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Environmental Health Factors Associated with the Incidence of Acute Respiratory Infection in Toddlers

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Abstract

The purpose of this study was to analyze the environmental health factors associated with the incidence of acute respiratory infections in toddlers at the Bulango Selatan Health Center, Bone Bolango Regency. This type of observational research with a cross sectional study design. The population is households with toddlers in Bulango Selatan District in 2021 as many as 305 households. A sample of 173 households was calculated using the slovin formula and drawn using purposive sampling technique. Univariate analysis in the form of frequency distribution, bivariate analysis was performed using the chi square test. Multivariate analysis was performed by logistic regression test. All data processing and analysis uses SPSS. Based on the findings, it can be concluded that there is a relationship between house ventilation (χ2 count 34.479; ρ value 0.000), house humidity (χ2 count 19.737; ρ value 0.000), house lighting (χ2 count 8.176; ρ value 0.004), house roomization (χ2 count 10.473 ; ρ value 0.001), kitchen conditions (χ2 Count 7.874; ρ value 0.005), residential density (χ2 Count 12.210; ρ value 0.000), and exposure to cigarette smoke (χ2 Count 6.25; ρ value 0.012) with disease incidence acute respiratory infections in toddlers at the Bulango Selatan Health Center. House ventilation is the environmental health factor that is most related to the incidence of acute respiratory infections in toddlers at the Bulango Selatan Health Center, Bone Bolango Regency. Toddlers with inadequate ventilation conditions tend to be 7.3 times more at risk of experiencing ARI compared to toddlers living with adequate ventilation conditions.

Introduction

The problem of Acute Respiratory Infection (ARI) is one of the most common causes of death in children in developing countries. Almost all deaths due to ARI in children aged 1-5 years are caused by acute lower respiratory tract infections (ARI), most often pneumonia (WHO, 2018). ARI is still a major cause of morbidity and mortality from infectious diseases in the world. ARI mortality rate reaches 4.25 million every year in the world. Based on data from the World Health Organization (WHO) in 2019 lower respiratory tract infections reduced life expectancy by 2.09 years in sufferers (WHO, 2019). The most at risk group is toddlers. Approximately 20-40% of patients hospitalized among children are due to ARI with around 1.6 million deaths due to pneumonia alone in children under five per year. In adults, the mortality rate for adults (25-59 years) reaches 1.65 million (Ariani & Anwar, 2019).

The United Nations International Children's Emergency Fund (UNICEF) reported in 2020 that ARI due to pneumonia kills more children than any other infectious disease worldwide. Pneumonia kills 800,000 children every year or about 2,200 deaths a day. Globally, more than 1,400 cases of pneumonia per 100,000 children, or 1 case per 71 children each year, with the

largest incidents occurring in South Asia, namely 2,500 cases per 100,000 children and West and Central Africa, namely 1,620 cases per 100,000 children (UNICEF, 2020). ISPA disease in developing countries, is a 25% contributor to death in children, especially in infants aged less than two months. Indonesia is one of the developing countries with the highest ISPA cases. ARI in Indonesia always ranks first as the cause of death in infants and toddlers. ARI also often occupies the top 10 list of diseases in hospitals and health centers. ISPA is still a health problem in Indonesia because the impact it has is enormous on sufferers, not only in infants and toddlers, but also in adults, apart from that ISPA can also be a trigger for other diseases (RI Ministry of Health, 2017).

Based on routine report data from the 2020 ISPA Sub-Directorate of the Ministry of Health, it was found that the incidence (per 1000 children under five) in Indonesia was 20.06%, almost the same as the previous year's data, in 2019 it was 20.56%. The estimated case of ARI nationally is 3.55%. The proportion of under-five deaths due to pneumonia ranks second (13.2%) after diarrhea. ISPA control in Indonesia has been initiated since 1984, in carrying out the Acute Respiratory Infection Control Program (ARI P2 Program), the first ISPA National Workshop was held in Cipanas, West Java, which was then followed by the establishment of the ISPA sub-directorate within the Directorate General of Communicable Disease Prevention (PPM) and Settlement Environmental Health (PLP). Based on the Decree of the Minister of Health 558 of 1984 concerning the organization and work procedures of the Ministry of Health (Kemenkes RI, 2019).

