



Risk Factors and Association of Environmental with The Incidence of Acute Respiratory Infection in Toddlers: Study on Working Area of Lubuk Kilangan Public Health Center

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ABSTRACT

Air Pollution and environmental factors are closely related to the incidence of Acute Respiratory Infection (ARI). House construction and the environment that do not meet health requirements and environmental pollution such as smoke from industry, transportation facilities, and indoor air pollution are risk factors for the source of ARI. This study aims to find out the association between environmental risk factors and the Incidence of ARI in toddlers in the working area of Lubuk Kilangan Public Health Centre. This study used a descriptive-analytical research design with a cross-sectional approach, using a random sampling technique, a sample of 96 toddlers was obtained. Data analysis in this study used Chi-Square and t-Independent tests, PM₁₀ concentrations (p=0,009) ventilation area (p=0,000), occupancy density (p=0,029), humidity (0,000), and lighting (p=0,000). Meanwhile, for SO₂ concentration in this study, there was no relationship with the incidence of ARI in toddlers (p = 0,302). Based on the results obtained It is hoped that sanitarian staff and related institutions will further increase public knowledge, especially about home sanitation, healthy lifestyles, and the impact of exposure to pollutant concentrations from industry, so that they can control risk factors that can cause ARI.

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Kata kunci:

ISPA
Bayi
Risiko

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ABSTRAK

Pencemaran udara dan lingkungan erat kaitannya dengan angka kejadian ISPA. Konstruksi rumah dan lingkungan yang tidak memenuhi syarat kesehatan serta pencemaran lingkungan seperti asap yang berasal dari industri, sarana transportasi dan polusi udara dalam rumah merupakan faktor risiko sumber penularan penyakit ISPA. Tujuan penelitian ini untuk menganalisa perbedaan faktor risiko lingkungan yang berhubungan dengan kejadian ISPA pada balita di wilayah kerja puskesmas Lubuk Kilangan tahun 2021. Penelitian ini menggunakan rancangan penelitian analitik deskriptif dengan pendekatan cross sectional, menggunakan teknik random sampling didapatkan sampel sebesar 96 balita. Analisis data dalam penelitian ini menggunakan uji Chi-Square dan t-Independent. Hasil penelitian menemukan beberapa faktor lingkungan yang berhubungan dengan kejadian ISPA pada balita, yaitu: konsentrasi PM₁₀ (p=0,009), luas ventilasi (p=0,000), kepadatan hunian (p=0,029), kelembaban (0,000), dan pencahayaan (p=0,000). Sementara untuk konsentrasi SO₂ dalam penelitian ini tidak terdapat hubungan dengan kejadian ISPA pada balita (p=0,302). Berdasarkan hasil yang didapat diharapkan kepada tenaga sanitarian di puskesmas dan lembaga terkait untuk lebih meningkatkan pengetahuan masyarakat, khususnya tentang sanitasi rumah, pola hidup sehat, serta dampak paparan konsentrasi zat pencemar dari industri, sehingga bisa mengendalikan faktor risiko yang dapat menyebabkan terjadinya ISPA

dengan cara penyuluhan atau peningkatan pengetahuan masyarakat oleh tenaga kesehatan Puskesmas.



