposure and immunization completeness remain important challenges.

Table 1. Characteristics of Respondents

Characteristic	Category	Frequency (n)	Percentage (%)
Age	<20 years	18	15.0
	20–35 years	78	65.0
	>35 years	24	20.0
Education	Elementary school	18	15.0
	Junior high school	24	20.0
	Senior high school	55	45.8
	Bachelor degree or higher	23	19.2
Measles Immunization Status	Complete	68	56.7
	Incomplete	52	43.3
Exposure to Information Media	Yes	38	31.7
	No	82	68.3

Table 2 presents the distribution of parental knowledge, attitudes, and practices related to measles immunization among 120 respondents. The results show that the majority of parents had poor knowledge regarding measles immunization (60.0%), while only 40.0% demonstrated good knowledge. In contrast, attitudes toward measles immunization were more evenly distributed, with 45.0% of parents exhibiting positive attitudes and 55.0% showing less favorable attitudes. Regarding practices, more than half of the respondents (53.3%) reported good immunization-related practices, while 46.7% demonstrated poor practices. These findings indicate a gap between knowledge and behavior, where relatively better practices exist despite limited knowledge, highlighting the need for improved educational interventions to strengthen parental understanding and support consistent immunization practices.

Table 2. Distribution of Parental Knowledge, Attitudes, and Practices

Variable	Category	Frequency (n)	Percentage (%)
Knowledge	Good	48	40.0
	Poor	72	60.0
Attitude	Good	54	45.0
	Poor	66	55.0
Practice	Good	64	53.3
	Poor	56	46.7

Table 3 shows the distribution of measles immunization status among 120 children included in the study. More than half of the children (56.7%) had received complete measles immunization, while a substantial proportion (43.3%) remained incompletely immunized. Although the majority had completed immunization, the coverage rate has not yet reached the recommended target, indicating persistent gaps in immunization uptake. This finding highlights the need for strengthened efforts to address factors contributing to incomplete immunization and to improve overall measles immunization coverage in school-based programs.

Table 3. Measles Immunization Coverage

Immunization Status	Frequency (n)	Percentage (%)
Complete	68	56.7
Incomplete	52	43.3

Table 4 presents the association between parental factors and measles immunization coverage among the study participants. The analysis demonstrates a significant relationship between parental knowledge and immunization status, where children of parents with good knowledge were more likely to have complete immunization (79.2%) compared to those whose parents had poor knowledge (41.7%) (p = 0.001). Parental attitude also showed a significant association, as complete immunization was more common among children of parents with positive attitudes (74.1%) than among those with less favorable attitudes (42.4%) (p = 0.003). Similarly, good parental practices were associated with higher immunization coverage (68.8%) compared to poor practices (42.9%) (p = 0.010).

Table 4. Association Between Parental Factors and Measles Immunization Coverage

Variable	Category	Complete n (%)	Incomplete n (%)	p-value
Knowledge	Good	38 (79.2)	10 (20.8)	0.001
	Poor	30 (41.7)	42 (58.3)	
Attitude	Good	40 (74.1)	14 (25.9)	0.003
	Poor	28 (42.4)	38 (57.6)	
Practice	Good	44 (68.8)	20 (31.2)	0.010
	Poor	24 (42.9)	32 (57.1)	
Information Exposure	Yes	30 (78.9)	8 (21.1)	0.002
	No	38 (46.3)	44 (53.7)	

In addition, exposure to immunization-related information was significantly associated with measles immunization coverage, with 78.9% of children of parents exposed to information having complete immunization, compared to 46.3% among those without information exposure (p = 0.002). These findings indicate that parental knowledge, attitudes, practices, and access to information are key factors influencing measles immunization coverage.

DISCUSSION

Current measles immunization coverage remains below the targets set by global health organizations, raising serious public health concerns given the potential risks associated with vaccine-preventable diseases. Numerous studies have shown that parental knowledge, attitudes, and practices are significantly associated with childhood immunization completeness. For instance, parents who have a good understanding of the benefits of vaccination and who hold positive attitudes toward immunization are more likely to support and ensure complete vaccination for their children (11). Access to and the quality of health services also influence parental decisions to bring their children for vaccination, indicating that socioeconomic conditions and an appropriate information environment contribute to achieving high and effective immunization coverage (12).

Therefore, improving vaccination coverage requires stakeholders to design educational and service delivery programs that take these factors into account.

