Analysis of the Phenomenon of Acute Respiratory Infection (ARI) in Children Under Five at the Boyolali Regency Regional Health Center

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Boyolali Regency is located in the foothills of Mount Merapi with cold and humid air temperatures, the difference in climatic conditions in the highlands and lowlands will affect the incidence of Acute Respiratory Tract Infections (ARI)/ISPA in toddlers. The high number of ARI cases is influenced by individual and environmental factors. Cold climate is one of the factors for rapid transmission of ARI. ARI is an infection that attacks the respiratory tract, both the upper part (nose, pharynx, larynx) and the lower part (trachea, bronchi and lungs) which lasts < 14 days. The causes of ARI are viruses, bacteria and fungi, which are often caused by viruses. ARI ranks in the top 3 in Central Java. **The purpose of** this study is to analyze individual and environmental factors on the occurrence of ARI in children under five. **The method** of this study is observational with *a cross-sectional design.* This study discusses the factors that cause the occurrence of ARI in Boyolali Regency. Data on nutritional factors, maternal education, and housing density were obtained through questionnaires. The sample size in this study was calculated using the WHO sample size application. The number of children under five years old recorded in the work area of the Health Center in Boyolali Regency in 2024 is 109,968, so that a minimum sample of 383 was obtained. The questionnaire was distributed in 6 working areas of the Health Center in Boyolali. Data analysis used binary logistic regression technique. Results: Individual factors affect the ARI factor in toddlers (sig < 0.05). The odds ratio is 4.307. This means that toddlers who have good individual factors will increase the number of non-ARI toddlers by 4,307 times. Environmental factors also affect the status of ARI in toddlers (sig < 0.05). The odds ratio is 152,660. This means that toddlers who have good environmental factors will increase the number of non-ARI toddlers by 152,660 times. Based on the results of the Spearman correlation test, it shows that individuals are related to the environment. Individual factors are important factors in environmental factors.
Conclusion: In this study, it is shown that individual factors and environmental factors affect the incidence of ARI in toddlers in the work area of the Puskesmas in Boyolali

Keywords : ARI analysis, individual, environment

INTRODUCTION

ARI disease is an infectious disease originating in the upper or lower respiratory tract that can cause a wide spectrum of diseases ranging from mild infections to severe and deadly severe illnesses. It depends on the cause of the situation and the environment. ARI is one of the health problems in developing countries. The morbidity of ARI is still high, especially in infants and toddlers. (Scott, I., & Ferusgel, 2019). ARI is an acute infectious disease that affects one or more parts of the airways starting from the nose to the lungs (alveoli) including its adnexic tissues such as the sinuses/cavities around the nose, pleural middle ear cavity The etiology of ARI consists of 300 types of bacteria, vitus and riketsia. ARI is an acute infectious process that lasts for 14 days that is caused by an organism and attacks one or more parts of the airway. Almost all deaths of ARID in children are generally lower respiratory tract infections (J. V.

Asa, 2023).

Acute Respiratory Tract Infections (ARI) are one of the main causes of morbidity and mortality due to infectious diseases in the world. Nearly 4 million people die from ARI, with 98% of deaths due to lower respiratory tract infections. (WHO), 2020). The WHO estimates that about 1.9 million children under five die each year from ARI, citing a figure of 70% of deaths occurring in developing countries (WHO, 2023).

In Indonesia, ARI ranks first in the top 10 diseases most commonly found in health care facilities. Based on data from the Ministry of Health of the Republic of Indonesia, in 2022 there were more than 5 million cases of ARI reported in various regions, showing the high burden of this disease on the national health system(Ministry of Health of the Republic of Indonesia, 2022)

.Central Java Province ranks in the top three including West Java and East Java with a case rate of 132,565 or 13.03%. The prevalence of ARI in toddlers reached 93,620 cases and 10,551 or 11.27% of them occurred in Central Java (Ministry of Health of the Republic of Indonesia, 2020). Data on ARI in Indonesia according to the 2023 Indonesian Health Survey (SKI) shows that the prevalence of ARI in toddlers is 4.8% (BKPK, 2023).

Boyolali Regency is located at the foot of Mount Merapi with cold and humid air temperatures, the difference in climatic conditions in the highlands and lowlands will affect the incidence of ARI in toddlers (Lestari, R., Budiyono, & Dewanti, 2018). Cold climate is one of the factors that cause the transmission of diseases the fastest. Humidity, rainfall, and temperature are some of the climatic parameters that determine the rapid transmission of diseases (Anwar, R.G., Hidayati, R., & Budianto, 2020).

