



Factors Influencing Complete Basic Immunization Coverage among Infants in Lubuk Siam Village: A PRECEDE-Based Approach

Eva Mayasari[✉], Riska Epina Hayu, Ika Permanasari, Wilker Helary
Institut Kesehatan dan Teknologi Al Insyirah, Indonesia

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Abstract

Background: Immunization coverage in Indonesia declined, with most provinces, including Riau, missing the Ministry of Health's strategic plan targets. In Lubuk Siam Village, Riau, community awareness of the importance of immunization was low. A 2023 survey showed that only 13% of toddlers were immunized.

Methods: This mixed-method study utilized a sequential exploratory design. It began with the collection of qualitative data, which was then followed by quantitative data to enhance the findings. The study was conducted from May to September 2025 in Riau, Indonesia. The target population consisted of all mothers with toddlers aged 0 to 60 months. A total of 113 mothers participated in the study.

Results: Bivariate analysis showed that family support ($p = 0.031$), knowledge ($p = 0.004$), and attitude ($p < 0.001$) were significantly associated with immunization status. In the final multivariable model, attitude was the strongest predictor of immunization status (AOR = 9.11; $p < 0.001$). Qualitative findings identified parental concerns about vaccine side effects, lack of paternal support, low maternal education, weak community leadership, limited health promotion activities, and family-centered decision-making as barriers to immunization.

Conclusions: Maternal attitude was the most influential factor associated with immunization status. Family support, community influences, and health education were identified as key factors affecting immunization uptake. Strengthening family engagement and health promotion programs may improve immunization coverage.

[✉] Correspondence Address:
Email : eva.mayasari@ikta.ac.id

INTRODUCTION

Immunization, a cornerstone of public health, significantly curbs illness and mortality from infectious diseases, yet global coverage remains below established targets. The World Health Organization (WHO, 2017) reported that millions of children worldwide, particularly in areas with limited healthcare access, missed complete basic immunizations. Aligned with the Sustainable Development Goals (SDGs) and Indonesia's Health Law Number 36 of 2009, efforts to prevent vaccine-preventable diseases (PD3I)—such as polio, measles, hepatitis B, tetanus, pertussis, diphtheria, pneumonia, and meningitis—have been prioritized through immunization programs. These programs adhere to the Regulation of the Minister of Health of Indonesia Number 12 of 2017, encompassing routine basic and follow-up immunizations. However, the 2024 Indonesian Health Profile data revealed a decline in complete basic immunization coverage, dropping from 99.6% in 2022 to 95.4% in 2023 and further to 83.1% in 2024. Only four provinces met the Strategic Plan target, with Riau Province falling short. In Lubuk Siam Village, Kampar Regency, Riau, immunization coverage was notably low compared to national goals.

A survey conducted in Lubuk Siam Village in 2023 revealed that only 20 out of 152 infants and toddlers (13%) had received immunizations. Barriers included negative community perceptions about the effects of vaccines, unapproachable attitudes of health workers, and mothers' limited understanding of the importance of immunization. A challenge included poor communication between health workers and the community, low involvement of community leaders and health workers in education, and a lack of locally relevant immunization materials. These findings indicate that low coverage results from various technical, social, behaviours, and environmental factors.

Additionally, study has found that low immunization coverage arises from technical challenges, such as vaccine availability, and behaviours, social, and environmental factors (Wulandari, 2017). Effective interventions must therefore extend beyond technical fixes to include strategies for transforming community

behaviours and strengthening health systems. Lawrence Green (1980) identified three behaviours drivers: predisposing factors (knowledge, attitudes, age, gender, socioeconomic conditions), enabling factors (health infrastructure, services, and skilled personnel), and reinforcing factors (support from health workers, family, and social groups) (Notoatmodjo, 2014). Holipah (2018) emphasized that boosting coverage requires enhancing community education, improving economic conditions, raising maternal awareness, expanding healthcare access, and increasing rural health facilities and services.

