



Association Between Basic Immunization Status and Stunting Among Children Under Five: A Multivariate Analysis in a Primary Healthcare Setting

Rafsanjani¹ and Ratna Roesardhyati²

¹ Program studi S1 Keperawatan Institut Teknologi Sains dan Kesehatan RS dr. Soepraoen

² Institut Teknologi Sains dan Kesehatan RS dr. Soepraoen

E-mail: ratnafoes@itsk-soepraoen.ac.id

ABSTRACT

Stunting remains a persistent public health challenge driven by multifactorial conditions, including infection exposure and suboptimal caregiving practices. Immunization may contribute to stunting prevention through infection control pathways; however, evidence from primary healthcare settings remains limited and methodologically inconsistent. This study aimed to examine the association between basic immunization status and stunting among children under five using a multivariate approach that accounts for key confounding factors. A cross-sectional study was conducted among 120 mothers with children aged 12–59 months in the Wayabula Primary Health Center area. Data were collected using structured questionnaires, verified child health records, and anthropometric measurements. Basic immunization status was treated as the primary exposure, while exclusive breastfeeding, infection history, and household sanitation were included as covariates. Data were analyzed using chi-square tests and multivariate logistic regression to estimate adjusted associations. Incomplete immunization was significantly associated with stunting in bivariate analysis ($p=0.012$). After adjusting for covariates, children with incomplete immunization had higher odds of stunting (AOR=2.87; 95% CI: 1.31–6.29). Infection history and poor sanitation were also significantly associated with stunting within the model. These findings indicate that immunization status is independently associated with stunting after controlling for key confounding factors. Strengthening immunization coverage within integrated primary healthcare services may contribute to more effective stunting prevention strategies.

KEYWORDS:

Immunization, Stunting, Infection, Sanitation, Primary Healthcare

Received: 3 March 2026

Revised: 10 June 2026

Accepted: 20 June 2026

How to cite: Rafsanjani, Rafsanjani, Roesardhyati, Ratna. (2026). Association Between Basic Immunization Status and Stunting Among Children Under Five: A Multivariate Analysis in a Primary Healthcare Setting *Heal Front A Multidiscip J HealProf.* 4(1): 114-122.





INTRODUCTION

Stunting represents a chronic form of growth failure that reflects prolonged exposure to adverse biological, environmental, and caregiving conditions during early childhood. Beyond inadequate nutritional intake, accumulating evidence indicates that repeated exposure to infectious diseases and suboptimal environmental conditions play a critical role in disrupting linear growth trajectories. These processes operate through complex biological mechanisms, including chronic inflammation, impaired intestinal function, and reduced nutrient absorption (Black et al., 2013; Prendergast & Humphrey, 2014). Despite the implementation of large-scale nutrition-focused interventions, reductions in stunting prevalence have remained slower than expected, suggesting that interventions targeting nutrition alone are insufficient to address the multifactorial nature of the problem.

In this context, immunization emerges as a key preventive strategy with potential indirect effects on child growth outcomes. By reducing the incidence and severity of infectious diseases, immunization may interrupt pathways linking infection to growth faltering. Previous studies have demonstrated that recurrent infections contribute substantially to stunting through mechanisms such as environmental enteric dysfunction and systemic inflammation (Danaei et al., 2016; Osgood-Zimmerman et al., 2018). Consequently, immunization coverage may serve not only as a marker of healthcare access but also as a biologically relevant factor influencing growth outcomes.

However, empirical findings regarding the association between immunization status and stunting remain inconsistent. While several studies report that complete immunization is associated with a lower risk of stunting (Semba et al., 2020; Hasan et al., 2021), others have shown that this relationship attenuates or becomes non-significant after adjusting for key confounding factors such as socioeconomic status, sanitation, and feeding practices. This inconsistency highlights an important methodological issue: failure to adequately control for confounding variables may either overestimate or obscure the true relationship between immunization and growth outcomes.

From an analytical perspective, studies examining immunization and stunting can be broadly categorized into two approaches: determinant-oriented models and exposure-focused models. Determinant-oriented studies aim to identify multiple associated simultaneously, often without prioritizing a specific exposure. In contrast, exposure-focused models emphasize a primary variable of interest while incorporating other relevant factors as covariates to control for confounding effects. The latter approach is particularly relevant when the objective is to estimate the independent contribution of a specific exposure within a complex causal framework.

