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ORIGINAL ARTICLE

Relationship of Physical Environmental Conditions of Houses with the Incidence of Pneumonia among Children under Five

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ABSTRACT

Introduction: In 2019, according to the World Health Organization (WHO), pneumonia is the leading infectious cause of death in children under the age of five. In 2017, pneumonia killed 448,694 children under five, accounting for 15% of all fatalities among children under the age of five. **Methods:** An observational analytic survey with a case control design was used as the study approach. The research samples were collected using a simple random sampling procedure with 48 children under the age of five separated into two groups, 24 samples for the case group and 24 samples for the control group. The research was carried out between February and July of 2020. This study tools used were observation sheets and rollmeters. The data was analyzed using univariate and bivariate analysis using the Chi-Square test at a significance level of 0.05. **Results:** The results showed that there was a relationship between incidence of pneumonia in children under five with different variables, respectively, ventilation area, floor type, wall type, presence of smoke hole. **Conclusion:** It implies that the community should pay attention to the overall condition of the house, one of which is by improving home ventilation, adjusting the room area to the number of occupants, quitting smoking in the house, and cleaning the floor more often.

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Keywords: Children under five, Pneumonia, Ventilation Area, Occupancy Density, Floor Type & Wall Type

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INTRODUCTION

According to the World Health Organization (WHO), pneumonia is the biggest cause of mortality due to infectious in children globally in 2019. Pneumonia kills 740,180 children under the age of five, accounting for around 60% of all child deaths (1). Pneumonia affects kids and families all around the world, although it is most prevalent in South Asia and Sub-Saharan Africa. With simple interventions, children can be protected from pneumonia and treated with inexpensive, low-tech medications and treatments. According to the Ministry of Health cause of deaths of 920,136 children under five, are more than 2,500 per day. In fact, it is estimated that two children under five died every minute in 2015 (2).

In Indonesia, the Basic Health Research Data (Riskesdas) in 2007 stated that pneumonia was the second leading cause of infant mortality (23.8%) and under-five mortality (15.5%). According to the 2013 Riskesdas data, the prevalence and prevalence periods of pneumonia in 2013 were 1.8% and 4.5%, respectively. Based on data from the 2017 ARI Sub-Directorate Routine Report, the incidence (per 10,499 children under five) in Indonesia was 20.54, while data from the Indonesian Ministry of Health in 2019 stated that there were 56.51% of children under five in Indonesia (3).

One of the efforts made to control this disease is to increase the screening of pneumonia among children under the age of five. Estimates of pneumonia cases nationally are 3.55%, but the estimated number of pneumonia cases in each province were different figures. Until 2014, the coverage rate for pneumonia under five did not experience significant development, ranging from 20%–30%. The increase in coverage in 2015–2017 was due to a change in the estimated number of cases

from 10% to 3.55%. In addition, there was an increase in the completeness of reporting from 91.91% in 2015 to 94.12% in 2016 and 97.30% in 2017(3).

Data from the Riau Islands Province Health Service mentioned that the coverage of pneumonia interventions for children under five in the Riau Islands Province in 2017 (9.2%) had increased compared to 2016 (7.7%). However, this achievement has not yet reached the 2017 target of 10.5%. The basis for calculating the estimated pneumonia cases in the Riau Islands region in 2017 were based on a letter from the Directorate General of P2P is from 13% to 3.98%. In 2017, of the 21,857 cases of pneumonia estimated, only 1,097 cases were found and treated. The low percentage of pneumonia cases that are treated shows that the detection of pneumonia cases has not been effective, and there is a lack of awareness in the public about the signs of pneumonia among children under five and is dangerous if it is not treated immediately (4).