The prevalence of ARI in Indonesia is at the level of 9.3%. Meanwhile in Central Java Province, the prevalence of ARI is 8.7%. As many as 25% of ARI cases occur in children under the age of five and at the age of 5 years and over, the prevalence of ARI is 10%. Incidence is higher in women than men. This study aims to determine the relationship between age, gender and the January-December 2018 period with the incidence of ARI (Bandar et al, 2021).

Based on data from the Bone Bolango District Health Office, the number of ISPA sufferers in 2019 was 4,800 sufferers, 4,147 diarrheal diseases, the number of residents using clean water facilities that met the requirements was 1173,456 or 76.6%, the population using latrines was 101,595 or 42.5 % and the number of healthy houses is 25,269 or 60.4%. (Bone Bolango District Health Office, 2020).

Based on Profile Data from the Bone Bolango District Health Office, the implementation of Acute Respiratory Disease Inspection (ARI) activities in 2020 was constrained by the Covid 19 pandemic, apart from budget efficiency, almost all activities were focused on handling Covid 19. However, cases of toddler pneumonia that were recently reported As far as what is found at the health center, almost all city districts have not involved hospitals in their reporting system, so it is very likely that the estimated number of cases so far is used to estimate the area, so if each region has included hospital reports, the description may be different. It can be seen from the data that the coverage of the discovery of pneumonia under five at the district/city level did not reach 60% in 2020. Of the 5 districts, Bone Bolango Regency reached 24.71%.

Based on data from the Health Office of Bone Bolango Regency, the number of cases of ISPA under five in 2021 totaled 3,822 cases spread over 18 sub-districts in Bone Bolango Regency. This study aims to determine the effect of implementing a sanitation clinic on the incidence of environment-based diseases in the South Bulango Health Center area, by taking two types of environment-based diseases that are dominant in the South Monthly Health Center, namely diarrhea which is closely related to the provision of clean water and family latrines and ISPA. closely related to healthy housing.

The Bulango Selatan Health Center in 2019 was the health center with the highest number of ISPA cases in Bone Bolango Regency. In the last three years the number of ARI cases in toddlers in 2019 was 1082 cases with a percentage (68.8%), in 2020 there were 690 cases with

a percentage (43.8%) and in 2021 there were 695 cases with a percentage (44.2%) %). ISPA cases at the South Bulango Health Center in 2021 are ranked first in the 10 biggest diseases at the health center (Bulango Selatan Health Center Profile, 2021). The 2001 National Health Survey (SURKENAS) showed that acute respiratory infections (ARI) ranked 2nd with 15.7% of deaths, diarrheal diseases ranked 3rd with 9.6% of deaths, tuberculosis ranked 4th with 7, 4% mortality. In total, environmental-based diseases account for 33% or a third of total deaths in all age groups (Bone Bolango District Health Office, 2020)

Infants and toddlers are a group of people who are very vulnerable to various kinds of diseases, especially infectious diseases. The toddler period is a period that is very sensitive to the environment and this period is very short and cannot be repeated, so the toddler period is also referred to as the "golden period" (golden period) and "critical period" (critical period). The basic growth that takes place in infancy and toddlers greatly influences and determines the development of subsequent children. Therefore, this group must receive protection to prevent the occurrence of a disease that can cause growth and development to be disrupted or even cause death. One of the highest causes of death in infants and toddlers is acute respiratory infection (ARI), (Yanti & Sari, 2018).

