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Factors Associated with Complete Basic Immunization Adherence Among Children Aged 12-24 Months in Jambi City

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Abstract
Introduction: *Complete basic immunization is essential for preventing vaccine-preventable diseases among children. However, incomplete immunization remains a public health concern in the working area of Putri Ayu Public Health Center, Jambi City.* ***Objective:*** *This study aimed to analyze factors associated with complete basic immunization adherence among children aged 12–24 months and identify the most dominant associated factor.* ***Method:*** *This quantitative study used an observational analytic cross-sectional design involving 258 mothers of children aged 12–24 months, selected through simple random sampling. Data were collected through structured interviews and observations of immunization records. Data were analyzed using univariate analysis, Chi-square tests, and multiple logistic regression.* ***Result and Discussion****: Of the 258 children, 72.9% had received complete basic immunization, while 27.1% had incomplete immunization. Family support, healthcare access and affordability, family income, maternal attitude, and health worker roles were significantly associated with immunization completeness (p<0.05). Maternal employment was not significantly associated (p=0.407). Family support was the strongest associated factor (OR=62.220; 95% CI: 16.417–235.809; p<0.001).* ***Conclusions:*** *Complete basic immunization adherence was associated with family support, healthcare access, family income, maternal attitude, and health worker roles. Strengthening family involvement, improving healthcare accessibility, and enhancing health worker communication may help improve immunization coverage.*

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Introduction

Immunization is one of the most effective public health interventions for preventing morbidity, disability, and mortality caused by vaccine-preventable diseases. Complete basic immunization plays an essential role in protecting children against infectious diseases and supporting healthy growth and development. The World Health Organization (WHO) estimates that immunization prevents approximately 3.5–5 million deaths annually worldwide. Despite these benefits, achieving equitable immunization coverage remains a challenge, particularly among children who have not received any vaccine or have not completed their recommended immunization schedules (WHO, 2023; WHO, 2025).

In Indonesia, childhood immunization coverage continues to require attention. According to the Ministry of Health of the Republic of Indonesia, immunization coverage has varied across regions, and several areas have not achieved the national target (Kemenkes RI, 2024). In Jambi Province, complete basic immunization coverage reached 83.95% in 2024, remaining below the national target (Dinas Kesehatan Provinsi Jambi, 2024). At the local level, data from the Jambi City Health Office indicated that the coverage at Putri Ayu Public Health Center was approximately 73% in 2025, representing the lowest coverage among public health centers in Jambi City. This situation highlights the need to identify factors associated with immunization adherence among children in this area (Dinas Kesehatan Kota Jambi, 2025).

Under the Indonesian national immunization program, complete routine childhood immunization is assessed based on the receipt of recommended vaccine doses according to the national immunization schedule. According to the Ministry of Health of the Republic of Indonesia, routine infant immunization includes hepatitis B (HB-0), Bacillus Calmette–Guérin (BCG), four doses of bivalent oral poliovirus vaccine (bOPV), three doses of diphtheria-tetanus-pertussis-hepatitis B-Haemophilus influenzae type b vaccine (DPT-HB-Hib), three doses of pneumococcal conjugate vaccine (PCV), three doses of rotavirus vaccine (RV), two doses of inactivated poliovirus vaccine (IPV), and one dose of measles-rubella (MR) vaccine. Japanese encephalitis (JE) vaccination is additionally provided in designated endemic areas. The national schedule also recommends follow-up immunization during the second year of life, including a fourth dose of DPT-HB-Hib and a second dose of MR vaccine at 18 months of age (Kemenkes RI, 2024).

The child's age is an important consideration when assessing immunization completeness, particularly among children aged 12–24 months. Children aged 12–17 months may not yet have reached the recommended age for the 18-month follow-up doses, whereas children aged 18–24 months are expected to have received these additional doses. Therefore, immunization completeness should be assessed in relation to the child's age at the time of evaluation and the doses recommended for that age. Distinguishing between age-appropriate immunization status and completion of the full recommended schedule by 24 months is important to avoid misclassifying children who have not yet become eligible for subsequent doses.