According to the Riau Islands Province Health Profile (2016), children under five with pneumonia conditions in Karimun Regency totaled 57 cases of infant mortality and ranked second. It is known that the highest number of infant deaths was in Batam City with 138 cases, and the lowest in Anambas Islands Regency with 13 cases. The scope of intervention for pneumonia under five in 2016 decreased by 7.70%. The results of the 2012 IDHS Survey, show that the IMR of the Riau Islands Province is still at 35/1,000 live births. Infant mortality is caused by a variety of factors, including asphyxia (shortness of breath at birth), low birth weight babies (LBW), neonatal infections, pneumonia, diarrhea, and malnutrition (Strategic Plan of the Riau Islands Provincial Health Office, 2016-2021)(5).

From the survey data on children under five with pneumonia obtained from the Meral Health Center during 2019, there were 64 cases, namely 1.15% of pneumonia and 5,480 (98.8%) cases of non-pneumonia out of 5,544 total children under five. In January-April 2020, there were 30 cases, namely 6.31% of pneumonia and 445 (93.6%) cases of cough, not pneumonia, out of 475 total children under five. According to the health profile of the Meral Health Center, the percentage of healthy houses in the working area is 59.9%, with a total of 11,988 houses. The number of houses inspected was 7,181; 5,263 houses (73.29%) met the health requirements (6).

The results of a preliminary survey in the working area of the Meral Health Center, Karimun Regency, Riau Islands, show that there are still non-permanent and semi-permanent houses for residents. Non-permanent houses are characterized by all buildings using combustible materials such as wood and floors that are not impervious to water, i.e., not yet tiled. In addition, lots of respondents' houses still lack good air circulation,

such as the absence of smoke holes, which results with no air circulation in the room, and the walls are made up of brick or wood materials (6).

Based on the above background, it is critical to pay attention to the physical environmental conditions of the house, such as occupancy density, ventilation area, lighting, type of floor, type of wall, ownership of smoke holes, and humidity of the house to prevent the proliferation of bacteria, viruses, or parasites. Therefore, researchers are interested in researching the relationship between physical environmental conditions of houses and incidence of pneumonia among children under five.

MATERIALS AND METHODS

An observational analytical survey with a case control design was employed in this investigation. The populations in this study were patients with pneumonia and non-pneumonia cough at outpatient health services at MBTS in January-April 2020, amounting to 475 children under five. Therefore, inclusion criteria for this study are children under five years of age with history of pneumonia. Children above five years of age and without any Acute respiratory infections (ARI) history were excluded from the study. The research samples were collected using a simple random sampling procedure with 48 children under the age of five, separated into two groups; 24 samples for the case group and 24 samples for the control group. This research was conducted in the Meral Health Center Work Area, Karimun Regency, Riau Islands. This study had obtained the KEPK USM Indonesia's ethical test with certificate number 184/F/KEP/USM/VIII/2020 dated 18th August 2020. The study took place between February and July 2020. The instruments used in this study were observation sheets and rollmeters. The data was analyzed at using univariate and bivariate analysis with the Chi-Square test at a significance level of 0.05.

RESULTS

Table I shows that the majority of children under five are 37–60 months old (54.2%), the majority is male (58.3%), the majority of children's nutritional status were good (70.8%), the majority gets exclusive breastfeeding (50%), and the majority of children under five (75.0%) are fully immunized.

Table II shows that most of the ventilation area (75%) is adequate, most of the occupancy density (70.8%) is adequate, most of the floor type (83.3%), most of the wall type (66.7%), and most of the smoke whole (83.3%) are all adequate. Table III shows that the distribution of the frequency of pneumonia in children under five is 50.0% in each control and in case group respectively.

