Transpublika International Research in Exact Sciences
https://ojs.transpublika.com/index.php/TIRES
Online ISSN 2828-5921

https://doi.org/10.55047/tires.v4i3.1845

Original Article

The Relationship of DPT Immunization, Maternal Education, and Residential Density with ARI Incidence in Toddlers

Rina Ayu Putri[1*], Rahayu Lubis[2]

[1,2]Faculty of Public Health, Universitas Sumatera Utara, Medan, Indonesia
Email: [1)] rinayuputri15@students.usu.ac.id, [2)] rahayu@usu.ac.id

Received : 20 June 2025
Accepted : 25 July - 2025
Published online : 30 July - 2025

Abstract

Acute Respiratory Infection (ARI) is a common contagious illness that impacts the respiratory system. The World Health Organization (WHO) reports that ARI is a major contributor to mortality in young children, with a death rate of 15 percent among those under five years old. According to Indonesian Health Survey (SKI) in 2023, incidence rate of ARI in Indonesia is 23.5 percent, with 34.5 percent in toddlers, and in North Sumatra in 2023 is 16.1 percent. The study discusses about the relationship of DPT (Diphtheria, Pertussis, Tetanus) immunization, mother's education and residential density with incidence of ARI on toddlers at Simpang Limun Public Health Center in 2025. The research conducted is an evaluative examination utilizing a cross-sectional approach, involving 101 participants chosen through random selection. The information collected was assessed utilizing the Chi-square test with a 95 percent confidence level ($\alpha = 0.05$). The results of the bivariate analysis indicated a significant relationship between mother's education ($p = 0.006$), DPT immunization ($p = 0.001$), frequency of DPT immunization ($p = <0.001$), exclusive breastfeeding ($p = 0.006$), residential density ($p = <0.001$), and the presence of smokers in the household ($p = 0.022$) with the incidence of ARI on toddlers at Simpang Limun Public Health Center in 2025. It is recommended that the staff at Simpang Limun Public Health Center provide education on the importance of primary and booster immunizations for toddlers, exclusive breastfeeding, home health, and the dangers of exposure to cigarette smoke on toddler health.

Keywords: Acute Respiratory Infection, DPT Immunization, Mother's Education, Residential Density, Toddlers.

1. Introduction

Infectious illnesses stem from biological sources like viruses, bacteria, fungi, and parasites, which spread among individuals through direct or indirect contact (WHO, 2024). Transmission can occur through various means, such as direct contact with infected persons, exposure to body fluids, bites from disease-carrying insects (vectors), or contaminated food and water. Infectious diseases pose a serious challenge to public health due to their easily transmissible nature and potential to cause outbreaks if not properly controlled (Indonesian Ministry of Health Regulation No. 82 of 2014 on Infectious Disease Control).

Acute Respiratory Infection (ARI) is a form of contagious illness that targets the respiratory system (Astuti Wulandari et al., 2022). This illness is known for causing symptoms like coughing, increased breathing rate with rapid, shallow breaths, and in some cases, breathing difficulties unrelated to nasal congestion (WHO, 2025). ARI is an illness that impacts both the upper and lower parts of the respiratory system, such as the nose, throat, sinuses, bronchi, and lungs. ARI can be triggered by a variety of factors like viruses, bacteria, fungi, or other foreign substances that enter the respiratory system (Directorate of Health Promotion and Community Empowerment, 2023).

Globally, ARI causes death in children under 5 years old with a CFR of 15% (WHO, 2025). ARI easily attacks vulnerable age groups, namely toddlers and elderly people, which is in line with the proportion of population having health complaints in the last month from 2021-2023, where the proportion of toddlers with health complaints was 37.40% and the proportion of elderly people with health complaints was 41.49%. This is because toddlers and elderly people have immune systems that tend to be more vulnerable. Toddlers are vulnerable to getting sick more often than adults because their immune systems are not fully developed yet (Central Statistics Agency, 2023). Helping toddlers stay healthy and free from infectious diseases is a key focus of Sustainable Development Goal 3, which aims to ensure a healthy and prosperous life for all. This goal includes efforts to reduce preventable deaths of newborns and young children, with every country working towards lowering the Neonatal Mortality Rate to below 12 per 1,000 live births and the Under-Five Mortality Rate to 25 per 1,000 (Bappenas, 2024).

Based on the Indonesian Health Survey report for 2023, the incidence of ARI in Indonesia based on diagnosis history and/or symptoms (D/G) reached 23.5% with the highest incidence in Papua Mountains at 41.7%. North Sumatra Province has an ARI incidence rate based on diagnosis history and/or symptoms (D/G) of 16.1%. The incidence of ARI based on diagnosis history and/or symptoms (D/G) in Indonesia in the age group with the highest incidence rate is 1-4 years old at 35.7%. The incidence of ARI in toddlers based on diagnosis history and/or symptoms (D/G) in Indonesia is 34.5% with the highest ARI incidence in toddlers in the province being DI Yogyakarta with an incidence of 49.1%, while North Sumatra Province reached an incidence rate of 21.0% (Central Statistics Agency, 2023).