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INTRODUCTION

Air pollution and environmental factors are closely to the incidence of Acute Respiratory Infection (ARI) (Ema, 2015). House construction and the environment that do not meet health requirements and environmental pollution such as smoke from industry, transportation facilities, and indoor air pollution are risk factors for source ARI (Depkes RI, 2004). Transmission of ARI complaint can also do through circular contact with air intermediated from objects exposed to contagions or bacteria from ARI victims (Prihaningtyas, 2019). ARI is still the main cause of contagious complaint morbidity and mortality in the world. The mortality rate for ARI reaches 4.25 million every time in the world. Grounded on data from the World Health Organization (WHO) in 2019, lower respiratory tract infections reduced life expectation by 2.09 times for victims. (WHO, 2019) The group most at threat is toddlers. Around 20-40 of cases rehabilitated among children due to ARI with about 1.6 million deaths due to pneumonia alone in children under five per time. In grown-ups the mortality rate in grown-ups (25-59 times) reaches 1.65 million. (Najmah, 2016) The frequency of pneumonia in toddlers in Padang City 3,91% was of the total number of toddlers, while cases with pneumonia were plant and treated as numerous as cases 2.723 (85,8%) out of an estimated 3.174 cases. (Dinkes Padang, 2019) In the working area of the Lubuk Kilangan Health Center, in 2020 the frequency of ARI in toddlers was. ARI is still in the first rank of the 10 most conditions at the Lubuk Kilangan Health Center. (Kilangan, 2020)

A threat factor is a factor or beget for a person to come ill or the illness to be severe. (UNICEF, 2006) In general, there are three threat factors for the circumstance of ARI, videlicet environmental factors, individual child factors, and behavioral factors. (Depkes RI, 2004) The construction of houses and the terrain that doesn't meet health conditions is a threat factor for the transmission of colorful types of conditions. Acute respiratory infection (ARI) is nearly related to casing conditions. Home and environmental sanitation is nearly related to the prevalence of contagious conditions, especially ARI. (Ema, 2015) Based on data from the Lubuk Kilangan Health Center annual report in 2020, the results of the achievement of healthy homes were 82,2%. This figure still does not meet the target of achieving healthy homes in the working area of the Lubuk Kilangan Health Center, which is 88%. (Kilangan, 2020)

Community settlements in the Lubuk Kilangan sub-district, which is located in the west of Padang City, are in an industrial area. Industrial anthropogenic activities of PT. Semen Padang and burning vehicle fuel can release particulates into the ambient air so that people living in the Lubuk Kilangan area become a population at risk for respiratory diseases. The highest concentration of PM10 in residential air in Lubuk Kilangan District is at a distance of 500 m from the pollutant source, which is 133 $\mu\text{g}/\text{m}^3$. When compared with Government Regulation 22 of 2021, attachment VII, the concentration exceeds the quality standard and there are still risk areas because there are still

41% of the community experiencing respiratory disorders. (Dinkes Padang, 2019)

Based on data that has been obtained in the Monthly Report of the ARI Control Program at the Lubuk Kilangan Public Health Center in 2020, environmental factors that are still said to be bad, such as the achievement of healthy homes that still do not meet the target and PM₁₀ concentrations that still exceed the threshold value are risk factors for the incidence of ARI in toddlers. Therefore, the purpose of this study was to analyze differences in environmental risk factors related to the incidence of ARI among toddlers in the working area of the Lubuk Kilangan Health Center in 2021.

METHOD

This study is an experimental explicatory study with across-sectional study design. This study aims to determine the threat factors and environmental connections with the prevalence of Acute Respiratory Infection (ARI) in toddlers. The independent variables in this study were PM₁₀, SO₂, domestic viscosity, moisture, and lighting. The dependent variable in this study is the prevalence of Acute Respiratory Infection (ARI) in toddlers. This study used a logical study design with a cross sectional approach. Analytic study design used to find the association between variables with a cross sectional approach, where each subject is observed formerly, and the dimension of the variables were carried out at the time of the examination. The population in this study were all toddlers who were at threat of passing acute respiratory infections in the working area of the Lubuk Kilangan Public Health Center in 2021. Grounded on the sample computation using the lameshow formula, a sample of 96 toddlers was attained in the working area of the Lubuk Kilangan Health Center. The slice fashion in this study used arbitrary slice. The place and time of the study were carried out in the working area of the Lubuk Kilangan Public Health Center in July-August 2021. This exploration instrument used an observation roster, LVAS, runt impinger, moisture cadence, lux cadence, and cadence. The data analysis used includes univariate and bivariate analysis by presenting the relationship between the independent and dependent variables in the form of a cross table and also performing Chi-Square and t-Independent statistical tests.