Methods

This type of research is an observational study with a cross sectional study design. Epidemiologically, the design of this study aims to study the relationship between disease and exposure by observing exposure status and disease incidence simultaneously (point time) in individuals from a population. In its application to this study, a research design was created which was intended to study the relationship between several independent variables (ventilation, humidity, lighting, roomization, kitchen conditions, occupant density, biomass fuel and smoking) on the dependent variable the incidence of ARI. This research will be carried out at the South Bulango Health Center in Bone Bolango district. The population in this study are households with toddlers in South Bulango District based on data from the South Bulango Health Center in 2021 as many as 305 households. The sample in this study were households with toddlers aged 24-59 months in the working area of the South Bulango Health Center. Data collection techniques using interviews and observation.

Results and Discussion

The research was conducted at the Bulango Selatan Health Center in February-April 2023. This type of research was an observational study with a cross-sectional study design. The population is households with toddlers in Bulango Selatan District in 2021 as many as 305 households. A sample of 173 households was calculated using the slovin formula and drawn using purposive sampling technique. Univariate analysis in the form of frequency distribution, bivariate analysis was performed using the chi square test. Multivariate analysis was performed by logistic regression test. All data processing and analysis uses SPSS.

Characteristics of Respondents

Frequency distribution of respondents based on maternal age characteristics

Table 1. Frequency distribution of respondents based on maternal age characteristics

No	Mother's Age	Frequency (n)	Percentage (%)
1	<20 Years	5	2,9
2	20-35 Years	161	93,1
3	>35 Years	7	4,0
	Sum	173	100,0

Source: Primary Data, 2023.

The table shows that most pregnant women in this study were aged 20-35 years, which was 161 people (93.1%), and at least <20 years old, which was 5 people (2.9%).

Frequency distribution of respondents based on maternal education level characteristics

Table 2. Frequency distribution of respondents based on maternal education level characteristics

No	Mother's Education	Frequency (n)	Percentage (%)
1.	Elementary (Elementary-Junior High)	58	33,5
2.	Intermediate (SMA)	84	48,6
3.	College (College)	31	17,9
Sum		173	100,0

Source: Primary Data, 2023.

The table shows that most of the pregnant women in this study had a secondary education (SMA) which was 84 people (48.6%), and at least a college education (Higher Education) which was as many as 31 people (17.9%).

Frequency distribution of respondents based on maternal job characteristics

Table 3. Frequency distribution of respondents based on maternal job characteristics

No	Mother's Work	Frequency (n)	Percentage (%)
1.	Honorary Personnel	7	4,0
2.	Housewives	91	52,6
3.	Civil Servant	23	13,3
4.	Private Employees	20	11,6
5.	Self employed	32	18,5
Sum		173	100,0

Source: Primary Data, 2023.

The table shows that most of the pregnant women in this study were housewives, namely 91 people (52.6%) and at least worked as honorary workers, which were 7 people (4.0%).

Frequency distribution of respondents based on maternal occupational characteristics

Table 4. Frequency distribution of respondents based on age characteristics of toddlers

No	Age of Toddler	Frequency (n)	Percentage (%)
1.	24-35 Months	78	45,1
2.	36-47 Months	52	30,1
3.	48-59 Months	43	24,9
Sum		173	100,0

Source: Primary Data, 2023.

The table shows that most toddlers in this study were aged 24-35 months, which was 78 people (45.1%) and at least 48-59 months old, which was 43 people (24.9%).

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Frequency distribution of respondents based on sex characteristics of toddlers

Table 5. Frequency distribution of respondents based on sex characteristics of toddlers

No	Gender of Toddler	Frequency (n)	Percentage (%)
1.	Man	82	47,4
2.	Woman	91	52,6
Sum		173	100,0

Source: Primary Data, 2023.

The table shows that most of the toddlers in this study were female, which was 91 people (52.6%) and at least male, which was 82 people (47.4%).