Based on research conducted by Fadila & Siyam (2022), several determinants of ARI disease in toddlers include mother's employment status, family members' smoking habits, dust exposure, exclusive breastfeeding, and immunization status. DPT-HB-Hib immunization contains diphtheria toxoid, pertussis antigens, tetanus toxoid, hepatitis B, and Haemophilus influenzae type b (Hib). Acute Respiratory Infections (ARI) often occur in toddlers who have not received DPT immunization S. Fatimah et al. (2023). In research conducted by Amelia et al. (2024), there is an influence between mother's age on family behavior in preventing ARI in toddlers. Mother's age influences the health behavior of mothers with toddlers, one of which is the visit of mothers with toddlers to posyandu (integrated health service posts) for toddlers to receive routine immunizations (Fathurrohman et al., 2021).

Based on research by Agustin (2022), it was found that the level of education a mother has can impact the frequency of ARI in toddlers. A mother's educational background can play a role in how she perceives health, particularly in relation to her family and young children. Mothers with higher education are expected to have good analytical abilities, so they will understand and accept health information more easily. In other research conducted by Zulfikar & Sukriadi (2021), it shows the level of room occupancy can impact smoking habits and ARI rates in toddlers living in the same house. The number of people in a room can influence the frequency of ARI cases among toddlers. Dense environments can increase the risk of indoor pollution. The more occupants in one house, the higher the possibility of ARI disease transmission.

ARI disease is among the ten largest diseases in all Primary Health Centers in Medan City in 2018, with ARI disease ranking first with 203,558 cases or an incidence rate of 41.09% (BPS Medan City, 2019). Simpang Limun Primary Health Center is one of the health facilities located in North Sumatra Province, Medan City, Medan Kota District. In a rapid

survey conducted by researchers in Medan Kota District in May 2024, the incidence of ARI in Medan Kota district was 10.04% with the number of ARI cases in toddlers being 69 cases, with cases experienced by toddlers aged 12-59 months (1-4 years) totaling 35 cases and those aged 0-11 months totaling 34 cases. ARI is among the 10 (ten) largest diseases at Simpang Limun Primary Health Center in 2023 and became the highest disease with 3,663 cases. In 2024 (January-July), ARI cases still became the number 1 (one) largest disease at Simpang Limun Primary Health Center with 1,978 cases. The incidence of ARI in toddlers (0-59 months) at Simpang Limun Primary Health Center in 2023 was 30.06% and the incidence of ARI in toddlers from January-July 2024 was 15.52% out of 1,862 toddlers at Simpang Limun Primary Health Center. ARI cases in toddlers in 2023 and 2024 were mostly experienced by toddlers aged 12-59 months (1-4 years), namely 499 cases (2023) and 231 cases (2024).

Based on the monthly report from Simpang Limun Public Health Center from January to September 2024, the total number of children under five at the Simpang Limun Health Center was 1,868. The target for DPT/HB/Hib immunization among children aged 0–9 months was 505, of which only 299 had received the DPT/HB/Hib immunization by September 2024. Meanwhile, among children aged 12–24 months, the target for the booster DPT/HB/Hib immunization was 439, but only 293 children had received the booster immunization.

In a rapid survey conducted by the researcher in Medan Kota District in May 2024, it was found that the majority of mothers of children under five had an educational background of junior or senior high school (SMP/SMA), accounting for 67.34% of the 147 respondents interviewed. In addition, the residential area in this district was characterized by high population density, with houses often occupied by more than one family. It was also found that 97.95% of the 147 respondents lived in dwellings where each bedroom was shared by more than one person.

Based on the previous explanation, it is very important to conduct research to examine the relationship between DPT immunization provision, mother's education, and occupancy density with the incidence of ARI in toddlers. This research is focused on the working area of Simpang Limun Primary Health Center in 2025 to obtain accurate and relevant data as a way to prevent and control ARI in toddlers.

2. Methods

This research employed an analytical approach using a cross-sectional study design. The investigation took place at the Simpang Limun Primary Health Center in Medan City, North Sumatra Province, spanning from Mei 2025 through June 2025. The study population consisted of all children under five years old (0-59 months) who received care at the Simpang Limun Primary Health Center. The research sample included children in the same age range whose mothers consented to participate in interviews. The minimum required sample size was determined using the formula from Lemeshow et al. (1997), resulting in at least 100 participants. Samples were selected using an incidental sampling technique, in which samples were chosen based on chance encounters with mothers of under-five children who met the researcher and agreed to participate. Statistical analysis involved bivariate testing using chi-square analysis at a 95% confidence interval ($\alpha = 0.05$), where p-values less than 0.05 indicated statistically significant associations between variables.

3. Results and Discussion

3.1. Research Results

Simpang Limun Primary Health Center is located on Saudara Street No. 38a, Sudirejo II Village, Medan Kota District, Medan City, North Sumatra Province. Simpang Limun Primary Health Center has a building area of 342.25 m² with a working area of 206.69 Ha consisting of 3 villages: Sudirejo I Village, Sudirejo II Village, and Sitirejo I Village. The population in the working area of Simpang Limun Primary Health Center is 37,114 people with 6,658 households (KK). The male population is 17,029 people and the female population is 17,653 people. The target for infants in the Working Area of Simpang Limun Primary Health Center in 2023 is 347 people and the target for toddlers is 1,636 people. The target for finding ARI cases in toddlers at Simpang Limun Primary Health Center in 2025 is 71 cases.

3.1.1. ARI Incidence

Table 1. Distribution of ARI incidence proportion in toddlers at Simpang Limun Primary Health Center in 2025

ARI Incidence	n	%
Non-ARI	44	43,6
ARI	57	56,4
Total	101	100

By referring to the data presented in Table 1, it is evident that the distribution proportion of toddlers (0-59 months) experiencing ARI at Simpang Limun Primary Health Center in 2025 is 56.4% (57 toddlers) and the proportion of toddlers who are non-ARI is 43.6% (44 toddlers).