Toddlers affected by ARI In general, there are 3 risk factors for the cause, namely behavioral, individual, and environmental factors (Febriyani, Paramita, 2023). ARI generally comes from three factors (Menanti, L., Azizah, R., Latif, 2022): 1) Behavioral factors: The active role of the family such as the use of mosquito repellent and smoking behavior there are internal and external factors. 2). Individual factors of the child: include: age of the child, birth weight, nutritional factors, vitamin A and immunization factors. 3). Environmental factors: among them the physical floor of the house is not concrete, humid temperature, poor air circulation due to ventilation, some cannot be opened and are squeezed with neighbors. Occupancy density, air pollution, cigarette smoke and waste burning smoke, gaung gas, transportation facilities, industrial exhaust (Rafaditya, S. A., Saptanto, A., & Ratnaningrum, 2022). Symptoms include earache, fever, headache, drainage from the infected ear, redness, swelling

and pain in the affected ear (Dewi, 2022).

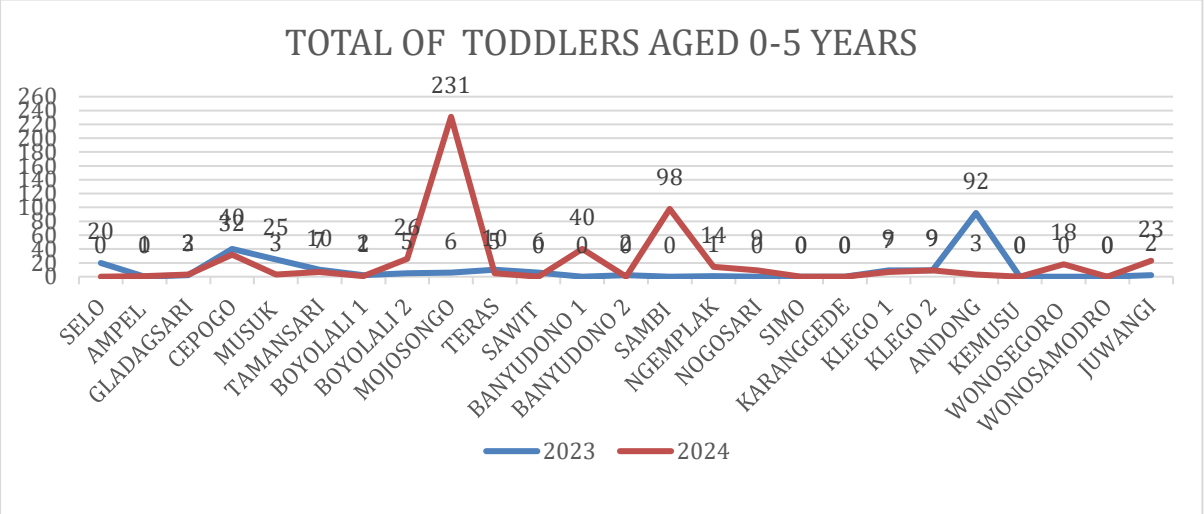
Blita who experiences ARI experiences symptoms that are categorized into three (3): Mild symptoms when coughing is found, hoarseness if the child makes a hoarse voice when making a sound, runny nose discharge from the nose, heat or fever body temperature is more than 37oC (J. F. Asa, 2023). Moderate symptoms: rapid breathing is grouped according to age, namely: for the infant's age group less than 2 months, the respiratory rate is 60 times per minute or more for the age of 2- <5 years, body temperature is more than 39oC. The throat is red, red spots on the skin resemble brownish measles patches and itching, sore ears or ear holes that are pus. Breathing sounds like snoring. Symptoms of severe ARI: blue lips or skin, child unconscious or decreased consciousness, breathing such as snoring and restlessness, between the ribs pulled inward when breathing, rapid pulse rate of 160 times per minute or not palpable, red throat (Hengky, 2024).

Individual factors that affect the occurrence of ARI include Low Birth Weight (BBLR) weighing < 2,500 grams (Lestari, D. A., & Adisasmita, 2021). Complete basic immunization with toddlers whose immunization is incomplete is related to the occurrence of ARI. abnormal nutritional factors for toddlers as a determinant of the occurrence of ARI. Behavioral factors affect the house, such as smoking, humid home conditions so that an unhealthy house can put toddlers at risk of experiencing ARI (Hane Wimalisca, Ali Harokan, 2023). Based on the description above, the researcher analyzed the flow of individual factors and environmental factors in the incidence of ARI in toddlers in Boyolali Regency.