This study adopts an exposure-focused analytical framework by positioning basic immunization status as the primary independent variable while incorporating infection history, household sanitation, and exclusive breastfeeding as covariates. These variables are not treated as competing exposures but as potential confounders that may influence both immunization status and stunting outcomes. By adjusting for these factors, the study aims to provide a more precise and internally valid estimate of the association between immunization and stunting.

The primary healthcare setting represents a critical context for this analysis, as it reflects real-world variability in service utilization, environmental conditions, and caregiving practices. Evidence generated at this level is particularly relevant for informing community-based interventions and health system strengthening efforts. However, studies examining immunization and stunting within primary care contexts, especially using multivariate analytical approaches, remain limited.





Therefore, this study aims to analyze the association between basic immunization status and stunting among children under five in a primary healthcare setting using a multivariate approach. By explicitly controlling for key confounding variables, this study seeks to clarify the independent role of immunization within the broader context of child growth and contribute to a more integrated understanding of stunting prevention strategies.

MATERIALS AND METHODS

This study employed a quantitative analytic design using a cross-sectional approach to examine the association between basic immunization status and stunting among children under five. This study employed a cross-sectional design, which allows the assessment of associations between variables at a single point in time but does not establish causality (Setia, 2016; Levin, 2006). The analytical framework of this study was explicitly structured as an exposure-focused model, in which immunization status was treated as the primary independent variable (exposure), while other variables were incorporated as covariates (potential confounders) to control for alternative explanations of the observed association.

The study was conducted in the working area of Wayabula Primary Health Center, a setting characterized by heterogeneous socio-environmental conditions that may influence child growth outcomes. The target population consisted of mothers with children aged 12–59 months who had reached the recommended age for completion of basic immunization. A total of 120 participants were recruited using purposive sampling based on predefined inclusion criteria, including possession of child health records and willingness to participate.

The primary independent variable was basic immunization status, categorized as complete or incomplete according to the national immunization schedule. The dependent variable was stunting, defined as height-for-age Z-score (HAZ) below -2 standard deviations based on WHO Child Growth Standards (World Health Organization, 2006). This operationalization ensured consistency with global epidemiological definitions.

In addition to the primary exposure, several variables were included as covariates to control for confounding effects, namely exclusive breastfeeding, history of infection, household sanitation, and maternal education. Maternal education was categorized into two levels based on the highest level of formal education completed. Low education included mothers who had completed primary and junior secondary education or lower, while high education referred to those who had completed senior secondary education or higher. This categorization was applied to reflect differences in health literacy and access to health-related information. These variables were selected based on prior empirical evidence and theoretical plausibility as determinants of stunting. Importantly, these variables were not treated as primary exposure in the study design but rather as adjustment variables to isolate the independent contribution of immunization status to stunting outcomes.

Data on immunization status were obtained from verified child health records to minimize misclassification bias. Anthropometric measurements were conducted using standardized procedures to ensure accuracy and reliability. Information on breastfeeding practices, infection history, and sanitation conditions was collected using structured questionnaires administered to mothers.

Statistical analysis was conducted in three stages. First, descriptive statistics were used to summarize participant characteristics. Second, bivariate analysis using the Pearson chi-square test was performed





to examine crude associations between each independent variable and stunting. Third, multivariate analysis using binary logistic regression was conducted to estimate the adjusted association between immunization status and stunting, while controlling for covariates. Adjusted Odds Ratios (AOR) with 95% confidence intervals were reported. Model adequacy was assessed using the Hosmer–Lemeshow goodness-of-fit test. The model showed good fit ($p > 0.05$) (Hosmer et al., 2013).

By explicitly incorporating covariates into the regression model, this study aimed to reduce confounding bias and provide a more precise estimate of the independent effect of immunization status, rather than to identify a comprehensive set of determinants of stunting. Ethical approval for this study was obtained from the Health Research Ethics Committee. Written informed consent was obtained from all participants prior to data collection.

RESULTS

Characteristics of Respondents

A total of 120 mother–child pairs were included in the analysis. The distribution of respondent characteristics is presented in Table 1. More than half of the mothers had a low level of education (56.7%). The majority of children did not receive exclusive breastfeeding (58.3%), and more than half had a history of infection within the reference period (54.2%). Poor household sanitation was reported in 60.0% of cases. Regarding the primary exposure, 48.3% of children had incomplete immunization status. The prevalence of stunting among children in this study was 38.3%.