The Precede-Proceed model, a proven framework for health intervention planning, has been effective in public health programs (Lotfi, 2022). In the Precede phase, the process begins with a social analysis to identify community needs and priorities. This is followed by an epidemiological analysis to determine key health problems, risk factors, and their impacts. The educational and ecological analysis focuses on identifying predisposing, enabling, and reinforcing factors that influence behavior. Finally, the policy and administrative In the Precede phase, the process begins with a social analysis to identify community needs and priorities. This is followed by an epidemiological analysis to determine key health problems, risk factors, and their impacts. The educational and ecological analysis focuses on identifying predisposing, enabling, and reinforcing factors that influence behavior. Finally, the policy and administrative analysis assesses existing resources, regulations, and policies that may support or hinder the intervention.

This study adopts the PRECEDE model, which focuses on identifying predisposing factors, enabling factors, and reinforcing factors related to health behaviors, including the implementation of planned health interventions or programs, followed by several evaluation stages: process evaluation ensures that the program is implemented as planned; impact evaluation measures short-term changes in behavior or environmental factors; and outcome evaluation assesses the long-term impact on public health. This phase also evaluates existing resources, regulations, and policies that may support or hinder the

intervention.

The Proceed phase involves implementing the planned health intervention or program, followed by several levels of evaluation: process evaluation ensures that the program is implemented as intended, impact evaluation measures short-term changes in behavior or environmental factors, and outcome evaluation assesses the long-term effects on community health. It helps identify the factors that influence parents' immunization decisions and enables the design of customized solutions. A study has found that these models increase Covid-19 vaccine acceptance in Hong Kong (Xie et al., 2024). In Lubuk Siam Village, improving low immunization coverage requires a strategic, needs-based approach that targets behaviours, social, and environmental factors. Customized health education materials, including videos and posters, can improve knowledge, encourage positive attitudes, and promote healthy behaviours when tailored to the needs of the audience. Success relies on relevant content, effective delivery, and audience alignment. Therefore, researchers will utilize the Precede-Proceed model to explore immunization challenges and develop targeted and impactful solutions comprehensively.

METHODS

This study employed a mixed-methods approach using a sequential exploratory design, which integrates quantitative and qualitative methods to gain a comprehensive understanding of the factors influencing vaccination behavior. The study participants were mothers with children aged 0–60 months residing in the study area, including both those who had vaccinated their children and those who had not. Inclusion criteria included the ability to communicate effectively and a willingness to participate, as evidenced by the provision of written informed consent. Exclusion criteria included mothers who could not be contacted, were absent during the data collection process, or refused to participate.

In the quantitative component, the sample was determined using total sampling, which involves all members of the population who meet the study criteria. Based on this approach, a sample of 113 respondents

was obtained. Furthermore, the qualitative component was conducted to explore in greater depth the experiences, perceptions, and contextual factors that influence mothers' decisions regarding their children's vaccination. The demographic characteristics studied included the mothers' age, number of children, educational level, and employment status.

This study adopts the PRECEDE framework from the PRECEDE-PROCEED Model as a theoretical foundation for identifying determinants of health behavior. The analysis focuses on predisposing factors, enabling factors, and reinforcing factors that play a role in shaping vaccination behavior.

The quantitative data were collected using a structured questionnaire consisting of several sections that measured both dependent and independent variables. The dependent variable was immunization status, measured using items assessing whether children received complete basic immunization according to national guidelines. The independent variables included knowledge, attitude, family support, health worker support, government policy, and program administration, each measured through Likert-scale statements or categorical questions. The questionnaire was developed based on relevant literature and adapted to the local context.

In the quantitative phase, data collection occurred from July to August 2025, while in the qualitative phase, data collection occurred from August to September 2025, continuing until saturation was achieved. For quantitative research, participants were informed that completing the questionnaire would take approximately 10 minutes. For qualitative research, participants were informed that completing the questionnaire would take approximately 15-20 minutes. All participants provided informed consent. The statistical analysis conducted is a correlation test to identify the relationship between dependent and independent variables. Statistical significance level of $p < .05$ was applied to all analyses. The statistical analyses were performed using IBM SPSS Statistics version 23.

