Factors Associated With The Incidence of Measles in Toddlers (Aged 0-5 Years) in Central Jakarta in 2024

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Abstract.

Measles remains a significant public health problem, particularly among children under five years old in urban areas. This study aimed to identify factors associated with measles incidence among children aged 0–5 years in Central Jakarta in 2024. A cross-sectional design was applied using secondary data from measles epidemiological investigations conducted by the Central Jakarta Health Sub-Department in 2024. The study included 115 children recorded in surveillance reports. Data were analyzed using univariate, bivariate, and multivariate methods with logistic regression. The results showed that several factors were associated with measles incidence, including nutritional status, age, sex, immunization history, and history of exposure. Multivariate analysis revealed that the dominant factor was nutritional status with an OR of 13.120 (95% CI: 1.698–101.320; p=0.014). In conclusion, nutritional status is the most influential factor in measles incidence among children in Central Jakarta. Efforts to improve children's nutritional status through growth monitoring, supplementation, and nutrition education should be strengthened to reduce measles risk.

Keywords : *Measles; public health center and nutritional status.*

I. INTRODUCTION

Measles is a highly contagious disease and remains a public health problem in Indonesia, particularly for children. Children with poor nutritional status are more susceptible to this infection due to their weakened immune systems. Furthermore, unimmunized/incompletely vaccinated individuals and vitamin A1 deficiency are at risk.According to a report by the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC)3, there will be approximately 10.3 million cases of measles worldwide in 2023, a 20% increase compared to 8.65 million cases in 2022. The reported number of cases and deaths due to measles in Indonesia from 2018 to 2022 was 47,261 suspected cases with 8 deaths. Meanwhile, laboratory results showed 6,846 positive cases of measles. Indonesia is among the 10 countries with the highest number of measles cases in the world2.The number of measles cases in DKI Jakarta was 3,641. The Central Jakarta Health Department reported 3,894 cases in 2023.

II. METHODS

This study used a cross-sectional design with secondary data from a measles epidemiological investigation conducted by the Central Jakarta Health Office in 2024. The sample consisted of 115 toddlers aged 0–5 years recorded in surveillance reports. Univariate, bivariate, and multivariate analyses were conducted using logistic regression.

III. RESULT AND DISCUSSION

Table 1. Univariate Analysis Results

No	VARIABLES	n	(%)
1	**Laboratory examination results for measles**		
	Positive	5	4.3
	Negative	110	95.7
2	**Nutritional status**		
	Malnutrition -3 SD to < -2 SD	12	10.4
	Good nutrition and more -2 SD to +1 SD	103	89.6

3	**Age**		
	≤1 Year	54	47
	25 years	61	53
4	**Gender**		
	Man	61	53
	Woman	54	47
5	**Immunization history**		
	Incomplete according to age	52	45.2
	Complete according to age	63	54.8
6	**Transmission History**		
	There is a contact history	8	7
	No contact history	107	93

Source: Central Jakarta Health Office Data, 2014

Based on the table above, the results of the laboratory examination showed that 5 people (4.3%) were positive for measles, 12 people (10.4%) had poor nutritional status, 61 people (53%) were aged >1 year, 61 people (53%) were male, 52 people (45.2%) had a complete immunization history according to their age, and 107 people (93%) had no history of contact.

Table 2. Bivariate Analysis Results

Variables	Positive for Measles		Measles Negative		Total		P-Value	OR (95% CI)
	n	%	n	%	N	%		
Nutritional status								
Malnutrition (-3 SD to < -2 SD)	3	25	9	75	12	100	0.008	16,833 (2.48 – 114.21)
Good nutrition and more (-2 SD to + 1 SD)	2	1.9	101	98.1	103	100		
Age								
≤1 year	2	3.7	52	96.3	54	100	1	0.744 (0.12 – 4.63)
25 years	3	4.9	58	95.1	61	100		
Gender								
Man	5	8.2	56	91.8	61	100	0.059	0.918 (0.85 – 0.99)
Woman	0	0	54	100	54	100		
Immunization History								
Incomplete according to age	1	1.9	51	98.1	52	100	0.376	0.289 (0.03 – 2.67)
Complete according to age	4	6.3	59	60.3	63	100		
Transmission History								
There is a contact history	0	0	8	100	8	100	1,000	1,049 (1.01 – 1.09)
No contact history	5	4.7	102	95.3	107	100		