Based on the cross-tabulation results of the ventilation area with the incidence of pneumonia in children

Table I: Frequency Distribution of Characteristics of Children under five at the Meral Health Center

No	Characteristics of Children Under Five	Control	%	Case	%
Ages (months)					
1	13-36	11	45.8	15	62.5
2	37-60	13	54.2	9	37.5
Sex					
1	Male	14	58.3	15	62.5
2	Female	10	41.7	9	37.5
Nutritional Status					
1	Good	17	70.8	11	45.8
2	Bad	7	29.2	13	54.2
Exclusive breastfeeding					
1	Yes	12	50.0	6	25.0
2	No	12	50.0	18	75.0
Immunization compliance					
1	Complete	18	75.0	3	12.5
2	Incomplete	6	25.0	21	87.5

Table II: Frequency Distribution of Research Variables at Meral Health Center

No	Variable	Control	%	Case	%
Ventilation Area					
1	adequate	18	75.0	9	37.5
2	inadequate	6	25.0	15	62.5
Occupancy Density					
1	adequate	17	70.8	6	25.0
2	inadequate	7	29.2	18	75.0
Floor Type					
1	adequate	20	83.3	2	8.3
2	inadequate	4	16.7	22	91.7
Wall Type					
1	adequate	16	66.7	7	29.2
2	inadequate	8	33.3	17	70.8
Smoke Hole Ownership					
1	adequate	20	83.3	10	41.7
2	inadequate	4	16.7	14	58.3

Table III: Frequency Distribution of Pneumonia Incidence in Children under Five

No	Pneumonia	n	%
1	Control	24	50.0
2	Case	24	50.0

under five in the Meral Health Center Work Area, it was obtained that the value of $p = 0.020 < 0.05$ with an OR of 5.000 (95% CI) (Table IV). This shows a relationship between ventilation area and the incidence of pneumonia in children under five.

Based on the cross-tabulation results of residential density with the incidence of pneumonia in children under five in the Meral Health Center Work Area, it was obtained that the value of $p = 0.004 < 0.05$ with an OR of 7.286 (95% CI). This shows a relationship between residential density and the incidence of pneumonia in children under.

Based on the cross-tabulation results of floor type with the incidence of pneumonia in children under five in

Table IV: Cross Tabulation of the Relationship between Ventilation Area, Occupancy Density, floor type, wall type and smoke hole ownership with Pneumonia Incidence in Children under Five

	Pneumonia				Total	p	OR (95%CI)	
	Control		Case					
	n	%	n	%				
Ventilation Area								
adequate	18	37.5	9	18.8	27	56.3	0.020	5.000
inadequate	6	6	12.5	15	31.5	21		
Total	24	50.0	24	50.0	48	100		
Occupancy Density								
adequate	17	35.4	6	12.5	23	47.9	0.004	7.286 (2.034-26.102)
inadequate	7	14.6	18	37.5	25	52.1		
Total	24	50.0	24	50.0	48	100		
Floor type								
adequate	20	41.7	2	4.2	22	45.8	0.000	55.000 (9.072-333.45)
inadequate	4	8.3	22	45.8	26	54.2		
Total	24	50.0	24	50.0	48	100		
Wall Type								
adequate	16	33.3	7	14.6	23	47.9	0.021	4.850 (1.430-16.497)
inadequate	8	16.7	17	35.4	25	52.1		
Total	24	50.0	24	50.0	48	100		
Smoke Hole Ownership								
adequate	20	41.7	10	20.8	30	62.5	0.006	7.000 (1.822-26.887)
inadequate	4	8.3	14	29.2	18	37.5		
Total	24	50.0	24	50.0	48	100		

the Meral Health Center Work Area, it was seen that the value of $p = 0.007 < 0.05$ with an OR of 55.000 (95% CI). This shows a relationship between the type of floor and the incidence of pneumonia in children under five.

Based on the cross-tabulation results of wall types with the incidence of pneumonia in children under five in the Meral Health Center Work Area, it was obtained that the value of $p = 0.021 < 0.05$ with an OR of 4.850 (95% CI). This shows a relationship between the wall type and the incidence of pneumonia in children under five in the.

Based on the cross-tabulation results of smoke hole ownership with the incidence of pneumonia in children under five in the Meral Health Center Work Area, it was obtained that the value of $p = 0.006 < 0.05$ with an OR of 7,000 (95% CI). This shows a relationship between presence of smoke holes and the incidence of pneumonia in children under five.