Immunization adherence may be influenced by individual, family, socioeconomic, and healthcare-related factors. Green and Kreuter's health promotion framework emphasizes that health behavior is shaped by predisposing, enabling, and reinforcing factors. In the context of childhood immunization, maternal attitudes may influence acceptance of vaccination, while family support can encourage mothers to follow immunization schedules. Healthcare accessibility, transportation availability, service costs, and convenient service schedules may facilitate immunization uptake. Family

income may also affect the ability to access healthcare services, while health workers can contribute through education, counseling, and reminders about vaccination schedules (Green & Kreuter, 2005; WHO, 2022).

Previous studies in Indonesia have identified family support, maternal attitudes, healthcare accessibility, socioeconomic conditions, and health worker involvement as factors associated with childhood immunization completeness. However, the relative importance of these factors may differ across communities because of variations in social, economic, cultural, and healthcare service conditions. Evidence from Indonesia has also highlighted the contribution of socioeconomic and household characteristics to childhood vaccination coverage (Sinuraya et al., 2024; Sriatmi et al., 2024). Therefore, local evidence is needed to determine which factors are most strongly associated with complete basic immunization adherence in specific healthcare settings.

Although previous studies have examined determinants of childhood immunization, identifying the most dominant associated factor in the working area of Putri Ayu Public Health Center is important for developing locally appropriate interventions. Understanding the relationships between family support, healthcare access and affordability, maternal employment, family income, maternal attitudes, and health worker roles may help healthcare providers design more effective strategies to improve immunization coverage.

This study aimed to analyze factors associated with complete basic immunization adherence among children aged 12–24 months in the working area of Putri Ayu Public Health Center, Jambi City, Indonesia, and to identify the factor most strongly associated with immunization completeness. The findings are expected to provide evidence for strengthening family involvement, improving access to immunization services, and supporting public health programs to increase childhood immunization coverage.

Method

This study employed a quantitative approach with an observational analytic design using a cross-sectional method. The study aimed to analyze factors associated with complete basic immunization adherence among children aged 12–24 months in the working area of Putri Ayu Public Health Center, Jambi City, Indonesia. The independent variables included family support, access to and affordability of healthcare services, maternal employment status, family income, maternal attitudes toward immunization, and the role of health workers. The dependent variable was complete basic immunization status.

The study population consisted of 730 mothers with children aged 12–24 months residing in the working area of Putri Ayu Public Health Center, Jambi City, in 2026. The sample comprised 258 mothers, with the sample size calculated using Slovin's formula at a 5% margin of error. Participants were selected using simple random sampling, with the selection process assisted by Microsoft Excel to provide eligible population members with an equal chance of being selected.

Data were collected using structured interviews and observations of immunization records. The research instruments consisted of a structured questionnaire and an immunization observation sheet. The questionnaire collected information on family support, healthcare access and affordability, maternal employment status, family income, maternal attitudes toward immunization, and health worker roles. Immunization completeness was assessed by reviewing the child's Maternal and Child Health (MCH) handbook (Buku KIA) and/or immunization register at the public health center.

Data were analyzed using univariate, bivariate, and multivariate analyses. Univariate analysis was used to describe the distribution of each study variable. Bivariate analysis was performed using the Chi-square test to examine associations between each independent variable and complete basic immunization status. Variables considered relevant based on the bivariate analysis were further evaluated using multiple logistic regression to identify factors independently associated with immunization completeness. Adjusted odds ratios (AORs), 95% confidence intervals (CIs), and p-values were used to assess the strength and statistical significance of the associations. The variable with the largest adjusted odds ratio was considered to have the strongest observed association with complete basic immunization among the variables included in the final model.

Result and Discussion

1. Result

A total of 258 mothers of children aged 12–24 months participated in this study. Of the children included, 188 (72.9%) had received complete basic immunization, whereas 70 (27.1%) had incomplete basic immunization. Regarding age distribution, 140 children (54.3%) were aged 12–17 months, while 118 children (45.7%) were aged 18–24 months. The distribution of the study variables is presented in Table 1.