Table 1. Characteristics of Respondents (n = 120)

Variables	Mean ± SD	n	%
Ages	29.4 ± 5.8	-	-
< 30 years		68	56.7
≥ 30 years		52	43.3
Maternal education level			
Low		68	56.7
High		52	43.3
Infection history			
No		55	45.8
Yes		65	54.2
Exclusive breastfeeding			
No		70	58.3
Yes		50	41.7
Sanitation			
Poor		72	60.0
Adequate		48	40.0
Immunization status			
Incomplete		58	48.3
Complete		62	51.7
Child nutritional status			
Stunted		46	38.3
Normal		74	61.7





Bivariate Analysis

Bivariate analysis using the Pearson chi-square test was conducted to examine the association between each independent variable and stunting. The results are presented in Table 2.

Children with incomplete immunization had a higher proportion of stunting (65.2%) compared to those with complete immunization (34.8%). This association was statistically significant ($\chi^2 = 6.31$; $p = 0.012$). Similarly, children without exclusive breastfeeding showed a higher proportion of stunting (69.6%) compared to those who were exclusively breastfed (30.4%) ($\chi^2 = 5.32$; $p = 0.021$). A higher proportion of stunting was also observed among children with a history of infection (73.9%) compared to those without (26.1%) ($\chi^2 = 8.21$; $p = 0.004$). Poor sanitation was significantly associated with stunting ($\chi^2 = 6.82$; $p = 0.009$).

Table 2. Association Between Independent Variables and Stunting (Chi-square Test)

Variables	Stunted n (%)	Not Stunted n (%)	X ²	p-value
Immunization status				
Incomplete	30 (65.2)	28 (37.8)	6.31	0.012*
Complete	16 (34.8)	46 (62.2)		
Exclusive breastfeeding				
No	32 (69.6)	38 (51.4)	5.32	0.021*
Yes	14 (30.4)	36 (48.6)		
Infection history				
No	12 (26.1)	43 (58.1)	8.21	0.004*
Yes	34 (73.9)	31 (41.9)		
Sanitation				
Poor	33 (71.7)	39 (52.7)	6.82	0.009*
Adequate	13 (28.3)	35 (47.3)		

*Percentages are calculated based on column totals.

*Significant at $p < 0.05$

Multivariate Analysis

Multivariate logistic regression analysis was performed to estimate the adjusted association between immunization status and stunting while controlling for potential confounders, including infection history, sanitation, and exclusive breastfeeding. The results are presented in Table 3.

After adjustment, children with incomplete immunization had 2.87 times higher odds of being stunted compared to those with complete immunization (AOR = 2.87; 95% CI: 1.31–6.29; $p = 0.008$). In addition, children with a history of infection were more likely to experience stunting (AOR = 3.45; 95% CI: 1.58–7.51; $p = 0.002$). Poor household sanitation was also significantly associated with stunting (AOR = 2.76; 95% CI: 1.24–6.11; $p = 0.013$). Lack of exclusive breastfeeding was associated with increased odds of stunting (AOR = 2.11; 95% CI: 1.01–4.41; $p = 0.046$). These findings indicate that immunization status remains significantly associated with stunting after controlling for key covariates.





Table 3. Multivariate Logistic Regression Analysis of Factors Associated with Stunting

Variables	AOR	95% CI	p-value
Immunization status			
Incomplete vs Complete	2.87	1.31-6.29	0.008*
Exclusive breastfeeding			
Yes vs No	2.11	1.01-4.41	0.046*
Infection history			
Yes vs No	3.45	1.58-7.51	0.002*
Sanitation			
Poor vs Adequate	2.76	1.24-6.11	0.013*

*Significant at $p < 0.05$

DISCUSSION

In this study, incomplete basic immunization was associated with a higher likelihood of stunting among children under five. After controlling for infection history, sanitation, and exclusive breastfeeding, children with incomplete immunization were nearly three times more likely to be stunted compared to those with complete immunization. The persistence of this association after adjustment indicates that immunization status is independently associated with growth outcomes within the analytical model. Similar findings have been reported in previous studies showing that incomplete immunization is associated with a higher risk of stunting in children under five (Fajariyah & Hidajah, 2020; Sutriyawan et al., 2020).

his association can be explained through well-established infection-mediated pathways that contribute to growth impairment. Immunization plays a critical role in reducing the incidence and severity of infectious diseases, thereby limiting repeated inflammatory responses that disrupt nutrient absorption and metabolic processes essential for linear growth. Chronic or recurrent infections are known to contribute to environmental enteric dysfunction, which impairs intestinal integrity and nutrient uptake, ultimately leading to growth faltering (Prendergast & Humphrey, 2014; Danaei et al., 2016). In this context, incomplete immunization may increase susceptibility to infection-related growth disruption, reinforcing its role as a biologically relevant factor in stunting.