Univariate Analysis

Home Ventilation Conditions for Toddlers

Table 6. Home Ventilation Conditions for Toddlers at the South Bulango Health Center, Bone Bolango Regency

No	Home Ventilation	Frequency (n)	Percentage (%)
1.	Qualify	105	60,7
2.	Not Eligible	68	39,3
Sum		173	100,0

Source: Primary Data, 2023.

The table shows that most of the toddlers in this study lived in homes where ventilation conditions met the requirements, which was as many as 105 people (60.7%). Meanwhile, respondents who live in houses with ventilation conditions do not meet the requirements as many as 68 people (39.3%). The condition of house ventilation that meets the requirements in this study is the ventilation area of the house > 10% of the floor area of the house.

Home Humidity Conditions for Toddlers

Table 7. Home Humidity Conditions for Toddlers at

No	Home Humidity	Frequency (n)	Percentage (%)
1.	Qualify	104	60,1
2.	Not Eligible	69	39,9
Sum		173	100,0

Source: Primary Data, 2023.

The table shows that most of the toddlers in this study lived in homes where humidity conditions met the requirements, which was 104 people (60.1%). Meanwhile, respondents who live in houses with unqualified humidity conditions are 69 people (39.9%). The condition of home humidity that meets the requirements in this study is the result of measuring the humidity of the toddler's bedroom with a hygrometer is 40-70%.

Home Lighting Conditions for Toddlers

Table 8. Home Lighting Conditions for Toddlers

No	Home Lighting	Frequency (n)	Percentage (%)
1.	Qualify	107	61,8

2.	Not Eligible	66	38,2
Sum		173	100,0

Source: Primary Data, 2023.

The table shows that most of the toddlers in this study lived in homes where lighting conditions met the requirements, which was 107 people (61.8%). Meanwhile, respondents who live in houses with lighting conditions do not meet the requirements as many as 66 people (38.2%). Home lighting conditions that meet the requirements in this study are the results of light measurements in the toddler's bedroom with a lux meter $\geq$ 60 lux.

Bivariate Analysis

Analysis of the relationship between home ventilation and the incidence of acute respiratory infections in toddlers

Table 9. Analysis of the Relationship between House Ventilation and the Incidence of Acute Respiratory Infections in Toddlers

Home Ventilation	ARI Occurrence				Total		x2 Count R Value
	ISPA		Not ISPA				
	n	%	n	%	N	%	
Qualify	19	11,0	86	49,7	105	60,7	34,479 0,000
Not Eligible	42	24,3	26	15,0	86	39,3	
Sum	61	35,3	112	64,7	173	100,0	

Source: Primary Data, 2023

The table shows that in 61 people (35.3%) under five who experienced ARI, there were 19 people (11.0%) who were eligible home ventilation and 42 people (24.3%) who were ineligible ventilation. Meanwhile, in 122 people (64.7%) under five who did not experience ARI, there were 86 people (49.7%) whose home ventilation conditions were eligible and 26 people (15.0%) whose home ventilation conditions were not eligible. The results of the chi square test get a value of $\chi 2$ count 34.479 > $\chi 2$ table (3.841) and ρ value 0.000 < α (0.05). It is interpreted that there is a relationship between home ventilation and the incidence of acute respiratory infections in toddlers at the South Bulango Health Center.

Home humidity and the incidence of acute respiratory infections

Table 10. Analysis of the Relationship between Home Humidity and the Incidence of Acute Respiratory Infections in Toddlers

Home Humidity	ARI Occurrence				Total		x2 Count R Value
	ISPA		Not ISPA				
	n	%	n	%	N	%	
Qualify	23	13,3	81	46,8	104	60,1	19,737 0,000
Not Eligible	38	22,0	31	17,9	69	39,9	
Sum	61	35,3	112	64,7	173	100,0	

Source: Primary Data, 2023

The table shows that in 61 people (35.3%) toddlers who experienced ARI, there were 23 people (13.3%) toddlers whose home humidity conditions were eligible and 38 people (22.0%) whose humidity conditions were not eligible. Meanwhile, in 122 people (64.7%) under five who did not experience ARI, there were 81 people (46.8%) who met the house humidity conditions and 31 people (17.9%) did not meet the house humidity conditions.