Table 1
Distribution of Study Variables

Variabel	n	%
Complete basic immunization		
Complete	188	72.9
Incomplete	70	27.1
Child's age		
12-17 months	140	54.3
18-24 months	118	45.7
Family support		
Good	139	53.9
Poor	119	46.1
Healthcare access and affordability		
Good	137	53.1
Poor	121	46.9
Maternal employment		
Employed	109	42.2
Unemployed	149	57.8
Family income		
High	135	52.3
Low	123	47.7
Maternal attitude		
Positive	143	55.4
Negative	115	44.6
Health worker role		
Good	135	52.3
Poor	123	47.7

As shown in Table 1, most children had received complete basic immunization (72.9%). Regarding age, more than half of the children (54.3%) were aged 12–17 months, while 45.7% were aged 18–24 months. More than half of the mothers reported good family support (53.9%), good healthcare access and affordability (53.1%), and positive attitudes toward immunization (55.4%). In addition, 52.3% of respondents reported good

health worker roles, and 52.3% of families were classified as having high income. Most mothers were unemployed (57.8%).

Bivariate analysis was conducted using the Chi-square test to examine the associations between the independent variables and complete basic immunization status. The results are presented in Table 2.

Table 2
Association Between Independent Variables and Complete Basic Immunization Status

No	Variable	Category	Incomplete		Complete		Total		p-value
			n	%	n	%	n	%	
1	Family Support	Poor	57	47.9	62	52.1	119	100	<0.001
		Good	13	9.4	126	90.6	139	100	
		Total	70	27.1	188	72.9	258	100	
2	Healthcare Access and Affordability	Poor	53	43.8	68	56.2	121	100	<0.001
		Good	17	12.4	120	87.6	137	100	
		Total	70	27.1	188	72.9	258	100	
3	Maternal Employment Status	Not Employed	37	24.8	112	75.2	149	100	0.407
		Employed	33	30.3	76	69.7	109	100	
		Total	70	27.1	188	72.9	258	100	
4	Family Income	Low	43	35.0	80	65.0	123	100	0.011
		High	27	20.0	108	80.0	135	100	
		Total	70	27.1	188	72.9	258	100	
5	Maternal Attitude	Negative	46	40.0	69	60.0	115	100	<0.001
		Positive	24	16.8	119	83.2	143	100	
		Total	70	27.1	188	72.9	258	100	
6	Healthcare Worker Role	Poor	57	46.3	66	53.7	123	100	<0.001
		Good	13	9.6	122	90.4	135	100	
		Total	70	27.1	188	72.9	258	100	
7	Child's age	12-17 months	30	21.4	110	78.6	140	100	0.025
		18-24 months	40	33.9	78	66.1	118	100	
		Total	70	27.1	188	72.9	258	100	

The bivariate analysis showed significant associations between complete basic immunization and family support, healthcare access and affordability, family income, maternal attitude, health worker role, and child age ($p < 0.05$). The proportion of children with complete immunization was higher among those with good family support (90.6%), good healthcare access and affordability (87.6%), positive maternal attitudes (83.2%), and good health worker roles (90.4%). Children from high-income families also had higher immunization completeness (80.0%) than those from low-income families (65.0%). Regarding child age, complete immunization was higher among children aged 12–17 months (78.6%) than those aged 18–24 months (66.1%). However, maternal employment status was not significantly associated with immunization completeness ($p = 0.407$), with similar proportions among children of unemployed mothers (75.2%) and employed mothers (69.7%). Multiple logistic regression was conducted to identify the factors most strongly associated with complete basic immunization status. The results are presented in Table 3.

Table 3
Multiple Logistic Regression Analysis of Factors Associated with Complete Basic Immunization

Variable	OR	95% CI	p-value
Family support	62.22	16.42–235.81	<0.001
Healthcare access and affordability	20.34	6.65–62.23	<0.001
Family income	5.84	2.13–16.08	0.001
Maternal attitude	11.18	4.01–31.18	<0.001
Health worker role	31.95	10.04–101.73	<0.001

The multivariate analysis showed that all five variables included in the model were statistically significantly associated with complete basic immunization status. Family support had the largest reported odds ratio (OR=62.22; 95% CI: 16.42–235.81; p<0.001), followed by health worker role (OR=31.95; 95% CI: 10.04–101.73; p<0.001) and healthcare access and affordability (OR=20.34; 95% CI: 6.65–62.23; p<0.001). Maternal attitude (OR=11.18; 95% CI: 4.01–31.18; p<0.001) and family income (OR=5.85; 95% CI: 2.13–16.08; p=0.001) were also significantly associated with immunization completeness.