3.1.2. Bivariate analysis between mother's characteristics and ARI incidence

Table 2. Cross-tabulation between mother's characteristics and ARI incidence in toddlers at Simpang Limun Primary Health Center in 2025

Mother's Characteristics	ARI Incidence				Total		PR (95% CI)	*p*
	ARI		Non-ARI					
	n	%	n	%	n	%		
Mother's Age								
> 35 years old	19	61,3	12	38,7	31	100	0,886 (0,662-1,260)	0,513
≤ 35 years old	38	54,3	32	45,7	70	100		
Mother's Education								
Low-medium education	40	67,8	19	32,2	59	100	1,675 (1,115-2,516)	0,006
High education	17	40,5	25	59,5	42	100		

Based on Table 2, of 70 mothers aged ≤ 35 years, the proportion of mothers who have toddlers infected with ARI is 54.3% (38 mothers) and the proportion of mothers who have toddlers not infected with ARI is 45.7% (32 mothers). Of 31 mothers aged > 35 years, the proportion of mothers who have toddlers infected with ARI is 61.3% (19 mothers) and the proportion of mothers who have toddlers not infected with ARI is 38.7% (12 mothers). The statistical analysis findings revealed a p-value of 0.513 (p>0.05), indicating that there is no association between the age of mothers and the incidence of ARI in toddlers at Simpang

Limun Primary Health Center in 2025. The calculated Prevalence Ratio (PR) of 0.886, with a value of PR < 1, implies that the age of mothers is not a contributing factor or determinant of ARI in toddlers.

Mothers with high education level number 42 people, the proportion of mothers who have toddlers infected with ARI is 40.5% (17 mothers) and the proportion of mothers who have toddlers not infected with ARI is 59.5% (25 mothers). Mothers with low-medium education number 59 people, the proportion of mothers who have toddlers infected with ARI is 67.8% (40 mothers) and the proportion of mothers who have toddlers not infected with ARI is 32.2% (19 mothers). The statistical analysis outcomes showed a p-value of 0.006, indicating a noteworthy correlation between the level of education of mothers and the occurrence of ARI in toddlers at Simpang Limun Primary Health Center in 2025. The Prevalence Ratio (PR) value obtained is 1.675 where PR > 1, meaning mothers with low education have a tendency 1.675 times to have toddlers infected with ARI or mother's education is a determinant of ARI disease in toddlers.

3.1.3. Bivariate analysis between immunization provision and ARI incidence

Table 3. Cross-tabulation between immunization provision and ARI incidence in toddlers at Simpang Limun Primary Health Center in 2025

Immunization Provision	ARI Incidence				Total		PR (95% CI)	*p*
	ARI		Non-ARI					
	n	%	n	%	n	%		
DPT Immunization Provision								
Not yet received	21	84,0	4	16,0	25	100	1,773 (1,324-2,375)	0,001
Already received	36	47,4	40	52,6	76	100		
DPT Immunization Frequency								
≤ 3 time(s)	52	66,7	26	33,3	78	100	3,067 (1,324-2,375)	< 0,001
> 3 times	5	21,7	18	78,3	23	100		

Referring to Table 3, of 76 toddlers who have received DPT immunization, the proportion of toddlers infected with ARI is 47.4% (36 toddlers) and the proportion of toddlers not infected with ARI is 52.6% (40 toddlers). Of 25 toddlers who have not received DPT immunization, the proportion of toddlers infected with ARI is 84.0% (21 toddlers) and the proportion of toddlers not infected with ARI is 16.0% (4 toddlers). In 2025, at Simpang Limun Primary Health Center, statistical analysis revealed a noteworthy connection between the administration of DPT immunization and the occurrence of ARI in toddlers, with a p-value of 0.001 (p<0.05). The Prevalence Ratio (PR) value obtained is 1.773 where PR > 1, meaning toddlers who do not receive DPT immunization have a tendency 1.773 times to be at risk of ARI infection or DPT immunization provision is a determinant of ARI disease in toddlers.

Referring to Table 3, of 23 toddlers who have received DPT immunization more than 3 times, the proportion of toddlers infected with ARI is 21.7% (5 toddlers) and the proportion of toddlers not infected with ARI is 78.3% (18 toddlers). Of 78 toddlers who received ≤ 3 times DPT immunization, the proportion of toddlers infected with ARI is 66.7% (52 toddlers) and the proportion not infected is 33.3% (26 toddlers). In 2025, data analysis found a notable connection between the frequency of DPT vaccinations and the occurrence of ARI in young children at the Simpang Limun Primary Health Center, with a p-value of less than 0.05 (less than 0.001). The Prevalence Ratio (PR) value obtained is 3.067 where PR > 1,

meaning toddlers who receive DPT immunization ≤ 3 times have a tendency 3.067 times to be at risk of ARI infection or DPT immunization frequency is a determinant of ARI disease in toddlers.

