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## Risk Factors for The Incidence of Acute Respiratory Infection (ARI) in Toddlers in The Working Area of Tarus Primary Health Center, Kupang District

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### Abstract

**Introduction:** ARI is an acute infection that attacks one or more parts of the respiratory tract, from the nose to the deep tissues of the lungs. The number of ARI in toddlers in the Tarus primary health center in 2020 was 1.352 people and in 2021 there was a decrease of 97 people recorded, in January 2022 to February 2023, the number of ARI in toddlers increased by 1.141 cases.

**Methods:** This research used a case-control study design. The case group is toddlers who experience ARI events, while the control group is toddlers who do not experience ARI events. The total population of toddlers in the Tarus Primary Health Center for the period January 2022 to February 2023 was 5,370 toddlers with a case group population of 1,141 toddlers and a control group population of 4,229 toddlers. The sample obtained for the case group was 117 toddlers and for the control group was 117 toddlers with a total of 234 samples.

**Results:** The results showed no significant relationship between age ( $p=1.000$ ;  $OR=1.000$ ), and gender ( $p=0.428$ ;  $OR=0.738$ ) with the incidence of ARI in toddlers. There was a significant relationship between immunization status ( $p=0.000$ ;  $OR=25.143$ ), exclusive breastfeeding history ( $p=0.000$ ;  $OR=25.016$ ), house occupancy density ( $p=0.000$ ;  $OR=15.416$ ), house ventilation ( $p=0.000$ ;  $OR=9.079$ ) and smoking habits of family members ( $p=0.000$ ;  $OR=9.775$ ) with the incidence of ARI in toddlers.

**Conclusion:** The incidence of ARI in toddlers can occur due to several risk factors such as immunization status, exclusive breastfeeding history, house occupancy density, house ventilation, and smoking habits of family members.

**Keywords:** Toddler, ARI, Case-Control Study

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### Introduction

Acute Respiratory Infections (AR) are one of the main causes of death in infants under five years old in the world. The disease is most prevalent in developing countries of the world. The population continues to grow and is uncontrolled

resulting in population density in an area that is not well organized in terms of social, cultural, and health aspects.<sup>[1]</sup> Acute Respiratory Infection (ARI) is one of the many diseases that are very well recognized by the public where this disease attacks the

respiratory tract starting from the nose (upper respiratory tract) to the alveolus (lower respiratory tract) including the adnexal membrane (middle ear cavity, pleura, and sinuses).<sup>[2]</sup>

ARI disease begins with fever accompanied by one or more symptoms, namely sore throat or pain when swallowing, runny nose, dry cough, or phlegm. The prevalence of ARI was calculated within the last month.<sup>[3]</sup> Based on data from the Indonesia Health Profile, the incidence of ARI in 2017 was 447.431 cases, meanwhile, in 2018 there were 478.078 cases, and in 2019 there were 885.551 cases.<sup>[4]</sup>

Recorded in the East Nusa Tenggara Health Profile, the incidence of ARI always ranks first out of the 10 biggest diseases for three consecutive years.<sup>[5]</sup> The number of general ARI toddlers in the working area of the Tarus Primary Health Center in 2020 was 1.352 people and in 2021 it has decreased, namely 97 people.<sup>[6]</sup> From January 2022 to February 2023, the number of general ARI cases increased by 1.141 cases.<sup>[7]</sup>

Based on the data obtained, the incidence of ARI in toddlers from January 2022 to February 2023 was caused by several risk factors such as immunization status, exclusive breastfeeding history, house occupancy density, house ventilation, and smoking habits of family members.

## Methods

This research used a case-control study design. The case group is toddlers who experience ARI events, while the control group is toddlers who do not experience ARI events. The total population of toddlers in the Tarus Health Center working area for the period January 2022 to February 2023 was 5,370 toddlers with a case group population of 1,141 toddlers and a control group population of 4,229 toddlers. The sample obtained for the case group was 117 toddlers and for the control group was 117 toddlers with a total of 234 samples using a sampling technique is *simple random sampling*.

## Results

Based on results, toddlers under 2 years old and over 2 years old can get ARI because toddlers are vulnerable to disease. There are also the number of ARI cases between male and female toddlers has a slight difference in numbers, which means that both male and female toddlers can get ARI. The toddlers with incomplete immunization status can easily get ARI due to a weakened immune system and the toddlers who do not receive exclusive breastfeeding can easily get diseases because they do not get natural antibodies from their mother's breast milk.