Data were analyzed using IBM SPSS Statistics version 23. Pre-post changes in paired categorical variables were analyzed using the

McNemar Test. Furthermore, binary logistic regression analysis was performed to identify factors associated with the study outcome and to determine the magnitude of association between independent and dependent variables. Variables with $p < 0.25$ in the bivariate analysis were included in the multivariate model. The results were presented as odds ratios (ORs), 95% confidence intervals (CIs), and p-values. A statistical significance level of $p < .05$ was applied to all analyses.

This study was approved by the

Research Ethics Commission of the Kudus Cendekia Utama Health Institute (No. 60/EC/KEPITEKES-CU/IX/2025) in 26 September 2025. All participants voluntarily participated in the study. Before completing the questionnaires and interviews, each participant was required to respond to an informed consent question. Data collection was conducted anonymously and was intended solely for academic publication.

RESULTS AND DISCUSSIONS

Quantitative Findings

Table 1. Univariate Analysis

Variable	f	%
Immunization Status		
No Immunization	63	55.8
Immunization	50	44.2
Family Support		
Unsupportive	43	38.1
Supportive	70	61.9
Knowledge		
Poor	6	5.3
Moderate	29	25.7
Good	78	69
Attitude		
Negative	51	45.1
Positive	62	54.9
Health Worker Support		
Moderat	14	12.4
Good	99	87.6
Education Level		
Low	72	63.7
High	41	36.3
Age of Mother		
<20 years	9	8
20 to 35 years	61	54
>35 years	43	38
Occupational Status		
No/Housewife	111	98.2
Government employees	2	1.8

The univariate analysis showed that 55.8% of children had not received immunization. Most mothers reported supportive family support (61.9%), good knowledge regarding immunization (69.0%), positive attitudes toward immunization (54.9%), and good

support from health workers (87.6%). The majority of mothers had a low educational level (63.7%), were aged 20–35 years (54.0%), and were unemployed/housewives (98.2%). According to the table above, the majority of mothers are within their productive age. This age

group is generally viewed as both biologically and socially equipped to understand health information and make informed decisions regarding their children, compared to very young or older mothers. Research conducted by Nisa et al. (2023) at the Merakurak Community Health Center in Tuban Regency found that most mothers fall within the age range of 26 to 35 and possess a high level of knowledge about immunization.

Many mothers have low levels of education, which significantly impacts their knowledge, attitudes, and the completeness of their children's immunizations. A study by Nisa et al. (2023) found a strong correlation between

maternal education levels and knowledge of basic immunizations. Similarly, research conducted at the Lolofitu Moi Community Health Center revealed that mothers with lower levels of education were more likely to have children with incomplete basic immunizations compared to mothers who had completed secondary education or higher (Rambe & Zai, 2019). This indicates that one of the barriers to achieving adequate immunization coverage is mothers' limited understanding of the importance of immunization, as well as their lack of access to health information. Consequently, they may be more susceptible to negative information or myths.

Table 2. Bivariate Analysis

Variable	Immunization Status				P-Value
	No immunization		Immunization		
	n	%	n	%	
Family Support					
Unsupportive	30	69.8	13	30	0.031
Supportive	33	47.1	37	52.9	
Knowledge					
Poor	6	100	0	0	0.004
Moderate	21	72.6	8	27.6	
Good	36	46.2	42	53.8	
Attitude					
Negative	42	82.4	9	17.6	0.000
Positive	21	33.9	41	66.1	
Health Worker Support					
Moderat	8	57.1	6	42.9	1.000
Good	55	56.6	44	44.4	
Education Level					
Low	41	56.9	31	43.1	0.888
High	22	53.7	19	46.3	
Age of Mother					
<20 years	5	55.6	4	44.4	0.481
20 to 35 years	31	50.8	30	49.2	
>35 years	27	62.8	16	37.2	
Occupational Status					
No/Housewife	62	55.9	49	44.1	1.00
Government employees	1	50	1	50	

The bivariate analysis showed that family support, knowledge, and attitude were significantly associated with immunization status ($p < 0.05$). Regarding family support, the proportion of children without immunization was higher among mothers who received unsupportive family support (69.8%) compared with those who received supportive family support (47.1%). A significant association was found between family support and immunization status ($p = 0.031$).