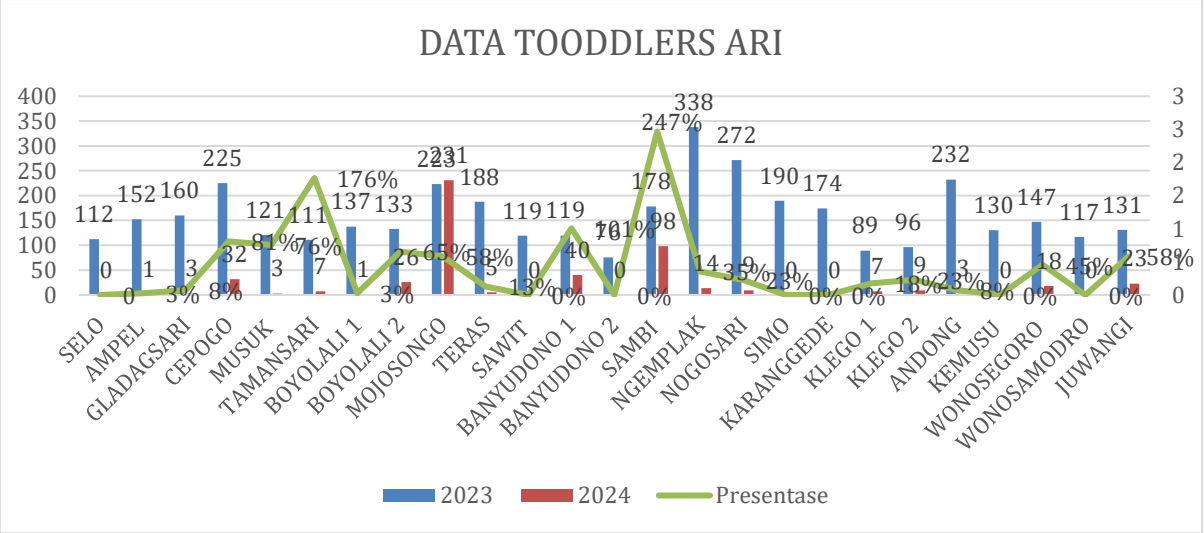
METHODS (12pt, all caps, Time News Roman, Bold, 1,5 space)

This research is observational with *a Cross Sectional design.* This study discusses the factors that cause the occurrence of ARI in Boyolali Regency. Data on nutritional factors, maternal education, and housing density were obtained through questionnaires. The sample size in this study was calculated using the WHO sample size application. The number of children under five years old recorded in the work area of the Health Center in Boyolali Regency in 2024 is 109,968, so that a minimum sample size of 383 is obtained. The questionnaire was distributed in 6 working areas of the Health Center in Boyolali. This is because the areas emphasized by farmers, horticultures, and tobacco growers with areas that have a minimum temperature of 18 ºC- 23ºC

RESULTS



Overview 1. ARI Toddler in Boyolali Regency



Overview 2. Percentage of ARI Toddlers in Boyolali Regency

The percentage of ARI incidence in Boyolali district in 2024 will increase in cases, namely in 2023 with 6.16% of cases to 13.35% in 2024, but based on ARI data in Boyolali Regency which has a high percentage of ARI incidence rates, which is above the prevalence of ARI in toddlers by 4.8% of data in Indonesia.

Table 1. Results of the Validity and Reliability Test of the Questionnaire

		r	Sig	Reliability
1.	Individual:			0,703
	1. Toddler Age	0,787	0,000	
	2. Long time getting breast milk	0,741	0,000	
	3. Gender	0,787	0,000	
	4. Nutritional Factors	0,525	0,003	
	5. Immunization	0,871	0,000	
	6. Access to health services	0,395	0,031	
2.	Environmental Conditions:			0,734
	1. Condition of the house	0,698	0,000	
	2. Air pollution/cigarette smoke	0,900	0,000	
	3. Occupancy density	0,917	0,000	

Based on the results of the test of the questions in the questionnaire were valid (the value of the correction test was significant and reliable or valid (the alpha conbrach test was > 0.7) After obtaining the validity and reliability test of the questionnaire which was distributed to 400 respondents. Of the questionnaires that have been distributed, a total of 400 were filled out completely, 386.

Table 2. Summary of Toddler Factor Data

A Hundred Toddlers	Ages 0-3 years		3-5 years	
	Man	**Woman**	**Man**	**Woman**
ARI	13 (17,8%)	8 (10,9%)	15 (20,7%)	37 (50,6%)
No ARI	21 (6,6%)	24 (7,9%)	126 (40,5%)	142 (45%)

Of the 386 toddlers, there are 73 toddlers with the ARI factor. The highest number of toddlers with ARI is at the age of 3-5 years.