3.1.4. Bivariate analysis between exclusive breastfeeding and ARI incidence

Table 4. Cross-tabulation between Exclusive Breastfeeding and ARI Incidence in Toddlers at Simpang Limun Primary Health Center in 2025

Exclusive Breastfeeding	ARI Incidence				Total		PR (95% CI)	*p*
	ARI		Non-ARI					
	n	%	n	%	n	%		
Non-exclusive breastfeeding	35	70,0	15	30,0	50	100	1,623 (1,128-2,334)	0,006
Exclusive breastfeeding	22	43,1	29	56,9	51	100		
Total	57	56,4	44	43,6	101	100		

Referring to Table 4 above, of 51 toddlers given exclusive breastfeeding, the proportion of toddlers infected with ARI is 43.1% (22 toddlers) and the proportion of toddlers not infected with ARI is 56.9% (29 people). Of 50 toddlers not given exclusive breastfeeding, the proportion of toddlers infected with ARI is 70.0% (35 toddlers) and the proportion of toddlers not infected with ARI is 30.0% (15 toddlers). The statistical analysis revealed a significant correlation ($p<0.05$, $p=0.006$) between exclusive breastfeeding and ARI incidence among toddlers attending Simpang Limun Primary Health Center in 2025. The Prevalence Ratio (PR) value obtained is 1.623 where PR > 1, meaning toddlers who receive exclusive breastfeeding have a tendency 1.623 times to be at risk of ARI infection or exclusive breastfeeding is a determinant of ARI disease in toddlers.

3.1.5. Bivariate analysis between environmental characteristics and ARI incidence

Table 5. Cross-tabulation between environmental characteristics and ARI incidence in toddlers at Simpang Limun Primary Health Center in 2025

Environmental Characteristics	ARI Incidence				Total		PR (95% CI)	*p*
	ARI		Non-ARI					
	n	%	n	%	n	%		
Residential Density								
Dense	29	85,3	5	14,7	34	100	2,041 (1,489-2,797)	< 0,001
Not Dense	28	41,8	39	58,2	67	100		
Use of Anti-Mosquito Products								
Yes	21	58,3	15	41,7	36	100	1,000 (0,741-1,497)	0,775
No	36	55,4	29	44,6	65	100		
Presence of Smokers in the House								
Yes	40	65,6	21	34,4	61	100	1,543 (1,030-2,310)	0,006
No	17	42,5	23	57,5	40	100		

Referring to Table 5, it can be seen that of 67 houses with non-dense occupancy, the proportion of toddlers infected with ARI is 41.8% (28 toddlers) and the proportion of toddlers not infected with ARI is 58.2% (39 toddlers). Of 34 houses with dense occupancy, the proportion of toddlers infected with ARI is 85.3% (29 toddlers) and the proportion of

toddlers not infected with ARI is 14.7% (5 toddlers). Statistical analysis results show a relationship between residential density and ARI incidence in toddlers at Simpang Limun Primary Health Center in 2025 with p<0.05 (< 0.001). The Prevalence Ratio (PR) value obtained is 2.041 where PR > 1, meaning toddlers with dense occupancy have a tendency 2.041 times to be at risk of ARI infection or occupancy density is a determinant of ARI disease in toddlers.

Moreover, it is known that of 65 houses that do not use anti-mosquito products, there are 36 houses (55.4%) that have toddlers infected with ARI and 29 houses (44.6%) have toddlers not infected with ARI. Of 36 houses that have the habit of using anti-mosquito products, 21 houses (58.3%) have toddlers experiencing ARI and 15 houses (41.7%) have toddlers without ARI. According to the findings of the statistical analysis, a p-value of 0.775 (p>0.05) was discovered, indicating that there is no correlation between the usage of anti-mosquito products and the occurrence of Acute Respiratory Infection (ARI) in young children at Simpang Limun Primary Health Center in 2025. The Prevalence Ratio (PR) value obtained is 1.000 where PR = 1, meaning the use of anti-mosquito products is not a cause or determinant of ARI disease in toddlers.

Based on Table 5, it is known that of 40 houses with no smokers in the house, 17 houses (42.5%) have toddlers infected with ARI and 23 houses (57.5%) have toddlers not infected with ARI. Of 61 houses with smokers in the house, 40 houses (65.6%) have toddlers infected with ARI and 21 houses (34.4%) have toddlers not infected with ARI. According to the statistical analysis findings, a significant relationship was found between the presence of smokers in the household and the incidence of ARI in toddlers at Simpang Limun Primary Health Center in 2025, as indicated by p<0.05 (0.022). The Prevalence Ratio (PR) value of 1.543 suggests that toddlers who live with smokers are 1.543 times more likely to develop ARI, indicating that having smokers in the household is a factor in the occurrence of ARI in toddlers.

3.2. Discussion

3.2.1. Relationship between Mother's Age and ARI Incidence

The statistical analysis using the chi-square test revealed a p-value of 0.513 (p>0.05), indicating that there is no significant connection between the age of mothers and the incidence of ARI in toddlers at the Simpang Limun Primary Health Center in 2025. The Prevalence Ratio (PR) of 0.886 was also determined, showing that a mother's age is not a contributing factor to the development of ARI in toddlers.

Mother's age does not directly influence ARI incidence; mother's age influences the visits of mothers with toddlers to posyandu Fathurrohman et al. (2021). The condition of mothers coming to Simpang Limun Primary Health Center is more mothers aged ≤ 35 years, so mother's age does not influence mothers coming to the Primary Health Center. Mothers who come to Simpang Limun Primary Health Center or posyandu will tend to try to make visits when toddlers are sick or when immunization schedules such as taking work leave or coming with companions such as with grandmothers or grandfathers.

The findings of this study align with prior investigations carried out by Sanjaya & Fadilah (2021), where the proportion of toddlers with positive ARI and mothers aged <20 years was 29.4% and toddlers with positive ARI and mothers aged 20 years was 29.4% with chi-square test analysis results obtaining p = 0.319 where p > 0.05. In addition, mother's age is also more related to at-risk or not at-risk births such as adequate birth weight and others (Purborini & Rumaropen, 2023). Therefore, mother's age is not related to ARI incidence in toddlers.