For knowledge, all mothers with poor knowledge (100%) had children who were not immunized. In contrast, among mothers with good knowledge, a higher proportion of children were immunized (53.8%) than not immunized

(46.2%). The association between maternal knowledge and immunization status was statistically significant ($p = 0.004$). Regarding attitude, most mothers with a negative attitude had children who were not immunized (82.4%), whereas the majority of mothers with a positive attitude had immunized children (66.1%). A highly significant association was observed between maternal attitude and immunization status ($p < 0.001$).

In contrast, health worker support ($p = 1.000$), educational level ($p = 0.888$), maternal age ($p = 0.481$), and occupational status ($p = 1.000$) were not significantly associated with immunization status.

Table 3. Multivariate Analysis

Variable	Model 1		Model 2		Model 3	
	OR	p-value	OR	p-value	OR	p-value
Knowledge (1)	2,83	0,403	2,75	0,413	-	-
Knowledge (2)	6,541	0,112	6,847	0,102	-	-
Attitude	8,089	<0,001	8,635	<0,001	9,111	<0,001
Family Support	1,377	0,511	-	-	-	-

Multivariable logistic regression analysis was performed using a backward elimination procedure. In Model 1, knowledge, attitude, and family support were included in the analysis. Family support was excluded from the model because it had a p-value greater than 0.05 ($p = 0.511$). Assessment of confounding showed that the changes in odds ratios (ORs) for knowledge and attitude after the exclusion of family support were less than 10%, indicating that family support was not a confounding variable.

In Model 2, attitude remained significantly associated with the outcome (AOR = 8.64, $p < 0.001$), whereas knowledge was not statistically significant ($p = 0.102$ – 0.413). Further evaluation demonstrated that the change in the OR for attitude after removing knowledge was 5.51%, which was below the 10% threshold. Therefore, knowledge was not considered a confounding variable and was excluded from the final model.

The final model (Model 3) identified attitude as the only factor independently associated with complete basic immunization. Mothers with a positive attitude were 9.11 times more likely to have children with complete

basic immunization compared with those with a negative attitude (AOR = 9.11, $p < 0.001$). These findings suggest that maternal attitude is the most influential determinant of complete basic immunization in the study area.

Qualitatif Findings

In-depth interviews resulted in 10 subthemes consisting of Weak social influence and community support, Parental concerns and family influence on immunization decisions, Maternal characteristics, Health service accessibility, Social and family support, Policy implementation support, Health information system, Limited health education activities, Family influence on immunization, Limited authority in policy enforcement. The 10 themes could be grouped into four themes: Social determinants influencing immunization behavior, Factors contributing to low immunization coverage, Predisposing, enabling, and reinforcing factors, Administrative and policy support. A summary of the results, subthemes, and themes can be seen in Table 4