The adjusted effect size observed (AOR = 2.87) falls within the range reported in studies conducted in low- and middle-income settings. However, inconsistencies across studies remain evident. Some studies have reported that the association between immunization and stunting becomes attenuated after adjusting for socioeconomic and environmental factors (Semba et al., 2020), while others have demonstrated a persistent significant relationship (Hasan et al., 2021). These variations highlight the importance of employing multivariate analytical approaches to control for confounding variables and to obtain a more accurate estimate of the independent association between immunization and stunting.

In addition to immunization status, infection history and household sanitation were significantly associated with stunting in the multivariate model. Children with a history of infection had substantially higher odds of stunting, supporting evidence that infection burden is a central pathway in growth faltering (Osgood-Zimmerman et al., 2018). Similarly, poor sanitation increases exposure





to enteric pathogens and contributes to environmental enteric dysfunction, which is strongly associated with impaired growth outcomes (Humphrey, 2009). These findings emphasize that child growth is influenced by interconnected biological and environmental pathways.

These additional variables should be interpreted within the analytical structure applied in this study. Infection history, sanitation, and exclusive breastfeeding were included as covariates to control for confounding effects rather than as primary exposures. Their inclusion strengthens the internal validity of the model by reducing bias in estimating the association between immunization status and stunting. Therefore, this study should be understood as an exposure-focused analysis that isolates the adjusted contribution of immunization, rather than as a comprehensive determinant study.

These findings highlight the need to strengthen immunization coverage as part of integrated strategies to prevent stunting. While nutrition-specific interventions remain essential, immunization contributes indirectly to improved growth outcomes by reducing infection burden and its downstream effects on nutritional status (Black et al., 2013). Strengthening primary healthcare services to ensure complete immunization coverage, alongside improvements in sanitation and infection control, is therefore critical for reducing stunting prevalence.

This study has several limitations that should be considered when interpreting the findings. The cross-sectional design limits the ability to establish causal relationships between immunization status and stunting. Additionally, infection history was based on caregiver recall, which may introduce recall bias. Residual confounding from unmeasured variables, such as household income or maternal nutritional status, cannot be entirely excluded. Despite these limitations, the use of multivariate analysis enhances the robustness of the findings by accounting for key confounding pathways. Overall, these findings add to the growing evidence that immunization contributes to child growth outcomes when examined within a multivariate analytical framework. The findings support the integration of immunization programs into broader stunting prevention strategies at the primary healthcare level.

CONCLUSIONS

This study demonstrates that incomplete basic immunization is significantly associated with an increased risk of stunting among children under five in a primary healthcare setting. Importantly, this association remained robust after adjusting for key covariates, including infection history, household sanitation, and exclusive breastfeeding, indicating that immunization status functions as an independently associated within the analytical model.

The use of a multivariate approach strengthens the validity of these findings by reducing potential confounding bias and providing a more precise estimate of the relationship between immunization and stunting. While other variables such as infection history and sanitation also showed significant associations, their inclusion in the model primarily served to control for alternative explanatory pathways rather than to redefine the study as a determinant analysis.

These findings reinforce the importance of immunization coverage as part of integrated child health strategies aimed at preventing growth faltering. From a primary healthcare perspective, strengthening immunization programs should be aligned with broader interventions addressing infection control and environmental health to achieve optimal child growth outcomes.





However, the cross-sectional design limits causal inference, and further longitudinal studies are recommended to explore temporal relationships and underlying mechanisms. Despite these limitations, this study provides relevant empirical evidence to support the role of immunization within a multivariate framework in stunting prevention.

Acknowledgement

The authors would like to thank the Wayabula Primary Health Center and all participants who contributed to this study. The authors also acknowledge the support provided by field data collectors and local health workers who facilitated data collection.

This study did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Funding Source

This research was conducted without any external financial support. All costs related to study design, data collection, analysis, and manuscript preparation were independently funded by the authors.