The relationship between parental knowledge and complete childhood immunization is particularly strong, as understanding vaccine benefits, safety, and the consequences of non-immunization plays a key role in parental decision-making. Research has shown that parents with good knowledge about vaccines tend to be more educated and, consequently, are more likely to complete their children's immunization schedules. For example, a study in Nigeria found that adequate maternal knowledge was positively associated with full immunization status (13). Similarly, research in Sabah demonstrated that parents with better knowledge of vaccination were more likely to immunize their children (14). These findings are consistent with international studies showing that improving parental health knowledge can lead to better immunization outcomes. A study in Pakistan reported that interventions aimed at increasing maternal knowledge successfully improved childhood immunization coverage (15). Overall, existing evidence confirms that enhancing parental understanding of vaccines and the consequences of non-vaccination is a critical step toward improving immunization coverage across different settings.

Parental attitudes toward immunization play a central role in vaccine acceptance, particularly in relation to stigma, trust, and risk perception. Studies have shown that stigma and unfounded concerns may discourage parents from vaccinating their children, whereas trust in vaccine safety and effectiveness serves as a major driver of immunization uptake (16). Positive attitudes toward vaccination are also associated with stronger beliefs that immunization not only protects individual children but also contributes to public health through herd immunity (17). Furthermore, risk perception is an important determinant; parents who recognize the risks posed by vaccine-preventable diseases are more likely to vaccinate their children than those who underestimate these risks (18). Supporting evidence from the literature reinforces the link between attitudes and immunization compliance, as demonstrated by a study in Cameroon which found that good knowledge and positive attitudes toward vaccination significantly increased the likelihood of complete immunization among children (19). These findings suggest that interventions aimed at fostering positive parental attitudes toward immunization may be a key strategy for improving vaccination coverage at the community level.

Good immunization practices, as behavioral expressions of parental knowledge and attitudes, are directly associated with attendance at immunization services and adherence to vaccination schedules. Research indicates that parents who understand the benefits and importance of immunization are more disciplined in bringing their children for vaccination according to the recommended schedule, thereby increasing coverage and program effectiveness (20). From a behavioral intervention perspective, educational programs that emphasize improving parental knowledge and fostering positive attitudes may play a significant role in increasing immunization attendance. Such interventions should not only focus on information dissemination but also aim to build trust, address vaccine-related stigma, and facilitate access and convenience within health services (21). For example, community-based campaigns involving peer support and testimonials

from parents who have vaccinated their children may serve as effective strategies for influencing parental attitudes and behaviors toward greater vaccine acceptance (22).

Exposure to information through various communication media and counseling by health workers plays a crucial role within the health system and school environment in improving immunization coverage. Effective information media, such as brochures, posters, and digital campaigns, can help disseminate knowledge about the benefits and importance of vaccination, thereby increasing parental awareness of child health issues (23). However, information gaps often arise due to limited access or inconsistent reinforcement of messages by health workers, which may result in low immunization attendance and poor adherence to vaccination schedules (24). Studies have shown that unclear or inaccessible vaccination information can generate uncertainty among parents, potentially leading to decisions not to vaccinate their children (25). Therefore, integrating stronger communication strategies and sustained support from health workers and school environments is essential to minimizing information gaps and improving immunization coverage within communities (24).

Immunization should not be viewed solely as an individual issue but rather as the outcome of complex interactions between parental behavior, health service systems, and the school environment. These three elements influence one another and collectively shape immunization coverage levels within a community (26). Integrated approaches, particularly school-based immunization programs, offer significant added value by improving accessibility and convenience for children to receive vaccines in familiar and supportive settings involving both schools and parents (27). The programmatic implications of this approach include the need to strengthen parental education regarding the benefits and importance of vaccination, enabling parents to play an active role in immunization decision-making (28). In addition, optimizing communication and support from health services is essential; health workers must be able to provide accurate, clear information and foster parental trust in immunization systems (29). Investment in parent-centered education, effective communication, and school engagement may therefore represent an effective strategy for increasing immunization coverage and creating a more supportive and proactive environment for disease prevention through vaccination.

This study has several strengths and limitations that should be considered when interpreting the findings. Its analytical design allows for the identification of associations between parental and system-related factors and measles immunization coverage, while the focus on parental behavior within a school-based immunization program provides relevant insights for public health practice. However, the cross-sectional design limits causal inference, and reliance on self-reported data may introduce reporting bias.

CONCLUSION

This study demonstrates that measles immunization coverage remains below the recommended target and is influenced by a combination of parental, health system, and environmental factors. Parental knowledge, attitudes, and practices were significantly associated with immunization completeness, indicating that informed and positively oriented parents are more likely to ensure their children receive

full vaccination. In addition, exposure to immunization-related information and the support of health services and school-based programs play an important role in facilitating immunization uptake. These findings highlight that measles immunization should not be viewed solely as an individual parental decision, but rather as the outcome of interactions between families, health services, and the school environment. Strengthening parental education, improving communication strategies, and enhancing collaboration between health facilities and schools are therefore essential to increasing measles immunization coverage and supporting effective disease prevention efforts.

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