Table 4. Excerpts of Statements, Subthemes, and Themes from In-depth Interview

Verbatim	Code	Subtheme	Theme	
“No, there aren’t any, no one wants to be an elder.”	weak community leadership; individual-based decision making	Weak social influence and community support	Social determinants influencing immunization behavior	
“It depends on your intentions, ma’am, there is no one who is respected, only the rich are respected (while laughing).”				
“My child has not received complete immunization.”	incomplete immunization status; fear of side effects; lack of paternal support	Parental concerns and family influence on immunization decisions	Factors contributing to low immunization coverage	
“My husband did not allow immunization because he was afraid the child would develop a fever after vaccination.”				
“Immunization prevents disease and maintains children’s immunity.”	maternal knowledge	Maternal characteristics	Predisposing, enabling, and reinforcing factors	
“Most people only graduated from elementary or junior high school.”	low education			
“Only at the posyandu.”	availability of Posyandu	Health service accessibility		
The father did not allow it because the child would get a fever after injection.”	lack of husband support	Social and family support		
My family forbade immunization because of previous bad experiences.”	family beliefs			
“There is no respected person here.”	weak community leadership	Policy implementation support		
“Written immunization policies are available at the Puskesmas and village levels.”	availability of immunization policy			
“Immunization coverage reporting is conducted manually and electronically through the ASIK application.”	immunization reporting system	Health information system	Administrative and policy support	
“Health education and socialization activities are still limited.”	limited health promotion	Limited health education activities		
“The final decision usually depends on the family, especially the father.”	family decision-making	Family influence on immunization		
“Health workers cannot force families to participate.”	limited authority of health workers	Limited authority in policy enforcement		

Fase 1. Social

The majority of the respondents were housewives or did not have a job. Being a housewife often provides more flexibility in time compared to mothers who work outside the home. However, this can also lead to more limited access to information and a smaller social network that shares health information. Several studies have shown that working mothers tend to have greater knowledge about immunization. For instance, a study conducted at the Merakurak Community Health Center in Tuban Regency found that maternal occupation was significantly associated with maternal knowledge about immunization. Mothers who did not work often received less information than those who were employed (Nisa et al., 2023).

Fase 2. Epidemiology

Based on in-depth interviews with three mothers of toddlers, it was found that all informants stated that their children had not received complete immunizations, and some had never been immunized at all. Most mothers explained that the fathers did not allow immunization because they were worried about side effects such as fever after vaccination. These findings are supported by quantitative data on toddlers' immunization status.

These qualitative results are supported by quantitative data showing toddlers' immunization status.

Fase 3. Education and ecology

Predisposing Factors

Knowledge

Interview results showed that most mothers had limited knowledge about the benefits of immunization and the risks of not vaccinating their children. Although some mothers understood that immunization is important for children's health, they still chose not to vaccinate due to family influence, especially from their husbands. In addition, doubts and fears about immunization were influenced by negative information from friends, the community, and social media, including concerns about side effects and disability after vaccination. These qualitative results are supported by quantitative findings that show a similar trend regarding mothers' knowledge about immunization.

The low levels of knowledge among mothers, along with hesitancy and belief in negative rumors, are significant barriers to achieving adequate immunization coverage. Although there is an awareness of the importance of immunization, doubts remain due to the influence of inaccurate information from both the public and the media. A study by Jusril et al. (2022) titled "Factors Affecting Vaccination Demand in Indonesia" found that negative perceptions and a lack of accurate information from relevant authorities are key contributors to public hesitancy regarding immunization. Additionally, another study on "COVID-19 Vaccine Rumors and Resistance in Indonesia" discovered that rumors, myths, and false stories can foster resistance or reluctance toward vaccines and immunizations (Ida et al., 2024).

Attitude

Social assessments showed that mothers' attitudes toward immunization were influenced by their husbands and social environment. Interviews with three mothers of toddlers revealed that although they believed immunization was important for their children's health, they were hesitant to immunize due to fear of side effects, negative influences from the community, and their husbands' objections. The quantitative analysis supports these qualitative findings, illustrating mothers' attitudes towards immunizing their children.

Supporting Factors

All informants stated that immunization schedules were available and clearly communicated by community health workers, who were also perceived as friendly and supportive. However, mothers rarely participated in formal outreach activities, resulting in limited knowledge regarding the benefits and safety of immunization. Although facilities and services were considered adequate, gaps in health education outreach remained at the community level. Previous studies reported that counseling and education play important roles in improving compliance with complete immunization. Research by Jusril et al. (2022) also found that barriers in delivering clear information regarding immunization benefits, side effects, and schedules may affect immunization uptake.