RESULTS AND DISCUSSION

The incidence of ARI in toddlers

After researching with a sample of 96 toddlers, it was found that almost half of the 45 (46,9%) incidence of ARI among toddlers in Lubuk Kilangan District, Padang City. Based on table 1, the highest incidence of ARI in toddlers is in

Urban Village Bandar Buat with 16 cases (35,6%) and the Urban Village with the smallest incidence of ARI in toddlers is Urban Village Baringin with 2 cases (4,4%) out of a total of 45 cases. The results of this study are the same with study conducted by Nur Hamdani, et al in 2020 regarding "Environmental Risk Factors for ARI Incidence in Toddlers in the Panambungan Health Center Work Area" which was obtained from 88 (100%) toddlers, there were 32 (46,4%) toddlers. had ARI and as many as 56 (63,6%) toddlers who did not experience ARI.(Nur, Muharti Syamsul, & Genoveva Imun, 2021) The results of this study are the same with study conducted by Prima Putri, et al in 2016 regarding "The Effect of the Physical Environment of the House on the Incidence of ARI in Toddlers in Ciwandan Subdistrict, Cilegon City for the Period of July-August 2016" with the incidence of ARI as many as 31 toddlers (34.4%) and those who did not experience ARI as many as 59 toddlers (65.6%)".(Putri & Mantu, 2019)

ARI is an acute infection that attacks one or further corridor of the respiratory tract starting from the nose to the alveoli including the adnexa (conforming of the sinuses, middle observation depression, and pleura).(RI, n.d.) In general, there are 3 (three) risk factors for the occurrence of ARI, namely environmental factors, individual child factors, and behavioral factors. Environmental factors include air pollution in the house, the physical condition of the house, and the density of housing. (Depkes RI, 2004)

According to researchers, the high incidence of ARI among toddlers in Lubuk Kilangan District is influenced by several environmental factors that do not meet the requirements, such as PM₁₀ concentrations whose values exceed the quality standard threshold, ventilation area, occupancy density, humidity, and lighting for toddlers' homes that do not meet the requirements by healthy home requirements. Therefore, it is hoped that the sanitarian staff at the public health center and related institutions will further increase public knowledge in the observation of environmental health, especially about home sanitation and healthy lifestyles so that they can control risk factors that can caused ARI.

Table 1.
Distribution of ARI incidence in toddlers

Urban Village Name	Frequency	Percentage (%)
Bandar Buat	16	35,6
Indarung	7	15,6
Padang Besi	3	6,7
Batu Gadang	6	13,3
Koto Lalang	7	15,6
Tarantang	4	8,9
Baringin	2	4,4
TOTAL	45	100

Differences in PM₁₀ concentration and the incidence of ARI in toddlers

The results of the analysis of the PM₁₀ variable using the Independent T-test. Grounded on table 2, it is found that the mean of PM₁₀ in toddlers suffering from ARI is 77,00 µg/m³. The results of the Independent T- test showed that the value of p = 0,009 where statistically there was a statistically significant difference with the mean of PM₁₀ in toddlers with ARI and no ARI. The results of this study are the same with study conducted by Maulidiyah Dwi Azti Putri in 2017 about "The Relationship between Physical Home Sanitation and PM₁₀ With the Incidence of ARI in Toddlers in Settlements Around the Industrial Environment of Tumapel

Village, Mojokerto Regency".(MAULIDIYAH DWI AZTI PUTRI, 2017) The results of this study are the same with study conducted by Rizki Zahrotul Hayati in 2017 about "The Relationship between PM₁₀ Concentration and Environmental Factors in the Home with Complaints of Acute Respiratory Tract Infections (ARI) in Toddlers at Rawa Terate Health Center, Cakung District in 2017.(Rizki Zahrotul Hayati, 2017) PM₁₀ can increase the number and inflexibility of ARI attacks, beget or worsen bronchitis and other lung conditions, and reduce the body's capability to fight infection. In general, PM₁₀ can be sourced from external air influences, namely human activities (due to fuel combustion, dust from construction processes, and industrial activities) and indoor air influences such as smoking behavior, use of cooking energy from biomass fuel, and use of mosquito coils. (Californian Environmental Protection Agency, 2009)