Toddlers who live in houses with crowded conditions can get ARI and other diseases because houses with a high density of occupants can easily transmit diseases among adults and toddlers. And toddlers who live in houses with unqualified ventilation conditions can easily get ARI and other diseases due to the obstructed air exchange process so indoor air cannot be replaced with air from outside the house properly.

Based on the research, toddlers who have families with smoking habits can easily get respiratory diseases such as ARI due to lung conditions that have been polluted by cigarette smoke.

## Discussion

### *Relationship between Age of Toddlers and the Incidence of ARI in Toddlers*

Age is one of the risk factors affecting the incidence of ARI in toddlers. Toddlers aged 12-59 months are a group that is vulnerable to respiratory disorders, one of which is ARI, where ARI cases that occur in toddlers are more common than in adults because the immune system of toddlers is not yet fully formed, so it can affect their ability to fight viruses and bacteria.<sup>[8]</sup>

Based on the results of the analysis and interviews, the researcher assumed that the age of toddlers <2 years and ≥2 years is a risk factor for toddlers exposed to ARI. Therefore, this toddler age variable does not have a relationship with the incidence of ARI because not only toddlers <2 years of age can experience ARI incidence but toddlers ≥2 years of age can also experience ARI incidence.

Table 1. Relationship between dependent and independent variable

Variable	Category	Incidence of ARI				OR 95% CI	p-value
		Case		Control			
		n	%	n	%		
Age	Yes	52	44.4	52	44.4	1.000 (0.597-1.675)	1.000
	No	65	55.6	65	55.6		
	Total	117	100.0	117	100.0		
Gender	Male	63	53.8	70	59.8	0.783 (0.466-1.315)	0.428
	Female	54	46.2	47	40.2		
	Total	117	100.0	117	100.0		
Immunization Status	Yes	96	82.1	18	15.4	25.143 (12.620-50.094)	0.000
	No	21	17.9	99	84.6		
	Total	117	100.0	117	100.0		
Exclusive breastfeeding history	Yes	97	82.9	19	16.2	25.016 (12.575-49.764)	0.000
	No	20	17.1	98	83.3		
	Total	117	100.0	117	100.0		
House Occupancy Density	Yes	89	76.1	20	17.1	15.416 (8.113-29.292)	0.000
	No	28	23.9	97	82.9		
	Total	117	100.0	117	100.0		
House Ventilation	Yes	82	70.1	24	20.5	9.079 (4.991-16.514)	0.000
	No	35	29.9	93	79.5		
	Total	117	100.0	117	100.0		
Smoking Habits of Family Members	Yes	85	72.6	25	21.4	9.775 (5.362-17.821)	0.000
	No	32	27.4	92	78.6		
	Total	117	100.0	117	100.0		

The results of this study are supported by research conducted by Nova, *et al* (2021) with the research title “The Relationship between the Incidence of ARI in Toddlers According to Individual Aspects and the Physical Environment of the House in Sukadanau Village” which indicates a *p-value* of 1,000 which means that there is no significant relationship between the age of toddlers and the incidence of ARI in toddlers. From this study, one of the individual aspects studied was age where it was found that toddlers who were aged 12-59 months are a group that is vulnerable to respiratory disorders, one of which is ARI, where ARI cases that occur in toddlers are more common than adults, because the immune system of toddlers is not yet fully formed, so it can affect their ability to fight viruses and bacteria.<sup>[22]</sup> This is in line with what the researchers did, which is not only the age of toddlers <2 years old who can be at risk of ARI, but the age of toddlers ≥2 years old can also be at risk of ARI.

#### *Relationship between Gender of Toddlers and the Incidence of ARI in Toddlers*

Gender by many experts is believed to be one of the factors that significantly influence the incidence of ARI in toddlers, both male and female toddlers are susceptible to ARI because at this time male and female toddlers have the same habits in terms of playing, both outside and inside the house. This can increase the risk of girls getting ARI, in other words, boys and girls are at the same risk of getting ARI.<sup>[10]</sup>

Based on the results of the analysis and interviews, researchers assume that there is no relationship between gender and the incidence of ARI in toddlers because male and female toddlers have the same habits in terms of playing both inside and outside the home.