3.2.2. Relationship between Mother's Education and ARI Incidence

The chi-square statistical test analysis results show a significant relationship between mother's education and ARI incidence in toddlers at Simpang Limun Primary Health Center in 2025 with p = 0.006 (p<0.05). The Prevalence Ratio (PR) value obtained is 1.675 where PR > 1, meaning mothers with low education have a tendency 1.675 times to have toddlers infected with ARI or mother's education is a determinant of ARI disease in toddlers.

Mothers of toddlers with higher education levels will influence the knowledge of mothers of toddlers regarding basic immunization, ARI infectious diseases, and others. Education level will also make it easier to absorb education provided by health workers. So mothers of toddlers will be more concerned about their toddlers' health by actively seeking information about toddler health through various means such as from health workers, mass media, and others (Budi et al., 2022)

The findings from surveys conducted with participants using questionnaires suggest that mothers who have received higher education are more likely to be knowledgeable about ARI, the number of routine immunizations that must be given to toddlers, and have knowledge about toddler health information such as the importance of toddler weight and height and timely immunization for toddlers. Interview results also found that mothers with higher education mostly do not work or are housewives, which makes mothers care for and raise toddlers according to knowledge obtained from various sources including health center staff. Mothers with higher education and housewives are very concerned about their toddlers' growth and development such as asking about ways to increase toddler weight and ways to prevent ARI as well as ARI symptoms and other things related to ARI to researchers during interviews.

The findings of this research align with previous studies conducted by Budi et al. (2022), which also found a strong correlation was discovered between the level of education of mothers and the instance of ARI in toddlers. The statistical analysis revealed a p-value of less than 0.05, indicating a significant finding. It was concluded from the study that mothers with greater educational attainment are less likely to have toddlers who experience ARI. In research conducted by Nurmalitasari & Indarjo (2021) there was also a relationship between mother's education level and ARI incidence in toddlers with chi-square test results showing p = 0.029 where p < 0.05 with a Prevalence Ratio (PR) value of 1.288 (PR > 1), meaning mother's education level becomes a determinant of ARI disease incidence in toddlers.

Study by Suhada et al. (2023) also shows The level of education that a mother has can impact the incidence of ARI (Acute Respiratory Infection) in toddlers, with statistically significant results suggesting that lower levels of education in mothers may increase the risk of ARI in children. Previous studies have also shown a correlation between a mother's education level and the occurrence of ARI in toddlers, further emphasizing the importance of education in preventing this respiratory disease in toddlers (Agustin, 2022).

3.2.3. Relationship between DPT Immunization Provision and ARI Incidence

Based on chi-square statistical test results, there is a significant relationship between DPT immunization provision and ARI incidence in toddlers at Simpang Limun Primary Health Center in 2025 with p = 0.001 (p<0.05). The Prevalence Ratio (PR) value obtained is 1.773 where PR > 1, meaning toddlers who do not receive DPT immunization have a tendency 1.773 times to be at risk of ARI infection or DPT immunization provision is a determinant of ARI disease in toddlers.

DPT immunization contains diphtheria toxoid, pertussis antigens, tetanus toxoid, hepatitis B, and Haemophilus influenzae type b (Hib). DPT immunization injected in

toddlers functions as a stimulant of the immune system in forming antibodies against various respiratory tract infection diseases including ARI which is classified in the ARI group (Ministry of Health RI, 2022). Therefore, DPT immunization is related to ARI incidence in toddlers.

The findings of this research align with a previous study by Fadila & Siyam (2022) indicating a connection between DPT vaccination status and ARI occurrence in young children, with a significance level of p=0.00 (p<0.05). Research findings from other studies have shown a potential link between the availability of DPT immunization and the occurrence of ARI in young children, with a significance level of p=0.08 (p<0.1). This suggests that providing DPT immunization may be a highly effective strategy for reducing the risk of ARI, particularly in preventing fatalities among toddlers caused by ARI (Fatimah & Rustan, 2022).

3.2.4. Relationship between DPT Immunization Frequency and ARI Incidence

The chi-square statistical test results obtained p less than 0.05 (< 0.001), which means there is a relationship between DPT immunization frequency and ARI incidence in toddlers at Simpang Limun Primary Health Center in 2025. The Prevalence Ratio (PR) value obtained is 3.067 where PR > 1, meaning toddlers who receive DPT immunization ≤ 3 times have a tendency 3.067 times to be at risk of ARI infection or DPT immunization frequency is a determinant of ARI disease in toddlers.

DPT immunization is a routine immunization given repeatedly 4 times, 3 times basic DPT immunization and 1 time booster immunization when toddlers are 2 months, 3 months, 4 months, and 12 months old. DPT booster immunization aims to increase antibody titers in toddlers to 6.7–10.3 IU/mL, which shows its effectiveness in enhancing immune response in preventing respiratory tract infection diseases including ARI (Regulation of the Minister of Health of the Republic of Indonesia Number 12 of 2017 on Immunization Implementation). This shows that complete DPT immunization frequency (> 3 times) will reduce the risk of ARI incidence, consistent with research results that can be seen in figure 7 that the proportion of toddlers who have received DPT immunization more than three times do not experience ARI is 78.3% and the proportion of toddlers who have received DPT immunization ≤ 3 times experience ARI is 66.7%.