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Table 3. Summary of Individual Factors Data

Category	Sum		Percentage	
	ISPA	No ISPA	ISPA	No ISPA
Toddler Age:				
1. < 3 years	12	57	16,2%	18,2%
2. >/= 3 years	61	256	83,6%	81,8%
How Long to Get Breast Milk :				
1. < 6 Months	47	16	62,2%	5%
2. 6 Months	28	267	37,8%	85%
3. > 6 Months	0	30	0%	10%
Immunization Factors				
1. Hepatitis	4	0	5,4%	0%
2. BCG	25	9	33,8%	2,9%
3. Polio 4 x months 1,2,3,4	9	85	12,2%	27,2%
4. DPT-HB 3 x 2,3,4 months	27	49	37,6%	15,7%
5. PCV 2x 2 months 2.3	4	77	5,4%	24,6%
6. Rotavirus 3x months 2,3,4	4	63	5,4%	20,15%
7. Measles	0	7	0%	2,2%
8. DPT-Hb	0	5	0%	1,6%
9. MR (Measles Rubela)	0	18	0%	5,8%
Access to health services:				
1. Distance and travel time	63	90	85,1%	28,8%
2. Availability of health facilities	11	223	14,9%	71,2%
Family Income/month:				
1. < 1.5 million	35	9	47,3%	2,9%
2. 1.5 million – 3 million	36	80	48,6%	25,6%
3. 3 million – 5 million	3	184	4,1%	58,8%
4. 5 million – 7 million	0	30	0%	9,6%
5. > 7 million	0	10	0%	3,2%
Family Member Factors:				
1. ISPA	20	74	27%	23,6%
2. No ISPA	54	239	73%	76,4%

Table 4. Summary of Environmental Factors Data

	ISPA	No ISPA	ISPA	No ISPA
Air Pollution:				
1. Roadside house	57	11	78,4%	3,5%
2. Cigarette Smoke	16	218	21,6%	69,7%
3. Houses Near Factory	0	84	0%	26,8%
Ventilation:				
1. Good	67	18	91,9%	5,8%
2. Bad	6	295	8,1%	94,2%
Occupancy density:				
1. 4 people	73	146	100%	46,6%
2. > 4 people	0	121	0%	38,7%
3. < 4 people	0	46	0%	14,7%

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Table 5. Spearman Correlation Test Results

Category	Factors of ISPA in Toddlers	
	r	Sig
Toddler Age	0,262	0,000
Long time getting breast milk	0,556	0,000
Gender	0,357	0,000
Nutritional Factors	0,629	0,000
Immunization	0,668	0,000
Access to health services	0,031	0,543
Condition of the house	0,410	0,000
Air pollution/cigarette smoke	0,453	0,000
Occupancy density	0,579	0,000

The results of the Spearman correlation test showed that the category of access to health services did not have a relationship with the stunting factor for toddlers (sig > 0.05). Therefore, access to health services is not included in the calculation to determine individual factors. So individual factors are calculated based on the score points from the category of toddler age, length of time breastfeeding, gender, nutritional factors, immunization, access to health services, home conditions, air pollution/cigarette smoke, housing density with ARI factor (sig < 0.005). So that the determination of environmental factors is calculated based on the total score of the categories of air pollution, ventilation and residential density grouped into 3.

Table 6. Summary of ISPA Data for Toddlers Based on Independent Variables

Variable		Sum		Percentage	
		ISPA	No ISPA	ISPA	No ISPA
Individual Factors	Bad	45	65	60,8%	20,8%
	Good	28	248	39,2%	79,2%
Environmental Factors	Bad	70	88	95,9%	28,3%
	Good	3	225	4,1%	71,9%

Based on the results of the data summary, it appears that many cases of ARI under five occur due to individual factors that have bad factors and environmental factors with bad factors. Before examining the influence of individual factors and environmental factors on the factor of toddlers with ITA, the correlation between individual factors and environmental factors with the factor of toddlers with ITA was first tested to determine the relationship between these variables. The results of the Spearman correlation test are presented in table 7.

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Table 7. Results of Free Variable Sperm Correlation Test to Toddler ARI Factor

	Environmental Factors	ARI Factors for Toddlers
Factor Individual	r = 0.543 sig = 0.000	r = 0.543 sig = 0.000
Environmental Factors		r = 0.701 sig = 0.000

The results of the Spearman correlation test showed that individual factors and environmental factors had a relationship with ARI factors in toddlers (sig <0.05). Individual factors also have a relationship with environmental factors (sig <0.05). Because individual factors and environmental factors have a significant relationship between ARI in toddlers, the two variables can be included in a binary logistics regression test to determine their effect on ARI in toddlers. The results of the binary logistics regression test are presented in table 8.