The results of this study are supported by research conducted by Muh. Arman, Wahiduddin, Rismayanti (2022) with the research title “Factors Associated with the Incidence of ARI in Toddlers Around the Waste Landfill Area” indicates a *p-value* of 0,648 which means that there is no significant relationship between gender and

the incidence of ARI in toddlers. In this study, it is said that the gender of toddlers has no relationship with the incidence of ARI because at this time male and female toddlers have the same habits in terms of playing, both outside and inside the house. This can increase the risk of girls getting ARI, in other words, boys and girls are at equal risk of being exposed to ARI.<sup>[10]</sup>

#### *Relationship between Immunization Status of Toddlers and the Incidence of ARI in Toddlers*

The immunization status of toddlers describes the history of immunization vaccine administration in toddlers according to the age of the toddler and the time of administration. Immunization aims to provide immunity to children against certain diseases.<sup>[11]</sup>

Based on the results of interviews with the respondents, namely mothers of toddlers, the reason why there are still many toddlers who have incomplete immunization status is that at the time of the posyandu schedule for immunization, the toddler is experiencing illness, There are also parents who do not have time to take their children to the posyandu for immunization because they are working either as employees or selling and this happens more when the toddler will be immunized for the last type of immunization. This is what causes incomplete immunization status of toddlers. Based on the results of these interviews, researchers assume that toddlers are more susceptible to ARI due to incomplete immunization status.

The results of this study are supported by research conducted by Muh. Arman, Wahiduddin, Rismayanti (2022) with the research title “Factors Associated with the Incidence of ARI in Toddlers Around the Waste Landfill Area” indicate a *p-value* of 0,031 which means that there is a significant relationship between immunization status and the incidence of ARI in toddlers. This study says that ARI comes from diseases that develop from preventable diseases such as diphtheria and measles, so increasing immunization coverage will play a major role in efforts to

prevent ARI in toddlers. Therefore, mothers of toddlers are advised to prevent disease by giving immunizations to increase toddlers' immune systems.<sup>[10]</sup>

#### *Relationship between Exclusive Breastfeeding History and ARI Incidence in Toddlers*

Breast milk is the first natural food for a baby and provides all the vitamins, nutrients, and minerals a baby needs for the first six months of growth, no other liquids or foods are required. Breast milk continues to provide up to half or more of a child's nutritional needs in the first year and into the second year of life. In addition, breast milk contains antibodies from the mother that help fight disease.<sup>[26]</sup>

Based on the results of interviews with mothers of toddlers, there are mothers of toddlers who give drinks or additional food to toddlers during the exclusive breastfeeding period for 6 months, there are also some toddlers who are not given breast milk because the mother's milk production has stopped so they are no longer given and continued with formula milk. Based on the results of the analysis and interviews, the researcher assumes that from the mother's view toddlers do not feel full if only given breast milk alone, so they give additional drinks such as formula milk and additional food such as instant porridge or homemade made until smooth.

The results of this study are supported by research conducted by Fauziah (2018) with the research title "The Relationship between Exclusive Breastfeeding History and the Incidence of Acute Respiratory Tract Infections in Toddlers at the Lepo-Lepo Health Center, Kendari City in 2018". Exclusive breastfeeding can prevent ARI because breast milk contains antibodies that can protect the toddler's body against infection, so toddlers who are exclusively breastfed are not susceptible to disease.<sup>[28]</sup>

#### *Relationship between House Occupancy Density and the Incidence of ARI in Toddlers*

House occupant density is the ratio of the floor area in the house to the number of family members living in the house. According to the Indonesian Ministry of Health (1999) housing health requirements,

requirements for occupancy density are expressed in  $m^2$  per person.<sup>[16]</sup>

Based on the results of interviews and observations in the field with mothers of toddlers, mothers and toddlers are living in houses with dense conditions due to a large number of family members, some respondents say that they are still in the same house with their parents and some have more than one household in one house and several mothers have more than one toddler, and mothers of toddlers said that even though the house is in the condition of a large number of family members or dense if there is one who is sick, they can keep their distance from toddlers or other toddler so that other toddlers are not affected by the disease. This is of course a risk factor for toddlers to get ARI because ARI diseases are transmitted through droplets or air, therefore if the condition of the house is in a dense category, the level of risk of disease transmission is even greater. This is very dangerous for toddlers who are prone to ARI.