The results of this study are in line with previous research by S. Fatimah et al. (2023), which obtained results that there is a significant relationship between complete DPT immunization status and ARI incidence in toddlers, with a p-value of 0.000 < 0.05. In other research, there was also a significant relationship between complete DPT immunization status and ARI incidence in toddlers with p = 0.032 (p<0.05), this is because the immune system in toddlers is still in the development stage and is vulnerable to infectious diseases, one of which is ARI, so immunization is needed, especially DPT immunization as an effort to increase toddler immunity and ARI is one of the infectious diseases that can be prevented with DPT immunization (Mayesti et al., 2024).

3.2.5. Relationship between Exclusive Breastfeeding and ARI Incidence

The chi-square statistical analysis revealed a p-value of 0.006 (p < 0.05), demonstrating a statistically significant association between exclusive breastfeeding practices and acute respiratory infection (ARI) occurrence among toddlers at Simpang Limun Health Center in 2025. The calculated Prevalence Ratio (PR) of 1.623 (PR > 1) suggests that children who received exclusive breastfeeding had 1.623 times greater

likelihood of developing ARI, establishing exclusive breastfeeding as a determining factor for ARI in this population.

Exclusive breastfeeding refers to providing infants with only breast milk from birth through six months of age, without any supplementary foods or beverages. This feeding practice is crucial for strengthening children's immune systems, offering protection against infectious diseases and decreasing infant mortality rates, as outlined in Government Regulation Number 28 of 2024 regarding the Implementation of Health Law Number 17 of 2023. The study findings align with this principle, showing that 43.1% of exclusively breastfed toddlers developed ARI, which was notably lower than the 70.0% ARI rate observed among children who did not receive exclusive breastfeeding for the full six-month period.

Toddlers who do not receive exclusive breastfeeding will be at higher risk of infectious diseases because exclusive breastfeeding influences antibody formation as protection against diseases in children. Breast milk contains various antimicrobial substances that can provide prolonged immune protection for children against ARI (Nurmalitasari & Indarjo, 2021)

The results of this study are consistent with research conducted by Aisyiah et al. (2024), showing a significant relationship between exclusive breastfeeding and ARI incidence in children aged 1-5 years, with a p-value of 0.015 < 0.05. Research conducted by S. Fatimah et al. (2023) also showed results indicating a relationship between DPT immunization and ARI incidence in toddlers with p=0.000 < 0.05 and OR=14.085, which can be interpreted as children who do not receive complete DPT immunization having a 14-fold risk of ARI infection. Other research also found a significant relationship between exclusive breastfeeding and ARI incidence in toddlers with a p-value of 0.018 (≤ 0.05) (Setiawati et al., 2021).

3.2.6. Relationship between Residential Density and ARI Incidence

Statistical test results using chi-square test showed a significant relationship between residential density and ARI incidence in toddlers at Simpang Limun Health Center in 2025 with p-value < 0.05 (< 0.001). The Prevalence Ratio (PR) obtained was 2.041, where PR > 1, meaning that children with dense residential have a 2.041 times higher tendency to be at risk of ARI infection, or residential density is a determinant of ARI disease in toddlers.

Residential density in one house is based on Minister of Health Regulation No. 2 of 2023 Concerning Implementation Regulations of Government Regulation Number 66 of 2014 on Environmental Health, explaining space requirements per person and the number of occupants living in a house based on building and land area, where one person needs 9 m^2 of space, such as building and land area of 36 m^2 can only accommodate 4 people.

High numbers of occupants in one house can increase the risk of disease transmission. Indoor air, including in bedrooms, mixes with air breathed by all occupants, facilitating pathogen spread, especially in toddlers because their immune systems are still developing, making them more susceptible to diseases like ARI, which can easily be transmitted through contaminated air (Wisudariani et al., 2022). This is consistent with this study, which shows that the proportion of toddlers infected with ARI in dense residential was 85.3%, higher than the proportion of toddlers infected with ARI in non-dense residential at 41.8%.

This research is consistent with research conducted by Zulfikar & Sukriadi (2021), showing a relationship between residential density and ARI incidence in toddlers with chi-square statistical test results showing p=0.008 (p < 0.05). Other research also showed a relationship between bedroom density and ARI incidence in toddlers with p=0.012 (p < 0.05) (Wisudariani et al., 2022).

3.2.7. Relationship between Mosquito Repellent Use and ARI Incidence

Chi-square statistical analysis results obtained p = 0.775, where p > 0.05, meaning there is no significant relationship between mosquito repellent use and ARI incidence in toddlers at Simpang Limun Health Center in 2025. The Prevalence Ratio (PR) obtained was 1.000, where PR = 1, meaning mosquito repellent use is not a cause or determinant of ARI disease in toddlers.

This research is consistent with research by Nyomba et al. (2022) with chi-square statistical test results obtaining p = 0.169, meaning there is no relationship between mosquito repellent use and ARI incidence in toddlers. This occurs because there are other factors causing ARI, such as birth weight, exclusive breastfeeding status, and presence of smokers in the house. Other research also explained that there is no significant relationship between mosquito repellent use and ARI prevention behavior with p = 0.138. This is due to knowledge and awareness of mothers and families of toddlers not to use mosquito repellent at home (Sanju et al., 2024).

The results of this study are supported by respondent statements during interviews, that they do not use mosquito repellent because they already understand the dangers of mosquito repellent use for children's health. As for respondents who answered using mosquito repellent at home, they do not use mosquito repellent daily or frequently; mosquito repellent is only used when there are mosquitoes, especially during the rainy season.