According to the World Health Organization PM-related deaths total 2.5 million deaths annually worldwide. PM₁₀ is the main air contaminant in several ASIA metropolises, the periodic PM₁₀ position in ASIA exceeds WHO and European Union (EU AQS) air quality norms.(CAI-Asia Factsheet, 2010) PM₁₀ is the stylish index in cases of respiratory diseases, because there's a strong relationship between symptoms of respiratory complaint and situations of dust patches.(H. J. Mukono, 2008)

Environmental conditions in the Lubuk Kilangan sub-district can be said to support the presence of PM₁₀. In Lubuk Kilangan District there is an industrial. Padang Cement. In addition, road access is dense with traffic which can lead to high concentrations of PM₁₀ in the Lubuk Kilangan sub-district. Therefore, it is recommended to the public to open windows or doors in the morning and close windows or doors during industrial activities and heavy traffic (afternoon to evening) so that air exchange can run well and minimize pollutants entering the body.

Differences in SO₂ concentration and the incidence of ARI in toddlers

The results of the analysis of the SO₂ concentration variable using the Independent T-test. grounded on table 2, it's found that the mean of SO₂ in toddlers who suffer from ARI is 141,33 µg/m³. The results of the Independent T-test showed that the p-value = 0,302 where statistically there was no significant difference between the mean of SO₂ in the environment toddlers with ARI and no ARI. The results of this study are the same with study conducted by This research is not the same with study conducted by Aris Putra Firdaus,(Firdaus & Sulistyorini, 2017). This research not related with research Rahmi Garmin et al in 2018. (Garmini & Purwana, 2020)

Combustion of sulfur- containing accoutrements will produce both forms of sulfur oxide, but the relative quantities of each aren't affected by the quantum of oxygen available. Although air is available in sufficient amounts, SO₂ is always formed in the topmost quantum.(Fardiaz, 1992) Sulfur dioxide is one of a group of largely reactive feasts known as"sulfur oxides". SO₂ is associated with a number of adverse goods on the respiratory system, and other environmental issues.(Roy P, 2015). Air pollution around Lubuk Kilangan District is due to the industrial activity of Semen Padang industrial and also the activity of vehicles on the highway cause environmental health to be disrupted, including the air quality in homes that are around industrial factory areas.

Therefore, it is recommended for sanitarians at the puskesmas to provide counseling and socialization to the community regarding the impact of SO₂ exposure on health, and the importance of a healthy home. It is expected that the community opens windows or doors in the morning and

closes windows or doors during industrial activities and heavy traffic (afternoon to evening) so that air exchange can run well and minimize pollutants entering the body, and people are advised to maintain plants in backyard and cooked area as a barrier against pollutants.

Table 2.
PM₁₀ and SO₂ Concentration Relationship With the Incidence of ARI in toddlers

Variable	PM ₁₀ Concentration		<i>p-Value</i>	SO ₂ Concentration		<i>p-Value</i>
	mean	SD		mean	SD	
ARI	77,00	1,00	0,009	141,33	23,75	0,302
No ARI	42,50	14,20		122,25	20,23	

The association between ventilation area and the incidence of ARI in toddlers

Ventilation area variable in table 3 as many as 49 toddlers homes have a ventilation area that does not meet the requirements, there are 34 toddlers experiencing ARI (69,4%). The resultans of the analysis showed of that *p-Value* = 0,000 <0,05, indicating that there was a significant relationship between ventilation area and the incidence of ARI in toddlers in Lubuk Kilangan District, Padang City. With an PR value of 7,418 (95% CI: 2,991-18,398), which means that the ventilation area in a toddler's house that doesn't meet the requirements is 7,418 times more risky than the ventilation area in a toddler's house that meets the requirements. The results of this study are related with Vera Triandriani, et al in 2018 on "The Relationship of the Physical Environment with the Incidence of ARI in Toddlers in the Working Area of the Sidomulyo Health Center, Samarinda City"(Triandriani & Hansen, 2019). The results of this study are related with Maria Martha Manese, et al in 2017.(Martha, Ratag, & Rattu, 2017)