Table 8. Binary Logistics Regression Test Results

Variable	B	Sig	OR	96% CI	
				Lower	Upper
Factor Individual	1,460	0,006	4,307	1,517	12,227
Environmental Factors	5,028	0,000	152,660	42,476	548,668
Constant	-8,608	0,000	0,000		

DISCUSSION

The results of the binary logistics regression test showed that individual factors and environmental factors had a relationship between ARI factors in toddlers (sig < 0.05). The odds ratio is 4.307. This means that toddlers who have good individual factors will increase the number of non-ARI toddlers by 4,307 times. This means that high individual factors can prevent the occurrence of ARI in toddlers. Environmental factors also affect the ARI factor in toddlers (sig < 0.05). The odds ratio is 152,660. This means that toddlers who have good environmental factors will increase the number of non-ARI toddlers by 152,660 times. It can be interpreted that good environmental factors are able to prevent stunted toddlers.

The incidence of ARI in this study occurred in individual factors, namely bad by 60.8% and good individual factors by 39.2%. Individuals under the age of 5 years have a higher

risk of developing ARI where the immune system is still in the development stage (Septiani, A., Juliana, A., Septiani, F., 2025). Mothers who breastfeed exclusively with factors do not work with exclusive breastfeeding as the only source of nutrition for the baby without additional food or drink during the first 6 months of the baby's life. The importance of exclusive breastfeeding because it contains complete nutrients, immune system, optimal growth, allergy prevention gets antibody protection from breast milk(Rita, N., Yundelfa, M., & Novianti, 2024). Parents' lack of understanding of children's health and lack of regular vitamin A fulfillment can be at risk of developing ARI, vitamin A can boost the immune system. Vitamin A is obtained from chicken liver, beef liver, carrots, sweet potatoes, broccoli, spinach and mango (Abainpah, M., Sir, A. B., Riwu, Y. R., Study, 2025). Immunization basis incomplete and low birth weight will be at risk for the incidence of ARI in toddlers (Freya Ekklesia Mayesti1, Syamsul Arifin2, 2024)

Poor environmental factors cause the risk of ARI. In this study, there were many ARI toddlers with a bad environmental factor of 95.9% and a good environmental factor of 4.1%. Toddlers who did not experience ARI in this study were mostly occupied in the environment with a good factor of 71.9% and a bad environmental factor of 28.3%. Toddlers who are in a good family factor will provide a boost to the condition of the family environment that does not smoke, the environment that is smoke-free of factories, and the location of the house is not on the side of the highway (Jasmine Rahma Saputri, 2025). Toddler lives in one house with exposure to cigarette smoke and indoor pollutants more susceptible to ARI, parents smoking while holding children and using mosquito repellent, burns the risk of developing ARIA 48% (Liu et al., 2025). Poor ventilation causes pollutants, bacteria, viruses to be trapped, and high occupancy densities increase the risk of disease transmission and experiencing ARI(Dingis et al., 2023) (Nabiha et al., 2023). Houses with dirt or cement floors so that they cannot be cleaned optimally result in the growth of bacteria that do not die easily (multiply at humid temperatures). The use of patent windows so that the windows cannot be opened, which results in poor air circulation that increases the humidity of the air causing microorganisms and bacteria to easily develop(Rafaditya et al., 2022)

Based on the results of the Spearman correlation test, it shows that individual factors are related to environmental factors. Individual factors have important factors in environmental factors. Individual factors can both guarantee that the environmental conditions are free of air pollution, the ventilation functions well has permanent natural ventilation with an area

of at least 10% of the interior floor area, ventilation is able to provide sufficient air exchange of 5 cubic meters per minute per inhabitant and maintains a comfortable temperature between 18 to 30^{Oc} and the occupancy density does not exceed (Thanks, 2024).

CONCLUSIONS

Areas located at the foot of Mount Merapi with cold and humid air temperatures, individual factors and environmental factors influence the occurrence of ARI. Toddlers will experience ARI if the individual factors are bad and environmental factors are bad. In order for toddlers not to experience ARI, it is necessary to have awareness from parents to increase the immune system. So that individuals who are in poor condition can increase exclusive breastfeeding, complete immunization for toddlers. In addition, to protect the environment, it is necessary to have awareness from family members of the father who does not smoke, the existence of a house with sufficient ventilation and fulfills the requirements for a healthy home.

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