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.

Keyword:
Acute Respiratory Infection
Baby
Risk

Kata kunci:
ISPA
Bayi
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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 about1.6 million deaths due to pneumonia alone in children under five per time. In grown-ups the mortality rate in grown-ups (25-59 times) reaches1.65 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 μg/m³. When compared with Govenment 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 explicated 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 viscocity, 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 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 another 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 sanitary 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 Lalong        | 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’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 H. J. Mukono in 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.

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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 substances 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 SO$_2$ 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.
**PM$_{2.5}$ and SO$_2$ Concentration Relationship With the Incidence of ARI in toddlers**

| Variable | PM$_{2.5}$ Concentration | SO$_2$ Concentration | p-Value | p-Value |
|----------|--------------------------|----------------------|---------|---------|
|          | mean         | SD       |         | mean         | SD       |         |
| ARI      | 77.00        | 1.00    | 0.009   | 141.33       | 23.75   | 0.002   |
| 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 have a ventilation area that does not meet the requirements, there are 34 toddlers experiencing ARI (69.4%). The results of the analysis showed 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 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 association between humidity and the incidence of ARI in toddlers

In the humidity variable in table 3 as many as 48 toddlers have humidity that does not meet the requirements, there are 32 toddlers experiencing ARI (66.7%). The results of the analysis showed 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 Triandriani, et al in 2020 regarding “Relationship of Environmental Conditions with ISPA Disease Incidence in Toddlers in Wasolangka Village, Parigi Moutong 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 variable, 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 (Suharno, et al., 2019).

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 does not meet the conditions because of the high moisture in the room, so it’s necessary to intermediate with the gesture 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 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

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