Original Article

Analysis of the Relationship Between Age and Immunization Completeness with Measles Incidence in Medan City

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Abstract

Objective: To analyze the relationship between age and immunization completeness and the occurrence of measles in Medan City in 2022.

Methods: This study is quantitative research with a case-control study design. The respondents in this study are the entire population of Medan City. The sample size for this research is 96 respondents, with 48 in the case group and 48 in the control group, all recorded in the measles case report at the Health Department of Medan City in 2022. The study was conducted from January to July 2023.

Results: Forty respondents in this study belonged to the toddler group, and most of whom had an incomplete immunization history. Based on chi-square analysis, a significant relationship was found between age and the occurrence of measles (p-value <0.05), as well as between immunization completeness and the occurrence of measles (p-value <0.05) with an odds ratio (OR) of 11.0. This means that respondents who are not immunized are 11 times more likely to experience measles compared to those who are immunized. Respondents with incomplete immunization are also 11 times more likely to experience measles compared to those with complete immunization.

Conclusion: There is a significant relationship between age and immunization completeness and the occurrence of measles. Respondents with an incomplete immunization history are at 11 times higher risk of experiencing measles compared to those with a complete immunization history. For future research, it is recommended to increase the number of study respondents and further explore and expand on risk factors such as the history of contact with measles cases in the city of Medan.

Keywords: Age, immunization, measles

Introduction

Measles is a contagious disease that affects the respiratory and immune systems. The symptoms of measles consist of three stages. Firstly, during the prodromal stage, patients experience symptoms such as fever, fatigue, loss of appetite, throat inflammation, and eye inflammation occurring within a period of 3 to 5 days. Subsequently, during the eruption stage, a rash appears on the face and behind the ears. Lastly, during the convalescent stage, the rash changes color and becomes darker.

According to data from the WHO in 2019, it was found that approximately 40 million children have been infected with measles over the past ten years, with about 74% of whom eventually dying. The majority of these measles cases occurred in preschool and elementary school-age children. In Indonesia, the death toll from measles reaches around 30,000 children, with many experiencing complications such as diarrhea, blindness, pneumonia, encephalitis (inflammation of the brain), and hearing impairment.[1]

There were 2,931 suspected measles cases

in Indonesia, with 75 confirmed positive cases, resulting in an Incidence Rate (IR) of 0.48 per 100,000 population.[2] According to the Ministry of Health of the Republic of Indonesia, measles cases increased by approximately 32 times in 2022 compared to 2021. In 2022, the Ministry of Health received reports of measles cases exceeding 3,341, spread across 223 districts/cities in 31 provinces in Indonesia.[3] This increase in measles cases occurred during the Covid-19 pandemic, which has sparked the interest of researchers in analyzing the distribution of ages among measles-affected respondents in Medan City, as well as understanding the immunization history of those affected and unaffected by measles.

The diversity of complications caused by measles, which often lead to deaths, is primarily due to the lack of public awareness regarding various risk factors associated with measles. Education and awareness about the importance of immunization and healthcare can help reduce the number of measles cases and their complications. John Gordon stated that the occurrence of diseases is determined by three components: the host, agent, and environment. These factors also apply to measles, with host factors including gender, age, exclusive breastfeeding, immunization status, individual nutritional status, and vitamin A supplementation.

Agent factors consist of the measles virus, while environmental factors include biological, social, and physical aspects.[4] To protect children from the measles virus, it is crucial to ensure immunization completeness. Vaccination is highly important in building immunity against the disease and preventing its spread. By ensuring that children receive the recommended immunizations on time, we can protect them and boost community immunity, thereby lowering the overall risk of measles outbreaks. The purpose of this research is to analyze the relationship between risk factors for measles occurrence, specifically age and immunization completeness, among the population in the city of Medan, and the reported measles cases in 2022.