The results of the chi square test analysis get a value of $\chi 2$ count 19.737 > $\chi 2$ table (3.841) and ρ value 0.000 < α (0.05), it can be stated that there is a relationship between house humidity

and the incidence of acute respiratory infections in toddlers at the South Bulango Health Center, Bone Bolango Regency.

Analysis of the relationship between home lighting and the incidence of acute respiratory infections in toddlers

Table 18. Analysis of the Relationship between Home Lighting and the Incidence of Acute Respiratory Infections in Toddlers

Home Lighting	ARI Occurrence				Total		x2 Count R Value
	ISPA		Not ISPA				
	n	%	n	%	N	%	
Qualify	29	16,8	78	45,1	107	61,8	8,178 0,004
Not Eligible	32	18,5	34	19,7	66	38,2	
Sum	61	35,3	112	64,7	173	100,0	

Source: Primary Data, 2023

The table shows that in 61 people (35.3%) toddlers who experienced ARI, there were 29 people (16.8%) toddlers whose home lighting conditions were eligible and 32 people (18.5%) whose lighting conditions were not eligible. Meanwhile, in 122 people (64.7%) under five who did not experience ARI, there were 78 people (45.1%) who qualified home lighting conditions and 34 people (19.7%) did not meet home lighting conditions.

The results of the chi square test analysis get a $\chi 2$ count value of 8.176 and a ρ value of 0.004. The fulfilled hypothesis is $\chi 2$ Count 8.176 > $\chi 2$ table (3.841) and ρ value 0.004 < α (0.05), it can be stated that there is a relationship between home lighting and the incidence of acute respiratory tract infections in toddlers at the South Bulango Health Center, Bone Bolango Regency.

Multivariate Analysis

Table 23. Environmental Health Factors Most Associated with the Incidence of Acute Respiratory Infections in Toddlers

Variable	Itself.	OR	95% CI for EXP (B)	
			Lower	Upper
Ventilation	0,000	7,312	3,641	14,683
Moisture	0,000	4,317	2,225	8,377
Lighting	0,005	2,531	1,329	4,820
Kamarisasi	0,001	2,883	1,504	5,529
Kitchen conditions	0,005	2,474	1,305	4,689
Occupancy density	0,001	3,158	1,638	6,090
Exposure to secondhand smoke	0,013	2,291	1,188	4,417

Source: Primary Data, 2023

Based on the variable selection table, it can be seen that for all environmental health factors the environment in toddlers at the Bulango Selatan Health Center, Gorontalo Regency has a value of ρ <0.05. The estimated Odd Ratio (OR) value with the incidence of acute respiratory infections in the house ventilation variable is 7.312 and is the largest OR value of the 7 environmental health factor variables studied. So it can be interpreted that the variable house ventilation is the environmental health factor that is most related to the incidence of acute respiratory infections in toddlers at the Bulango Selatan Health Center, Bone Bolango Regency. Toddlers with inadequate ventilation conditions tend to be 7.3 times more likely to experience ARI than toddlers living with adequate ventilation conditions.

Correlation between House Ventilation and the Incidence of Acute Respiratory Infection in Toddlers

The results showed that there was a relationship between home ventilation and the incidence of acute respiratory infections in toddlers at the Bulango Selatan Health Center. This was obtained from the results of the chi square test to get a $\chi 2$ count of 34.479 and a ρ value of 0.000. Of the 61 people (35.3%) under five who had ARI, the majority, namely 42 people (24.3%) did not meet ventilation requirements. Meanwhile, of the 122 children (64.7%) who did not experience ARI, the majority, namely 86 people (49.7%), had adequate house ventilation conditions.