The results of this study are supported by research conducted by Salimah, et al (2021) with the research title "The Relationship between Residential Density and Smoking Behavior with the Incidence of ARI in Toddlers in the Working Area of Mandomai Health Center, Kuala Kapuas City in 2021". In this study, it is said that the dense number of occupants in a room will increase CO<sub>2</sub> levels in the room and worsen the air in the room. In addition, the number of people living in one space also plays a role in the speed of microorganisms in the environment. If part of the person or more who sleeps in the same room with a toddler suffering from ARI and releases droplets containing ARI pathogens, it will cause direct transmission to toddlers.<sup>[30]</sup>

#### *Relationship between House Ventilation and the Incidence of ARI in Toddlers*

Ventilation is the process of providing air or directing air to or from a room either naturally or mechanically. Home ventilation has many functions.<sup>[31]</sup>

Based on the results of interviews and measurements of the ventilation area in each respondent's house, there are many houses with unqualified ventilation

size due to the modern form of ventilation so that the size is not large or not follow health standards where the size should be  $\geq 10\%$  of the floor area of the houses. Based on the results of analysis and observations in the field, researchers assume that mothers of toddlers assume that opening the window every day has made clean air circulation into the house or room so that the small size of the ventilation does not affect the circulation of air in and out.

The results of this study are supported by research conducted by Rafaditya, et al (2021) with the research title "Home Ventilation and Lighting Associated with Acute Respiratory Tract Infection (ARI) in Toddlers: Analysis of Physical Environmental Factors". This study says that ventilation functions as a means of air exchange so that the room air is always maintained. Ventilation is said to be good if the area is  $\geq 10\%$  of the floor area so that it allows air circulation in the room. If the ventilation area is  $< 10\%$ , the air circulation in the house is poor, causing the indoor air humidity to increase, making it easier for bacteria and microorganisms to grow.<sup>[33]</sup>

#### *Relationship between Smoking Habits of Family Members and the Incidence of ARI in Toddlers*

Millions of children breathe in secondhand smoke, even in their neighborhoods. Passive smoking can be damaging to health, especially for children as their lungs are still developing.<sup>[34]</sup>

Based on the results of interviews with mothers of toddlers, there are family members who have a habit of smoking who live in one house with the toddler and smoking habits in the house, but there are also family members who smoke outside the home, and the smoke from the cigarette is still inhaled by toddlers, so this is the cause of toddlers affected by respiratory problems. Based on the results of the analysis and observations in the field, the researcher assumes that most family members smoke inside the house and outside the house near toddlers. This happens because of the lack of knowledge of family members about the dangers of cigarette smoke if inhaled by toddlers. Smoking inside the house or outside the house close to toddlers has become a habit

that is often carried out by family members. Toddlers who have parents or other family members who smoke are at greater risk of developing ARI so it easily causes other diseases also due to the weakening of the toddlers' immune system.

The results of this study are supported by research conducted by Muh. Arman, Wahiduddin, Rismayanti (2022) with the research title "Factors Associated with the Incidence of ARI in Toddlers Around the Waste Landfill Area". In this study, it was said that if a family member smokes, there is a very high risk that the child can get respiratory diseases such as ARI. If children are exposed to cigarette smoke and then the smoke enters their respiratory tract, it will interfere with the child's respiratory tract and can even increase the risk of developing ARI and will experience lung problems when the child is an adult.<sup>[10]</sup>

#### **Conclusion**

There is no relationship between the age of the toddler and the gender of the toddler with the incidence of ARI in toddlers in the working area of Tarus Primary Health Center, Kupang District. There is a relationship between immunization status, exclusive breastfeeding history, house occupancy density, house ventilation, and smoking habits of family members with the incidence of ARI in toddlers in the working area of Tarus Primary Health Center, Kupang District. Suggestions for the Tarus Primary Health Center are to conduct health education by health promotion officers about the incidence of ARI in toddlers involving many people, such as posyandu activities, and provide counseling on how to overcome risk factors that can cause ARI incidents, for example, if there are family members who smoke then keep toddlers away from the person's reach so that cigarette smoke is not inhaled by the toddler.

#### **Ethics approval**

This study has received ethical approval from the Health Research Ethics Commission of the Faculty of Public Health, Nusa Cendana University, with number: 2023120-KEPK, the year 2023.

## Availability of data and materials

Available

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## Author Contribution

ESKDO collected and analyzed data using a questionnaire to determine the relationship between the age of toddlers, gender of toddlers, immunization status, exclusive breastfeeding history, house occupancy density, house ventilation, and smoking habits of family members with the incidence of ARI in toddlers in the working area of the Tarus Primary Health Center. The author has read and agreed on the final manuscript.

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