The area of adequat ventilation and the habit of opening the door found in most of the respondents' houses support the provision of fresh air and good circulation in the house. If the ventilation is used according to its function, then the sunlight entering the house will not be blocked by the ventilation itself. Poor ventilation can be dangerous, especially the respiratory tract. The consequences if the house ventilation does not meet health requirements is causing high humidity in the room so that it can become a place for the growth and proliferation of pathogenic germs which can lead to an increased risk of ARI occurrence in toddlers (J. Mukono, 2000).

From the results of the study, it was found that some of the respondent's houses had ventilation but most of the respondents' houses did not have ventilation. Ventilation is only in the front room, while in the family room and some rooms that do not use ventilation, this will cause health problems. Therefore, it is expected that health workers can furnish information to the public about the importance of having ventilation according to health standards so that air exchange in the room is well maintained.

The association between residential density and the incidence of ARI in toddlers

In the occupancy density variable in table 3, as many as 42 houses toddlers have a residential density that does not meet the requirements, 26 toddlers are experiencing ARI (61,9%). The resultans of the analysis showed of that *p-Value* = 0,008 <0,05 indicating that there was a significant relationship between residential density and the incidence of ARI in toddlers in Lubuk Kilangan District, Padang City. With

a PR value of 2,993 (95% CI: 1,297-6,910), which means that the density of occupancy in the homes of toddlers who do not meet the requirements is 2,993 times riskier than the density of occupancy in the houses of toddlers who meet the requirements. The results of this study are related with Maria Martha Manese, et al in 2017 regarding "Risk Factors for the Incidence of ARI in Toddlers in the Work Area of the East Amurang Health Center, South Minahasa Regency".(Martha et al., 2017). The results of this study are related with Hartawan, et al in 2020.(Hartawan, Suginarti, & Asyari, 2020)

The density of bedroom occupancy is mature to the largish number of house members resting in one bedroom.(Kementerian Kesehatan RI, 1999) Overcrowded makes it easier for disease transmission to occur(Mukono, 2000). In this study, there were still many respondents' houses that were inhabited by more than 3 people, were among the residents were toddlers. When the density of housing does not meet the requirements, it will hurt health, especially for toddlers, lack of oxygen and facilitate the transmission of diseases through the air, causing toddlers to be vulnerable to the incidence of ARI. Therefore, it is recommended that puskesmas officers can provide information to the public about healthy housing conditions and meet the requirements and the importance of a healthy environment and air circulation, especially for toddlers to avoid various diseases.

The association of humidity with the incidence of ARI in toddlers

In the humidity variable in table 3 as many as 48 toddlers homes have humidity that does not meet the requirements, there are 32 toddlers experiencing ARI (66,7%). The resultans of the analysis showed of that *p-Value* = 0,000 <0,05 indicating that there is a significant relationship between humidity and the incidence of ARI in toddlers in Lubuk Kilangan District, Padang City. With an PR value of 5,385 (95% CI: 2,245-12,915), which means that the humidity in the house of a toddler who does not meet the requirements is 5,385 times more risky than the humidity in the house of a toddler who meets the requirements. The results of this study are related with Titi Saparina L, et al in 2020 regarding "Relationship of Environmental Conditions with ISPA Disease Incidence in Toddlers in Wasolangka Village, Parigi Health Center Working Area, Muna Regency"(Saparina, Noviati, & Husnia, 2020). The results of this study are related with Vera Triandriani, et al in 2019.(Triandriani & Hansen, 2019)