Source: Central Jakarta Health Office Data, 2014

The number of measles-positive malnutrition status was 3 people (25%), the number of measles-positive good and over nutritional status was 2 people (1.9%). The negative results of measles were 9 people (75%), the number of measles-negative good and over nutritional status was 101 people (98.1%). The results of the analysis showed that there was an influence between nutritional status and measles disease which was indicated by a p-value of 0.003 and an Odds Ratio (OR) of 16.833 which means that the chance of malnutrition status when compared to good and over nutrition was 16.833 times to get measles.The relationship between nutritional status and the severity of measles in children in 2016 was obtained by the Gamma correlation coefficient test, showing a p value = 0.002 (<0.05) which means there is a significant strong negative relationship between nutritional status and the severity of measles in children5. Based on the results of the study of the relationship between nutritional status and the incidence of measles at Meuraxa Hospital, Banda Aceh, a p value of 0.029 was obtained, which means there is a significant relationship6.7.Recent studies have revealed that undernutrition plays a major role in driving measles outbreaks and also affects the immune response to vaccines, where stunted or malnourished children have lower antibody levels than well-nourished children8,9. Recent scoping reviews have also shown a positive correlation between malnutrition and increased measles incidence and mortality in various developing countries, with a higher risk of death in children with poor nutritional status[10].

An international medical review article states that up to 45% of measles deaths globally are related to malnutrition, particularly deficiencies of vitamin A and other micronutrients[11]. Other studies have confirmed that interventions in the form of mass nutritional supplementation, especially vitamin A, can reduce the severity and mortality rate in children with measles with low nutritional status[12]. Data from the Indonesian Ministry of Health reports that measles cases increased again in the 2022–2023 period, mostly occurring in groups of children with low immunization coverage and malnutrition.[13]Toddlers (aged 0-5 years) who tested positive for measles were 5 people (8.6%), aged ≤ 1 year who tested positive for measles were 2 people (3.7%), Negative results for those aged ≤ 1 year were 52 people (96.3%). Age > 1 year who tested positive for measles were 2 people (1.9%), Results for those aged > 1 year who tested negative for measles were 58 people (95.1%). The results of the analysis showed no effect between age and measles disease as indicated by a p-value of 1,000 (<0.05), based on the analysis, an Odds Ratio (OR) value of 0.744 with a 95% confidence interval (CI) was obtained, meaning that toddlers (aged 0-5 years) have a 0.744 times greater chance of experiencing measles compared to those aged > 1 year. This finding is in line with previous research which states that age is not the only factor that determines susceptibility to measles, because immunity is more influenced by immunization status and nutritional conditions of children than just age factors. [14.15]WHO also emphasized that although toddlers are included in the high-risk group clinically, the risk of measles is particularly increased in children who do not receive complete immunizations and have poor nutritional status.[13].

Thus, these results emphasize that measles prevention efforts should focus on increasing immunization coverage and improving nutritional status, not just considering age factors alone.[16,17].Based on the results of the analysis in table 2, 11 males were found to be positive for measles, totaling 5 (8.2%), females who were positive for measles were 0 people (0%). Negative measles results with male gender were 56 people (91.8%), females who were negative for measles were 54 people (100%). The results of the analysis showed that there was no influence between gender on measles disease, which was indicated by a p-value of 0.090 (<0.05), based on the analysis, an Odds Ratio (OR) value of 0.918 was obtained with a 95% confidence interval (CI) meaning that gender has a 0.918 times greater chance of experiencing measles.Based on the analysis results in table 2, it was found that those who had an incomplete immunization history according to age and positive for measles were 1 person (1.9%), had a complete immunization history according to age and positive for measles 4 people (6.3%). Negative measles results with an incomplete immunization history according to age were 51 (98.1%), had a complete immunization history according to age and negative for measles were 59 (93.7%). The analysis results showed that there was no influence between immunization history and measles as indicated by a p-value of 0.485 (<0.05), based on the analysis, an Odds Ratio (OR) value of 0.289 was obtained with a 95% confidence interval (CI) meaning that an incomplete immunization history had a 0.289 times greater chance of experiencing measles compared to those with a complete immunization history according to age.