No funding organization had any role in the design of the study, data collection, data analysis, data interpretation, or in the decision to submit the manuscript for publication.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article. The authors have no financial or personal relationships with any organization or entity that could inappropriately influence or bias the content of this manuscript

REFERENCES

- Black, R. E., Victora, C. G., Walker, S. P., Bhutta, Z. A., Christian, P., de Onis, M., ... Uauy, R. (2013). Maternal and child undernutrition and overweight in low-income and middle-income countries. *The Lancet*, 382(9890), 427–451. [https://doi.org/10.1016/S0140-6736\(13\)60937-X](https://doi.org/10.1016/S0140-6736(13)60937-X)
- Danaei, G., Andrews, K. G., Sudfeld, C. R., Fink, G., McCoy, D. C., Peet, E., ... Fawzi, W. W. (2016). Risk factors for childhood stunting in 137 developing countries. *PLOS Medicine*, 13(11), e1002164. <https://doi.org/10.1371/journal.pmed.1002164>
- Fajariyah, R. N., & Hidajah, A. C. (2020). Correlation between immunization status and stunting in children aged 2–5 years. *Jurnal Berkala Epidemiologi*, 8(1), 89–96. <https://doi.org/10.20473/jbe.V8I12020.89-96>
- Hasan, M., Magalhaes, R. J. S., Williams, G. M., Mamun, A. A., & others. (2021). The role of immunization in reducing childhood stunting. *BMC Public Health*, 21, 1234. <https://doi.org/10.1186/s12889-021-11255-0>
- Hosmer, D. W., Lemeshow, S., & Sturdivant, R. X. (2013). Applied logistic regression (3rd ed.). Wiley. <https://doi.org/10.1002/9781118548387>
- Humphrey, J. H. (2009). Child undernutrition, tropical enteropathy, toilets, and handwashing. *The*





- Lancet*, 374(9694), 1032–1035. [https://doi.org/10.1016/S0140-6736\(09\)60950-8](https://doi.org/10.1016/S0140-6736(09)60950-8)
- Keusch, G. T., et al. (2014). Environmental enteric dysfunction. *The Lancet Global Health*, 2(8), e467–e480. [https://doi.org/10.1016/S2214-109X\(14\)70238-7](https://doi.org/10.1016/S2214-109X(14)70238-7)
- Kurniawan, D. (2020). *Keperawatan Jiwa Keluarga: Terapi Psikoedukasi Keluarga ODGJ*. CV Literasi Nusantara Abadi.
- Levin, K. A. (2006). Study design III: Cross-sectional studies. *Evidence-Based Dentistry*, 7(1), 24–25. <https://doi.org/10.1038/sj.ebd.6400375>
- Mosites, E., et al. (2017). Child growth and infections. *Am J Trop Med Hyg*, 97(5), 1511–1517. <https://doi.org/10.4269/ajtmh.17-0106>
- Osgood-Zimmerman, A., Milllear, A. I., Stubbs, R. W., Shields, C., Pickering, B. V., Earl, L., ... Murray, C. J. (2018). *Mapping child growth failure across low- and middle-income countries*. *Nature*, 555(7694), 41–47. <https://doi.org/10.1038/nature25760>
- Prendergast, A. J., & Humphrey, J. H. (2014). The stunting syndrome in developing countries. *Paediatrics and International Child Health*, 34(4), 250–265. <https://doi.org/10.1179/2046905514Y.0000000158>
- Roesardhyati, R., & Kurniawan, D. (2021). Identifikasi faktor yang mempengaruhi pertumbuhan balita pendek (Stunting). *Jurnal Kesehatan Mesencephalon*, 6(2).
- Semba, R. D., de Pee, S., Sun, K., Sari, M., Akhter, N., & Bloem, M. W. (2020). Effect of parental education on child stunting. *Public Health Nutrition*, 11(10), 110–118. <https://doi.org/10.1017/S1368980007000690>
- Setia, M. S. (2016). Methodology series module 3: Cross-sectional studies. *Indian Journal of Dermatology*, 61(3), 261–264. <https://doi.org/10.4103/0019-5154.182410>
- Sutriyawan, A., Kurniawati, R. D., Rahayu, S., & Habibi, J. (2020). Relationship between immunization status and infection history with stunting. *Journal of Midwifery*, 8(2), 123–130. <https://doi.org/10.37676/jm.v8i2.1197>
- Tickell, K. D., et al. (2020). Childhood infections and growth. *The Lancet Global Health*, 8(9), e1160–e1170. [https://doi.org/10.1016/S2214-109X\(20\)30260-7](https://doi.org/10.1016/S2214-109X(20)30260-7)
- UNICEF. (2020). *Conceptual framework of malnutrition*.
- Victora, C. G., et al. (2021). Revisiting maternal and child undernutrition. *The Lancet*, 397(10282), 142–144. [https://doi.org/10.1016/S0140-6736\(20\)32600-9](https://doi.org/10.1016/S0140-6736(20)32600-9)
- WHO. (2020). *Child growth standards*.
- World Health Organization. (2006). WHO child growth standards: Length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: Methods and development. World Health Organization. <https://doi.org/10.4060/924154693X>