2. Discussion

This study examined factors associated with complete basic immunization among children aged 12–24 months in the working area of Putri Ayu Public Health Center, Jambi City. The results showed that 72.9% of children had received complete basic immunization, while 27.1% had incomplete immunization. Family support, healthcare access and affordability, family income, maternal attitude, and health worker role were significantly associated with immunization completeness, whereas maternal employment was not statistically significant. These findings indicate that childhood immunization completion is associated with a combination of family, socioeconomic, maternal, and healthcare-service factors. Similar factors have been identified in previous research examining childhood immunization completeness in Indonesia and other settings (Hatijar et al., 2025; Madolan et al., 2025).

Family support was significantly associated with complete basic immunization, with completion rates of 90.6% among children whose mothers reported good family support and 52.1% among those whose mothers reported poor support. Family support remained the strongest associated factor in the multivariate analysis (OR = 62.22; 95% CI: 16.42–235.81; p < 0.001). Family support may involve several dimensions, including emotional support through encouragement and motivation, informational support through reminders about immunization schedules, and instrumental support through assistance with transportation, childcare, and financial resources. These forms of support may facilitate mothers' ability to attend immunization services and complete their children's recommended vaccination schedules. However, the interpretation of these dimensions should correspond to the specific items measured in the study questionnaire. Therefore, identifying the actual forms of family support experienced by respondents is important for understanding how family involvement may contribute to childhood immunization completeness (Andrianto et al., 2025; Aridiansyah Aridiansyah et al., 2024; Putri et al., 2025).

Healthcare access and affordability were also significantly associated with immunization completeness. The proportion of children with complete immunization was 87.6% among mothers reporting good access and affordability, compared with 56.2%

among those reporting poor access and affordability. This association remained significant in the multivariate analysis (OR = 20.342; 95% CI: 6.650–62.225; p < 0.001). Distance, transportation expenses, waiting times, service hours, and difficulties balancing healthcare visits with household responsibilities may influence caregivers' ability to attend immunization services, although these specific barriers were not independently established by the present results. Previous research has identified healthcare accessibility and service-related barriers as relevant considerations in childhood immunization adherence (Madolan et al., 2025; Muathe et al., 2020). Supporting evidence is provided by an umbrella review of childhood immunization studies in Ethiopia, which identified factors such as proximity to vaccination services, antenatal care attendance, maternal knowledge, and postnatal healthcare visits as factors associated with immunization coverage. These findings further highlight the importance of accessible services and effective communication with caregivers (Zemariam et al., 2024).

Family income was significantly associated with complete basic immunization, with completion rates of 80.0% among families with high income and 65.0% among families with low income (p = 0.011). The association remained significant in the multivariate analysis (OR = 5.845; 95% CI: 2.125–16.078; p = 0.001). Families with greater financial resources may find it easier to cover indirect costs such as transportation and time away from paid work, even when immunization itself is provided without direct payment. This finding is consistent with previous research identifying socioeconomic circumstances as factors associated with childhood immunization completion (Hatijar et al., 2025; Putri et al., 2025). Similarly, a study of children aged 12–23 months in India found that socioeconomic characteristics, including household wealth, were associated with full childhood vaccination coverage (Islam et al., 2021). Research in Zhejiang Province, China, also documented socioeconomic inequalities in full vaccination coverage, supporting the relevance of household circumstances when examining differences in immunization uptake (Hu et al., 2021).

Maternal attitude toward immunization was significantly associated with complete basic immunization. Completion was observed in 83.2% of children whose mothers had positive attitudes, compared with 60.0% among those whose mothers had negative attitudes (p < 0.001). Maternal attitude remained significant in the multivariate analysis (OR = 11.184; 95% CI: 4.012–31.181; p < 0.001). Mothers who recognize the benefits of immunization and feel confident about vaccination may be more willing to follow the recommended schedule, while concerns or uncertainty may contribute to missed or delayed doses. Previous studies in Central Java and Banggai Laut also identified maternal or parental attitudes as factors associated with childhood immunization (Madolan et al., 2025; Sriatmi et al., 2024). However, research in Garut City reported no statistically significant association between maternal perception and immunization status, suggesting that differences in populations and measurement methods may affect the findings (Widadi & Kurniasih, 2025). These results support the value of clear, accessible immunization education that addresses caregivers' questions and concerns.