These results are similar to previous research by Medhyna (2019), in the working area of the Pasaman District Health Center, which found that the statistical test obtained $p = 0.04$, so it can be concluded that there is a significant relationship between home ventilation and the incidence of ARI. Pathogenic bacteria that cause ARI can be released from room air flowing out through ventilation that meets the requirements. The humidity in the room rises causing bacteria to develop properly, but with ventilation that meets the requirements this will not happen because good ventilation keeps the humidity in the room optimal.

The conditions for house ventilation that met the requirements in this study were the ventilation area of the house > 10% of the floor area of the house. The relationship between house ventilation and the incidence of acute respiratory infections in toddlers can be explained by researchers that indoor air that is poorly ventilated tends to contain more germs, viruses and other harmful particles that can cause ARI. The bacteria and viruses that cause the flu, colds, bronchitis, or pneumonia can spread more easily in stagnant, poorly circulated air. Poor ventilation can cause high humidity levels in the house. Excessive humidity creates an ideal environment for the growth of mold and mites, which can trigger respiratory allergies in toddlers and increase the risk of ARI.

In addition, poor ventilation can lead to high humidity levels in the house. Excessive humidity creates an ideal environment for the growth of mold and mites, which can trigger respiratory allergies in toddlers and increase the risk of ARI. Poor ventilation can increase the risk of transmitting ARI from adults around toddlers. Adults infected with ARI can transmit this virus or bacteria to children through contaminated air.

Transmission of respiratory tract diseases is caused by germs in the house that cannot be exchanged and settle so that ventilation is required to meet the requirements of the Minister of Health 1039 RI Number RI No.1077/MENKES/PER/V/2011, namely ventilation area of at least 10% of the floor area. Home ventilation has a very important role in the exchange of air from and into the house. Ventilation is the process of supplying fresh air into and removing dirty air from a closed room naturally or mechanically. The availability of fresh air in a house or room is very much needed by humans, so if a room does not have a good ventilation system and is over crowded it will cause conditions that can be detrimental to health. Healthy ventilation must meet the requirements, namely 10% of the floor area (Harto, 2020).

The function of ventilation in the house, among others, is to free the room air from odors, smoke or dust and other pollutant substances by diluting the air, so that the exchange of clean air becomes smooth. This means that the O2 balance needed for the occupants of the house is maintained. Lack of ventilation in the house will cause a lack of O2 in the house which means that the level of toxic CO2 will increase. The second function is to free the air from bacteria, especially pathogenic bacteria. There are two kinds of ventilation namely natural ventilation and artificial ventilation. Natural ventilation is where the airflow in the room occurs naturally through windows, vents or holes coming from the walls and so on. Artificial ventilation is ventilation that uses special devices to circulate air, such as fans and air suction machines (AC). Good ventilation measures 10% of the floor area. Good ventilation will provide fresh air from

outside, ventilation also plays an important role in influencing the intensity of natural lighting in the house. If ventilation is used according to its function, the sunlight entering the house will not be blocked by the ventilation itself. Poor ventilation can endanger health, especially the respiratory tract (Zairinayati & Putri, 2020).

Lack of ventilation will cause a lack of oxygen in the house, which means that the level of carbon dioxide which is toxic to the occupants increases. Acute Respiratory Infection (ARI) is generally caused by bacteria and viruses, where the process of transmission is through the air, with good ventilation, air that has been contaminated with germs will be easily replaced with fresh air (Sudirman et al., 2020).

Correlation between House Humidity and the Incidence of Acute Respiratory Infection in Toddlers

The results showed that there was a relationship between the humidity of the house and the incidence of acute respiratory infections in toddlers at the Bulango Selatan Health Center, Bone Bolango Regency. This is shown from the results of the chi square test which obtained a $\chi 2$ Count value of 19.737 and a ρ value of 0.000. Of the 61 people (35.3%) under five who had ARI, the majority, namely 38 people (22.0%), humidity conditions did not meet the requirements. Meanwhile, for 122 children (64.7%) who did not experience ARI, the majority, namely 81 people (46.8%), met the requirements for humidity conditions in the house.