There were no cases with a history of transmission and positive measles, there were cases with a history of transmission and positive measles 8 people (100%). Positive measles results with no history of transmission were 5 (4.7%), negative measles results with no history of transmission were 102 (95.3%). The results of the analysis showed no influence between the history of transmission on measles disease as indicated by a p-value of 1,000 (<0.05), based on the analysis, an Odds Ratio (OR) value of 1.049 was obtained with a 95% confidence interval (CI) meaning that a history of transmission has a 1.049 times greater chance of experiencing measles compared to those without a history of transmission.

Table 3. Results of Multivariate Analysis of the Final Model

Variables	B	SE	P-Value	OR	95% CI
Nutritional status	2,574	1,043	0.014	13,120	1,698 – 101,320
Gender	18,670	5087.150	0.997	128369497.3	0.00 - …..
Immunization history	-0.952	1,223	0.436	0.386	0.035 – 4.239

The final multivariate modeling results showed that of the three variables analyzed, only nutritional status was significantly associated with the incidence. Nutritional status had a regression coefficient (B) of 2.574 with a p-value of 0.014, and an odds ratio (OR) of 13.120 (95% CI: 1.698 – 101.320). This means that

children with poor nutritional status have approximately 13 times greater chance of experiencing an incident compared to children with good or better nutrition, and this effect remains significant even when controlled for gender and immunization history.The gender variable showed a p-value of 0.997 with a very large OR (128 million) and a confidence interval (CI) that had a range that was too wide, so that a significant relationship could not be concluded. This condition likely occurred due to skewed data distribution or a limited sample size.

Immunization history was also not significantly related (p-value 0.436) with an OR of 0.386 (95% CI: 0.035 – 4.239), although the value tended to be protective because the OR <1, but the confidence interval crossed the number 1 so the results were not statistically significant. Thus, the conclusion from this model is that nutritional status is the dominant factor influencing the incidence, while gender and immunization history were not proven to have a significant effect.The nutritional status variable with a p-value of 0.014 was proven to be significant for the incidence of measles in children aged 0-5 years in the Central Jakarta Health Sub-Department in 2024. The OR value of 13.120 (CI 95%: 1.698 - 101.320) indicates that children with poor nutritional status have approximately 13 times greater chance of contracting measles compared to children with good and more nutrition. Meanwhile, the immunization history variable has a p-value of 0.436 and an OR of 0.386 (CI 95%: 0.035 - 4.239), so it is not significantly related to the incidence of measles; children who have a history of immunization actually tend to be protected although the results are not statistically significant. The gender variable with a p-value of 0.997 and a very large OR (128369497.3) shows instability in estimates due to unbalanced sample sizes, so this variable cannot be considered significant or epidemiologically meaningful.

IV. CONCLUSION AND SUGGESTIONS

This study shows that of the five variables analyzed, nutritional status was significantly associated with measles incidence in toddlers in Central Jakarta. Toddlers with poor nutritional status had a 13-fold higher risk of infection compared to well-nourished toddlers. Age and history of infection showed an epidemiological association but were not statistically significant in the final model. Gender and immunization history were not significantly associated with measles incidence in this study. Therefore, nutritional status is the dominant factor, while other variables remain important to monitor in routine surveillance.Future research is expected to utilize cohort and case-control designs to further analyze the association between age, gender, and history of infection with measles incidence. Public awareness of the importance of balanced nutrition and adherence to routine immunizations should be raised as an integrated measles prevention strategy.

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