Based on the humidity theory, it states the amount of water vapor in the air. Air temperature can affect the concentration of air pollutants, where high air temperatures will cause the air to be more tenuous so that the concentration of pollutants is low, and at cold temperatures,

the air is denser so that the concentration of pollutants is higher. If the humidity in the room is high, it allows the growth of bacteria to be faster too, making it easier for someone to contract diseases caused by bacteria in humid air, including ARI.(Ernyasih, Fajrini F, 2018)

From the results of compliances at the time of observation, it can be seen that the lighting of each replier's house that's visited doesn't meet the conditions because The habit of the repliers who infrequently open windows and the ventilation area that doesn't meet the conditions because of the high moisture in the room, so it's necessary to intermediate with the geste of opening windows every day and perfecting ventilation that doesn't meet the conditions.

The association of lighting with the incidence of ARI in toddlers

In the lighting variable in table 3, as many as 39 toddlers' homes have ventilation areas that do not meet the requirements, 33 toddlers are experiencing ARI (84,6%). The resultans of the analysis showed of that p-Value = 0,000 <0,05, indicating that there is a significant relationship between lighting and the incidence of ARI in infants in Lubuk Kilangan District, Padang City. With a PR value of 20,625 (95% CI: 7,018-60,614), which means that the lighting in the home of a toddler who does not meet the requirements is

20,625 times riskier than the lighting in the house of a toddler who meets the requirements. The results of this study are related with Irma Suharno, et al in 2019 regarding "The Relationship of Physical Conditions of the Home Environment with the Incidence of ARI in Toddlers in the Work Area of the Wawonasa Health Center Manado City".(Suharno et al., 2019) The results of this study are related with Sabtian Sarwoko, et al in 2019.(Sarwoko, 2020)

Natural lighting is the natural lighting of the house 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, this light also reduces room humidity, repels mosquitoes or other insects, and kills germs that cause certain diseases. (Menteri Kesehatan RI, 2011)

From the observations at the time of observation, it can be seen that the lighting in each respondent's house that is visited does not meet the health requirements of the respondent's house, indeed there is a window in the living room only for the room and the family room is not. Therefore, it is expected that health workers can provide information in the form of counseling to the public about lighting requirements in the criteria for healthy homes.

Table. 3
The Association of Ventilation Area, Occupancy Density, Humidity, And Lighting With the Incidence of ARI in toddlers

No	Variable	Status				Amount		p-Value	PR	95% CI
		ARI		No ARI		F	%			
		F	%	F	%					
1	Ventilation Area									
	Not eligible	34	69,4	15	30,6	49	100	0,000	7,418	2,991-18,398
Qualify	11	23,4	36	76,6	47	100				
2	Occupancy Density									
	Not eligible	26	61,9	16	38,1	42	100	0,008	2,993	1,297-6,910
Qualify	19	35,2	35	64,8	54	100				
3	Humidity									
	Not eligible	32	66,7	16	33,3	48	100	0,000	5,385	2,245-12,915
Qualify	13	27,1	35	72,9	48	100				
4	Lighting									
	Not eligible	33	84,6	6	15,4	39	100	0,000	20,625	7,018-60,614
Qualify	12	21,1	45	78,9	57	100				

CONCLUSIONS AND SUGGESTION

There are several variables related to the incidence of ARI in toddlers in Lubuk Kilangan District, Padang City, including PM₁₀ concentration, ventilation area, occupancy density, humidity, and lighting. While the variable that is not related to ARI in toddlers is the concentration of SO₂. It is hoped that sanitarians and related institutions will further increase public knowledge in the field of environmental health, specifically about home sanitation, healthy lives, and the impact of exposure to pollutant concentrations from industry, so that they can control risk factors that can cause ARI by way of counseling. or increasing public knowledge by health center personnel by involving existing health cadres. And for the public to pay more attention to and maintain the

cleanliness of their homes so that they do not become a breeding ground for germs.

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