Methods

This quantitative study employed a case-control design and utilized secondary data. The research instrument used was an observation sheet obtained from the Health Department of Medan City, specifically regarding measles cases in 2022. The population for this research consisted of all suspected measles cases,

totaling 282 cases recorded in the data reports of the Medan Health Department in 2022. The sample size for this study was determined based on calculations using the analytical categorical sampling formula, resulting in a sample size of 96 individuals. This sample size included 48 respondents in the case group and 48 respondents in the control group. The inclusion criteria for the case group were respondents with positive laboratory results directly observed from the laboratory report records at the Health Department of the City of Medan. The control group included respondents with negative lab results directly observed from the laboratory report records at the Health Department of the City of Medan. The exclusion criteria for both the case and control groups were respondents with pending lab results. The sampling technique utilized in this research was simple random sampling. The sampling procedure involved a lottery method, where the researcher wrote sequential numbers on small pieces of paper, rolled them up, and placed them inside a plastic cup with a small hole covered. The researcher then shook the cup until one rolled-up paper emerged. Each number drawn was recorded and used as a sample for the research. The variables in this study were age and completeness of immunization.

The completeness of respondents' immunization is determined based on the data from the measles vaccine report. It is considered complete if the respondent has received the measles vaccine three times, as indicated in the report data. Conversely, it is deemed incomplete if the respondent has received less than three doses of the measles vaccine. Data collection for this study involves analyzing the compilation of measles case reports and distinguishing between groups with positive and negative results from measles lab tests. The Health Department of Medan City acquires these reports through routine reports from 41 primary health centers in Medan. The data analysis conducted for this study includes univariate and bivariate analyses, employing the chi-square test. The research was carried out in Medan City from January 2023 to July 2023. Ethical approval for this study has been obtained from the Health Research Ethics Committee at *Politeknik Kesehatan* Kemenkes Medan, under reference number 01. 25 149 / KEPK/POLTEKKES KEMENKES MEDAN 2023.

Results

Based on the research results, the majority of

Table 1 Characteristics of Respondents

Variable	Sample (n=96)	
	Frequency (n)	Percentage (%)
Age		
Toddlers	40	41.7
Children	33	34.4
Adolescents	21	21.9
Adults	2	2.1
Immunization Completeness		
Complete	28	29.2
Incomplete	68	70.8

the 96 respondents are toddlers. When their immunization completeness is observed, it is clear that many respondents still have incomplete immunizations. This characteristic can be seen in Table 1.

Based on the bivariate analysis using the chi-square test at a 5% significance level, the results show a significant relationship between age and measles occurrences (p-value<0.05). The toddler group has the highest proportion of individuals experiencing measles. Additionally, the statistical test

yielded an Odds Ratio (OR) value of 0.215, with lower and upper limits below 1 (0.110–0.418). These findings indicate that age acts as a significant protective factor against measles occurrences. The results of this analysis can be seen in Table 2.

Based on the analysis of the immunization completeness variable using the chi-square test at a significance level of 5%, the results show a significant relationship between immunization completeness and measles occurrences (p-value<0.05). Moreover, we obtained an odds ratio (OR) of 11.000, indicating that respondents with an incomplete measles immunization history are 11 times more likely to experience measles compared to those with a complete measles immunization history. The results of this analysis can be seen in Table 3.

Discussion

Measles can affect not only infants or toddlers, but also adults. The results indicate that the majority of respondents in the case group fall into the toddler age category. This is consistent with Khotimah's study in Lebak, which found that toddlers aged 2 to 5 years are more susceptible to measles.[5] Additionally, the study by Ahadi *et al.* in Afghanistan indicated that the majority of individuals affected by measles were aged 2 to 5 years old.[6] Based on bivariate statistical analysis, it is known that age has

Table 2 Analysis Chi Square of the Relationship between Age and Measles Incidence