These results are in line with research from Lestari (2021) which found that the chi square results obtained a p value of 0.002 ($p < 0.05$) which showed that there was a relationship between house humidity and the incidence of ARI. Then it was found that the phi (φ) value was 0.356 which indicated that the relationship between house humidity and the incidence of ARI in toddlers at TPA Tamangappa Antang Makassar in 2020 had an adequate relationship.

Likewise research from Saparina et al. (2020), who obtained the result that based on the results of statistical tests using the Chi Square test, at $\alpha=0.05$ and df = 1, the calculated X2 value > X2 table (34.073> 3.841) was obtained, meaning that there was a significant relationship between humidity and incidence of ARI in toddlers in the Wasolangka Sub-District, Working Area of the Parigi Health Center, Muna Regency. The results of the closeness test showed a Phi coefficient (φ) of 0.641, this shows the strength of the relationship between humidity and the incidence of ISPA in the Wasolangka Subdistrict, Parigi Health Center Work Area, is in the strong relationship category.

The humidity conditions of the house that met the requirements in this study were the results of measuring the humidity of a toddler's bedroom with a hygrometer which was 40-70%. Researchers believe that this relationship exists because humidity that is too high or too low creates an ideal environment for the growth of microorganisms such as mold and dust mites. These microorganisms can cause respiratory allergies and stimulate an inflammatory reaction in the toddler's respiratory tract, increasing the risk of ARI. Humidity that is not up to standard can also trigger asthma and allergy symptoms in toddlers. Toddlers with asthma have respiratory tracts that are sensitive to environmental changes, including high humidity, which can trigger asthma attacks and increase the risk of ARI.

Low humidity can affect the survival of viruses and bacteria in the indoor environment. The flu virus, for example, is more stable in moist air and can survive longer, thereby increasing the risk of transmitting ARI to toddlers. Meanwhile, high humidity can cause accumulation of dust particles and pollutants in the room. These particles and pollutants can irritate toddlers' respiratory tracts and make them more susceptible to infection.

Temperature and humidity are factors that influence the incidence of ARI. Temperature and humidity are closely related to the growth and development of pneumonia etiological factors in the form of viruses, bacteria and fungi. This etiological factor can grow well if the conditions

are optimum. Viruses, bacteria, and fungi that cause ARI for their growth and reproduction require optimal temperature and humidity. At a certain temperature and humidity it allows its growth to be stunted or even not to grow at all or die. But at a certain temperature and humidity it can grow and develop very quickly. This is what is dangerous because children are often in a room with these conditions and for a long time, children are exposed to these risk factors. As a result, there is a greater chance for children to contract ARI (Ariani & Anwar, 2019).

Poor humidity conditions, namely less than 40% or more than 70%. While humidity is considered good if it meets 40% -70%. This is due to ventilation that is less than optimal or does not meet the requirements so that sunlight which is needed to enter the house to kill pathogens is reduced so that it can cause ARI (Lestari, 2021).

Kepmenkes No. 829/1999 states that a house meets the requirements if the humidity value is between 40% - 70%. Humidity levels are not only influenced by the home environment but also by weather factors. Human sweat also affects humidity, the more people who live the higher, especially because of water vapor both from breathing and sweat. Compared to humidity outside the room, in closed spaces where there are many people it also affects humidity (Tarigan & Heryanti, 2021).

The Relationship of Home Lighting with the Incidence of Acute Respiratory Infections in Toddlers

The results showed that there was a relationship between house lighting and the incidence of acute respiratory infections in toddlers at the South Bulango Health Center, Bone Bolango Regency. This was shown from the analysis of the chi square test which obtained a $\chi 2$ Count value of 8.176 and a ρ value of 0.004. Of the 61 people (35.3%) under five who had ARI, the majority, namely 32 people (18.5%), did not meet the lighting conditions. Meanwhile, for 122 people (64.7%) who did not experience ISPA, the majority, namely 78 people (45.1%), met the requirements for house lighting conditions.