Reinforcing Factors

Family support, particularly from husbands, was identified as a key factor influencing children's immunization status. Interviews showed that mothers often followed their husband's decision regarding immunization, even when they personally supported vaccination. Community attitudes toward immunization also varied, with some families supporting vaccination while others refusing it, resulting in social norms that were not fully supportive of vaccination. Research by Efendi et al (2023) found that husband support significantly increased the likelihood of complete immunization. Similarly, Wirawan et al (2022) reported that maternal autonomy influenced by family support was associated with higher immunization coverage.

Influential Figures in Decision-Making

Social assessments showed that fathers or husbands played a dominant role in decisions about child immunization. All informants stated that the final decision was usually made by the husband. Although mothers understood the importance of immunization, their husbands' refusal or prohibition often prevented children from receiving complete vaccinations, especially due to concerns about side effects such as fever after immunization. These qualitative results are supported by quantitative findings regarding family support for toddler immunizations.

Support from Health Workers

Social assessment findings showed that the role of health workers in supporting immunization was still limited. Although community health cadres regularly informed mothers about immunization schedules and were perceived as friendly, not all mothers consistently received counseling or education regarding immunization. Some informants stated that counseling was more often provided by midwives than by cadres.

Phase 4: Policy and Administration.

Government Policy

Interviews with health workers at community health centers (Puskesmas) showed that written immunization policies are available at both the Puskesmas and village levels, guided by Minister of Health Regulation No. 12 of 2017 on immunization implementation.

Puskesmas carry out these policies through program planning, vaccine distribution, and immunization services at Posyandu. Village midwives explained that immunization coverage reporting is conducted both manually and electronically through the My Indonesia Health Application (ASIK). However, health education and socialization activities are still limited and unevenly distributed. Follow-up services are available, but the authority of health cadres is limited, and existing policies are only recommendations, so the final decision about immunization usually depends on the family, especially the father. Discussions with health workers also showed that advocacy efforts with village officials have been carried out to encourage parents to bring their children to Posyandu for immunization. However, many parents still refuse because health workers cannot force families to participate.

Maternal understanding of childhood immunization plays a crucial role in the decision to complete these vaccinations. Mothers who are aware of the benefits, schedules, side effects, and risks associated with skipping immunizations are generally more proactive in taking their children for vaccinations. These findings are consistent with a study conducted at the Cileungsi Community Health Center in Bogor Regency, which showed that mothers with good knowledge were more likely to have their children fully immunized, while those with less knowledge faced a higher risk of under-immunization (Oktavirona, 2022).

Research conducted by Nurdiana et al. (2022) on "Mothers' Knowledge and Attitudes Regarding Basic Immunization Completeness in Infants" found that maternal attitudes significantly affected the completeness of basic immunizations. The study concluded that respondents with positive or agreeing attitudes had higher rates of immunization completeness compared to those who disagreed (0.002).

These findings are consistent with several studies that have reported similar results. Hanani et al. (2024) found that while maternal knowledge was associated with complete immunization, the role of health workers was not significantly. Additionally, a study conducted that maternal education and access to health services were the most closely

linked factors to immunization completeness, rather than the involvement of health workers (Afriyanda et al., 2025).

This consistency in results suggests that the support from health workers alone is not enough to ensure high immunization coverage. Other factors, such as maternal knowledge, family support, community trust, and access to health services, are likely to play a more significant role. Therefore, while health workers are important as sources of information and service facilitators, interventions aimed at increasing immunization coverage should focus on a combination of strategies, including family education, strengthening social support systems, and improving access to health services.

The PRECEDE phase was used to identify predisposing, reinforcing, and enabling factors related to immunization status, including maternal characteristics, knowledge, attitudes, family support, and perceptions of health workers. The findings from this phase served as the basis for developing health education interventions. Predisposing factors included mothers' limited knowledge and doubts about immunization due to misinformation. Enabling factors were the availability of immunization facilities and health workers, while reinforcing factors included limited family support.

CONCLUSION

Maternal attitude was the most influential factor associated with immunization status. Family support, community influences, and health education were identified as key factors affecting immunization uptake. Strengthening family engagement and health promotion programs may improve immunization coverage

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