Age	Measles Incidence				p-value	OR (95% CI)
	(+) Measles		(-) Measles			
	n=48	%	n=48	%		
Toddlers	28	29.2	12	12.5		
Children	20	20.8	13	13.5	0.000	0.215 (0.110 – 0.418)
Adolescents	0	0	21	21.9		
Adults	0	0	2	2.1		

Table 3 Analysis Chi Square of the Relationship between Immunization Completeness with Measles Incidence

Immunization Completeness	Measles Incidence				p-value	OR (95% CI)
	(+) Measles		(-) Measles			
	n	%	n	%		
Incomplete	44	91.7	24	50		11.000
Complete	4	8.3	24	50	0.000	(3.416–5.425)
Total	48	100	48	100		

a significant relationship with the incidence of measles (p<0.05). This is consistent with Andriani's study at the Wonoayu Health Center in Sidoarjo Regency, which indicated that there is a significant relationship between age and the number of measles cases.[7]

There is also a significant correlation between age and measles cases in the study conducted by Yanti & Sulistyaningsih in Bantul District.[8] Furthermore, the study conducted by Azis and Rahmadhani in South Tangerang City demonstrates a significant relationship between age and measles incidence.[9]

The measles virus is transmitted through droplets from the nose, mouth, and throat of infected individuals when they cough, sneeze, or talk. Maternal antibodies in a child's body decrease as they grow older, making them more vulnerable to the measles virus.[10] Indeed, during the first year of a child's life, they still possess antibodies passed on by the mother to combat measles virus infections. However, as the child reaches 6–12 months of age, the level of these maternal antibodies declines, thereby increasing the child's vulnerability to measles.[11]

Children often play and interact with their peers, increasing their chances of contracting the measles virus from infected individuals. This is supported by a study conducted by Mujiati *et al.*, which showed that children are more likely to contract measles from schoolmates or contacts with measles patients residing in the same household.[12] Incomplete immunization is closely related to measles incidence. In this study, cases with incomplete immunization accounted for a higher percentage (91.7%) compared to cases with complete immunization (8.3%). The chi-square test analysis revealed a significant relationship between immunization completeness and measles occurrences (p<0.05). This finding is consistent with a previous study by Harisnal & Ediana in Bukittinggi City, which also found a significant relationship between immunization completeness and measles occurrences.[13] Similarly, the research conducted by Falawati *et al.* in Muna Regency also demonstrated a significant relationship between immunization status and measles

occurrences.[14] Immunization has two significant effects: it forms humoral immunity and cellular immunity.[15] Initially, a measles infection in the surroundings will induce IgG from immunization. Then, there is an increase in IgG, and IgG produced from vaccination will be induced again by the surrounding measles infection.[16] According to the information obtained from surveillance officers, the respondents' incomplete immunization in Medan City was due to the pandemic, as routine immunization activities were interrupted and healthcare personnel were redirected to handle the COVID-19 pandemic.

This aligns with the findings of Mukhibin *et al.*,[17] where healthcare workers reported that immunization officers at their workplace were redirected to COVID-19 services. Respondents also reported that immunization services in their residential areas were temporarily suspended during the PSBB (Large-Scale Social Restrictions) period.The limitations of this study include the lack of age matching, which may have caused bias in the research. The study also did not further analyze the respondents' antibody titers (immune status) and contact history. Therefore, these aspects should be investigated further in future research. Overall, this study provides insights into several risk factors for measles.

This study discovered a significant relationship between age and measles incidence in Medan City in 2022 (P value: 0.000; OR: 0.215; 95% CI 0.110–0.418). Furthermore, there is a significant association between immunization completeness and measles incidence in Medan City in 2022 (P value: 0.000; OR: 11.000; 95% CI 3.416–35.425).

Age and immunization completeness are both significantly related to the occurrence of measles in the city of Medan (p-value<0.05). Respondents with incomplete immunization history are 11 times more likely to experience measles compared to those with a complete immunization history. For future research, it is recommended to increase the number of study respondents and further investigate and expand on risk factors such as the history of contact with measles cases in Medan City.

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