The results of this study are in accordance with previous research by Yustati (2020), who found that the relationship between lighting and the incidence of ARI in toddlers, based on univariate results from 265 respondents, 157 (59%) of respondents whose house lighting was not good was greater than the lighting of their house good, namely 108 respondents (41%). The results of the Chi-square test obtained a p value of 0.000 meaning that there is a significant relationship between lighting and the incidence of ARI in toddlers.

Likewise research by Maulana et al. (2022), obtained the result that the chi square statistical test obtained a value of ρ-value = 0.000 (< = 0.05), which means that indoor lighting is a risk factor for the incidence of ARI in toddlers in Write Village, the Work Area of the Written Health Center. The value of OR = 31.714 with CI 95% = 9.716-103.532> 1, which means that toddlers who have a house with lighting that does not meet the requirements are a risk factor for ISPA events 32.714 times greater than those who have a house with lighting that meets the requirements.

The lighting conditions in the house that met the requirements in this study were the results of measuring light in a toddler's bedroom with a lux meter > 60 lux. Researchers assume that the relationship between lighting and the incidence of ARI in toddlers is due to poor lighting or lack of exposure to sunlight in the house which is often associated with a lack of adequate ventilation. Poor ventilation can cause moisture accumulation and indoor pollution. Excessive humidity creates an ideal environment for the growth of microorganisms, such as mold and mites, which can trigger respiratory allergies in toddlers and increase the risk of ARI. Indoor pollution such as cigarette smoke, dust, and chemicals can also cause respiratory tract irritation and affect the immune system, thus increasing toddlers' susceptibility to infection.

Exposure to UV rays from sunlight can have an antimicrobial effect and help kill bacteria and

viruses on surfaces. However, UV rays from the sun can also cause damage to the immune system and irritate the respiratory tract if too much exposure. Toddlers who are exposed to excessive sunlight, especially under direct light, can experience respiratory tract irritation and are at a higher risk of developing ARI. For this reason, it is very necessary to maximize exposure to sunlight in the house by opening windows and doors, and using curtains or windows that allow light to enter without causing too bright direct sunlight.

Lighting in homes with ISPA sufferers that do not meet health requirements poses a risk of transmission to their families. The risk of ARI transmission still occurs because not many people know how to prevent it, including by ventilating the house in the form of vents and windows and glass tiles that meet the health requirements for direct sunlight to enter. Sunlight contains ultra violet which has the ability to kill germs (Maulana, 2020).

According to the Decree of the Minister of Health of the Republic of Indonesia, Number 829/MENKES/SK/VII/1999 Concerning Housing Health Requirements, it is stated that lighting is natural and/or artificial lighting directly or indirectly that can illuminate the entire space at least 60 lux and is not dazzling. Natural lighting is lighting the house naturally by sunlight through windows, vents and doors from the east in the morning and west in the afternoon. Natural lighting is very important in lighting the house to reduce humidity. A healthy house must have access to sunlight from the west and east of at least 15% -20% of the floor area contained in the house. Besides being useful for lighting, these rays also reduce room humidity, repel mosquitoes or other insects and kill germs that cause certain diseases (Yustati, 2020).

Conclusion

Based on the results of the research conducted, it can be concluded as follows; (1) There is a relationship between home ventilation and the incidence of acute respiratory infections in children under five at the Bulango Selatan Health Center ($\chi 2$ Count 34.479; ρ value 0.000); (2) There is a relationship between the humidity of the house and the incidence of acute respiratory infections in toddlers at the Bulango Selatan Health Center, Bone Bolango Regency ($\chi 2$ Count 19.737; ρ value 0.000).

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