The role of health workers was significantly associated with complete basic immunization, with completion rates of 90.4% among children whose mothers reported a good health worker role and 53.7% among those reporting a poor role. The association remained significant in the multivariate analysis (OR = 31.950; 95% CI: 10.035–101.731; p < 0.001). Health workers may support immunization adherence by explaining schedules, responding to caregivers' concerns, reminding families about upcoming doses, and providing guidance when doses are missed. Previous research has emphasized the

importance of healthcare-worker communication and support in shaping parental immunization behavior (Balgovind & Mohammadnezhad, 2022; Madolan et al., 2025). In contrast, maternal employment was not significantly associated with immunization completeness in the present study ($p = 0.407$), although completion was slightly higher among children of unemployed mothers than among children of employed mothers (75.2% versus 69.7%). This result suggests that employment status alone may not adequately reflect caregivers' ability to attend services; work flexibility, family assistance, and clinic opening hours may also be relevant. Other research has identified employment-related constraints as potential barriers, indicating that the relationship may differ across service settings and household circumstances (Muathe et al., 2020).

In contrast, an analysis of children across 17 sub-Saharan African countries examined women's empowerment in relation to childhood immunization coverage and highlighted the relevance of maternal decision-making and empowerment. This evidence suggests that the relationship between maternal employment and immunization may depend on broader circumstances, including women's autonomy and their ability to access healthcare services (Amoah et al., 2023).

Overall, the findings suggest that complete basic immunization is associated with several interrelated factors, particularly family support, healthcare access and affordability, family income, maternal attitude, health worker role, and child age. The reported Nagelkerke R^2 of 0.707 describes the model's explanatory performance but does not establish causal relationships. The cross-sectional design prevents conclusions about temporal order or causality, and questionnaire-based measurements may be affected by recall or subjective reporting. Furthermore, although child age was included in the bivariate analysis, the study did not provide a detailed age-stratified analysis of immunization completeness among children aged 12–24 months. Differences in age-related eligibility for scheduled vaccine doses may have influenced the classification of immunization completeness. In addition, family support was analyzed using an overall categorical measure, which limited the ability to identify the specific dimensions of support that contributed most to immunization adherence. The study was also conducted in one public health center, which may limit the generalizability of the findings to other settings. In addition, the large odds ratios and wide confidence intervals warrant verification of variable coding, reference categories, and the original regression output before publication. Future research could use longitudinal or multicenter designs to investigate these associations further and evaluate interventions such as family-inclusive counseling, caregiver reminders, improved follow-up, and more accessible immunization services. In practice, the results support an integrated approach that combines family engagement, effective health worker communication, attention to financial barriers, and accessible services to help more children complete their basic immunization schedules.

Study Limitations

This study has several limitations. First, its retrospective, single-center design and small sample size (64 patients) limit generalizability and statistical power. Second, only 13 distant metastasis events were documented, resulting in wide confidence intervals and substantial uncertainty in effect estimates. Third, variable imaging methods and surveillance frequency may have led to incomplete outcome ascertainment, including missed recurrences occurring outside the hospital or after the last documented contact. Fourth, individual follow-up duration and event dates were unavailable, preventing time-to-event analysis and potentially underestimating late recurrence. Fifth, the analysis was

unadjusted for potential confounders, including clinical stage, endocrine therapy, treatment duration, and chemotherapy regimen. Finally, excluding patients who received more than eight cycles of targeted therapy may limit comparability with standard one-year trastuzumab treatment cohorts. These findings should therefore be interpreted cautiously

Conclusion

This study concludes that complete basic immunization among children aged 12–24 months in the working area of Putri Ayu Public Health Center, Jambi City, was associated with family support, healthcare access and affordability, family income, maternal attitude, and health worker role, whereas maternal employment was not significantly associated with immunization completeness. These findings indicate that improving immunization coverage requires an integrated approach that strengthens family involvement, provides accessible and affordable healthcare services, promotes positive maternal attitudes through effective health education, and enhances the role of health workers in counseling and follow-up. These efforts may help address barriers to immunization and improve adherence to the recommended basic immunization schedule. Because the study used a cross-sectional design, the findings indicate associations rather than causal relationships.

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