3.2.8. Relationship between Presence of Smokers in the House and ARI Incidence

Chi-square statistical analysis results showed a significant relationship between the presence of smokers in the house and ARI incidence in toddlers at Simpang Limun Health Center in 2025 with p = 0.022, where p is less than 0.05. The Prevalence Ratio (PR) obtained was 1.543, where PR > 1, meaning that children with smokers in the house have a 1.543 times higher tendency to be at risk of ARI infection, or the presence of smokers in the house is a determinant of ARI disease in toddlers.

The presence of smokers in the house causes children to become passive smokers, and cigarette smoke causes indoor air pollution, which becomes a risk factor for respiratory infections like ARI, especially in toddlers because they have weak immune systems (Amila et al., 2021). This is consistent with the results of this study, where the proportion of having smokers in the house with children having ARI was 65.6%, higher than the proportion of not having smokers in the house with children having ARI at only 42.5%.

This research is consistent with research by Amalia et al. (2024), which obtained chi-square statistical test results with p-value 0.000 < 0.05, meaning there is a significant relationship between family member smoking status and ARI incidence in toddlers because having one or more smokers in the house can increase the risk of respiratory disorders like ARI for all family members, especially toddlers. Other research also obtained results showing a relationship between cigarette smoke exposure and ARI incidence in toddlers with p-value 0.002 < 0.05 because cigarette smoke exposure from family members affects air circulation that will be continuously inhaled by other non-smoking family members, especially toddlers (Rahmawati et al., 2024).

In research conducted by Henilia et al. (2024), results consistent with this study were obtained, with statistical test results showing p = 0.00 (p<0.05), meaning there is a relationship between smoking behavior in the house and ARI incidence in toddlers. This is because cigarette smoke contains thousands of chemical substances that are irritating and can cause respiratory tract infections and even cancer. Smoking activities in the house harm

the health of smokers and all family members in the smoker's environment because it makes children and family members easily exposed to cigarette smoke and easily infected with respiratory diseases like ARI (Henilia et al., 2024).

4. Conclusion

The distribution proportion of ARI incidence in toddlers at Simpang Limun Health Center in 2025 was 56.4 percent. There are relationships between mother's education, DPT immunization provision, frequency of DPT immunization, exclusive breastfeeding, residential density, and presence of smokers in the house with ARI incidence in toddlers at Simpang Limun Health Center in 2025. There are no relationships between mother's age and mosquito repellent use with ARI incidence in toddlers at Simpang Limun Health Center in 2025. As such, it is recommended that mothers and families not smoke inside the house, provide exclusive breastfeeding, and visit health services so that toddlers receive basic and booster immunizations.

5. References

Agustin, P. R. (2022). Hubungan pendidikan ibu dan perilaku pengelolaan sampah dengan kejadian ISPA pada bayi usia 0-24 bulan di desa Pojok, Kecamatan Purwosari, Kabupaten Bojonegoro tahun 2020. *Preventif : Jurnal Kesehatan Masyarakat*, *13*(3), 486–495. https://doi.org/10.22487/preventif.v13i3.389

Aisyiah, I. K., Budiman, H., & Dewi, A. (2024). Faktor-faktor yang berhubungan dengan kejadian ISPA pada balita. *PREPOTIF: Jurnal Kesehatan Masyarakat*, *8*(3), 6947–6956. https://doi.org/https://doi.org/10.31004/prepotif.v8i3.37649

Amalia, A., Fahdhienie, F., & Fadhlullah, F. (2024). Faktor-faktor yang berhubungan dengan kejadian ISPA pada balita (1-4 tahun) di wilayah kerja Puskesmas Bandar Kecamatan Bandar Kabupaten Bener Meriah tahun 2023. *Jurnal Bidang Ilmu Kesehatan*, *14*(1), 72–81. https://doi.org/10.52643/jbik.v14i1.4116

Amelia, S., Ardiansyah, A., & Arjuna, A. (2024). Faktor - faktor yang Mempengaruhi Perilaku Keluarga dalam Pencegahan ISPA Pada Anak. *Jurnal Penelitian Perawat Profesional*, *6*(1). https://doi.org/10.37287/jppp.v6i1.1949

Amila, A., Pardede, J. A., Simanjuntak, G. V., & Nadeak, Y. L. A. (2021). Peningkatan pengetahuan orang tua tentang bahaya merokok dalam rumah dan pencegahan ISPA pada balita. *JUKESHUM: Jurnal Pengabdian Masyarakat*, *1*(2), 65–70. https://doi.org/10.51771/jukeshum.v1i2.119

Astuti Wulandari, N., Darmawan, E., & Umam Kurniawan, N. (2022). The Comparison of the Efficacy of Ceftriaxone and Combination of Ampicillin-Chloramphenicol in Children with Pneumonia at PKU Muhammadiyah Hospital in Bantul. *Pharmacology, Medical Reports, Orthopedic, and Illness Details (COMORBID)*, *1*(1). https://doi.org/10.55047/comorbid.v1i1.56

Budi, P. S. A., Benvenuto, A. F., Azmi, F., & Arjita, I. P. D. (2022). Hubungan tingkat pendidikan ibu dan status gizi anak dengan kejadian ISPA pada anak usia 0-5 tahun di Kabupaten Lombok Utara Provinsi Nusa Tenggara Barat (NTB). *AVERROUS: Jurnal Kedokteran Dan Kesehatan Malikussaleh*, *8*(2), 40–50. https://doi.org/10.29103/averrous.v8i2.9044

Fadila, F. N., & Siyam, N. (2022). Faktor risiko Infeksi Saluran Pernapasan Akut (ISPA) pada anak balita. *HIGEIA (Journal of Public Health Research and Development)*, *6*(4), 320–331. https://doi.org/10.15294/higeia.v6i4.56803

Fathurrohman, R. I., Norviatin, D., & Ahmad, Z. (2021). Hubungan antara usia, pendidikan pengetahuan ibu terhadap kunjungan ibu dengan anak balita ke posyandu dalam kegiatan penimbangan dan penimbangan balita di wilayah kerja puskesmas talun

Kabupaten Cirebon. *Tunas Medika Jurnal Kedokteran & Kesehatan*, *7*(2), 1–8.

Fatimah, D., & Rustan, H. (2022). Hubungan status imunisasi dengan Infeksi Saluran Pernafasan Akut (ISPA) pada balita sakit (1-5 Tahun). *Jurnal Fenomena Kesehatan*, *5*(2), 101–105.

Fatimah, S., Andriyani, & Anoluthfa. (2023). Hubungan imunisasi difteri pertusis tetanus dengan kejadian infeksi saluran pernafasan akut pada balita di Puskesmas Kolono Kabupaten Konawe Selatan. *Jurnal Pelita Sains Kesehatan*, *3*(5), 69–76.

Henilia, Ekawati, D., & Harokan, A. (2024). Analisis kejadian infeksi saluran pernapasan pada anak balita. *Jurnal 'Aisyiyah Medika*, *9*(2), 177–190.

Kementrian Kesehatan Republik Indonesia. (2022). *Kemenkes Tambah 3 Jenis Vaksin Imunisasi Rutin, Salah Satunya HPV*.

Mayesti, F. E., Arifin, S., Trisia, A., Widodo, T., & Carmelita, A. B. (2024). Hubungan status imunisasi dasar dan berat badan lahir dengan kejadian ISPA pada balita. *Barigas: Jurnal Riset Mahasiswa*, *2*(2), 71–75. https://doi.org/10.37304/barigas.v2i2.11849

Nurmalitasari, Y. K., & Indarjo, S. (2021). Pola asuh ibu dengan kejadian ISPA balita di Puskesmas Geyer. *Indonesian Journal of Public Health and Nutrition*, *1*(3), 428–432.

Nyomba, M. A., Wahiduddin, & Rismayanti. (2022). Faktor yang berhubungan dengan kejadian ISPA pada balita di sekitar wilayah TPA sampah. *Hasanuddin Journal of Public Health*, *3*(1), 8–19. https://doi.org/10.30597/hjph.v3i1.19796

Purborini, S. F. A., & Rumaropen, N. S. (2023). Hubungan usia, paritas, dan tingkat pendidikan dengan kehamilan tidak diinginkan pada pasangan usia subur di surabaya. *Media Gizi Kesmas*, *12*(1), 207–211. https://doi.org/10.20473/mgk.v12i1.2023.207-211

Rahmawati, I. N., Diahsari, A., & Arifah, S. (2024). *Hubungan paparan asap rokok dengan kejadian ISPA pada balita di Puskesmas Pundong Bantul Yogyakarta*. *2*(September), 148–154.

Sanjaya, M., & Fadilah, I. N. (2021). Hubungan faktor ibu dan faktor keluarga terhadap kejadian Infeksi Saluran Pernapasan Akut (ISPA) pada balita usia 1-5 tahun di Puskesmas Panei Tongah Kabupaten Simalungun. *Jurnal Kesehatan*, *9*(1), 94–98.

Sanju, B. S., Santi, T. D., & Andria, D. (2024). Determinan perilaku pencegahan ISPA pada balita di wilayah kerja Puskesmas Meuraxa Kota Banda Aceh. *Jurnal Kesehatan Tambusai*, *5*(1), 879–887.

Setiawati, F., Sari, E. P., Hamid, S. A., & Hasbiah, H. (2021). Hubungan status gizi, pemberian ASI eksklusif dan paparan asap rokok terhadap kejadian ISPA pada balita di Puskesmas Sukaraya Kab. OKU. *JIUBJ: Jurnal Ilmiah Universitas Batanghari Jambi*, *21*(3), 1293. https://doi.org/10.33087/jiubj.v21i3.1739

Suhada, S. B. N., Novianus, C., & Wilti, I. R. (2023). Faktor-faktor yang berhubungan dengan kejadian ISPA pada balita di Puskesmas Cikuya Kabupaten Tangerang tahun 2022. *Environmental Occupational Health and Safety Journal*, *3*(2), 115–124.

Wisudariani, E., Zusnita, S., & Butar, M. B. (2022). Faktor-faktor yang berhubungan dengan kejadian ISPA pada balita di wilayah kerja Puskesmas Semerap Kerinci, Jambi. *JIK (Jurnal Ilmu Kesehatan)*, *6*(2), 362–369. https://doi.org/10.33757/jik.v6i2.602

Zulfikar, & Sukriadi. (2021). Hubungan kepadatan hunian kamar dan kebiasaan merokok dalam rumah dengan kejadian ISPA pada balita di Desa Tingkem Bersatu Kecamatan Bukit Kabupaten Bener Meriah. *Journal of Healthcare Technology and Medicine*, *7*(1), 2615–109.