DISCUSSION

Relationship between ventilation area and pneumonia incidence in children under five

The relationship between ventilation area and the incidence of pneumonia in children under five in the Meral Health Center Work Area, Karimun Islands, Riau Islands in 2020 showed that the chi-square statistical

test results showed $p\text{-value} = 0.020 < 0.05$ with an OR of 5,000 (95% CI). This shows that there is a link between the amount of ventilation and the number of children under five who get pneumonia in the Meral Health Center Work Area, Karimun Regency, Riau Islands, in 2020.

This study is consistent with Pusparini's 2016 research, where it was found a significant association between poor ventilation and the occurrence of pneumonia in children under the age of five ($p\text{-value} = 0.001$) (7). However, this study contradicts the findings of Agustyana in 2019, who found a strong association between poor ventilation in the bedroom and the prevalence of pneumonia in children under the age of five, with a $p\text{-value}$ of 0.001 (8).

According to the American Public Health Association (APHA, 2019), the criteria for a healthy home include perfect ventilation so that fresh airflow can be maintained. A healthy house with good ventilation will provide health benefits for its residents. Based on field observations, some of the respondents' houses are wooden houses with a small living area. In addition, the ventilation design is also not large, so the impact of sunlight cannot illuminate the entire room. The wooden planks that form the walls of the house function as air holes (9).

The observation results show that the ventilation area is more than or equal to 10% of the floor area. If we look at the table of respondents who met the ventilation area, 18 people did not have pneumonia. Meanwhile, despite adequate ventilation, nine people had pneumonia. This can be caused by other factors, namely the floor, which is still filled with solid soil and cement. Apparently, this means children's health is affected by bacteria in the soil and on cement floors. In the area of inadequate ventilation, there were 15 cases of controls because the ventilation area of the house did not meet good criteria. This makes the house inhabited by the unhealthy respondent with the impact of causing disease in the people who live in it. However, six respondents did not experience pneumonia even though the ventilation area of the house was inadequate. This is because the mother keeps the kitchen clean and keeps the door open when she is doing things in the kitchen to keep the air circulated.

The ventilation area referred to in this study is the ventilation area of more than or equal to 10% of the floor area. So, it does not qualify if the ventilation area is less than 10% of the floor area. According to the findings of this study, living in a house with a ventilation space that does not satisfy the standards, increases the likelihood of under-five children contracting pneumonia. The ventilation area of the house that is not adequate is usually due to the small type of house with narrow land ownership. Most of the ventilation in the house is only

at the front of the house, while on the side, it is close to the wall of the neighbor's house.

Home ventilation is related to the house's humidity, which affects the viability of viruses and bacteria. Sunlight can kill bacteria or viruses, so adequate lighting will reduce the risk of pneumonia (10). If the house does not have good ventilation, then artificial ventilation is needed to refresh the room, which plays a role in exchanging airflow or circulating air in the room. The movement of air in the room will cause a cooling airflow. Ideally, the air in a room can be regulated in both temperature and humidity.

Based on the study results, 43.8% of respondents have house ventilation that is not adequate. So, it is recommended that health workers who are allowed to do so raise people's awareness of pneumonia and give them advice. They should also explain what causes pneumonia so that people can understand and want to stay healthy, especially when it comes to environmental health.

Relationship of Occupancy Density with Pneumonia Incidence in Children Under Five

The relationship between residential density and the incidence of pneumonia in children under five in the Meral Health Center Work Area, Karimun Islands, Riau Islands in 2020 shows that, based on the results of the chi-square statistical test analysis, it was obtained that $p\text{-value} = 0.004 < 0.05$ with an OR of 7,286 (95% CI). This shows a relationship between occupancy density and pneumonia incidence in children under five in the work area of the Meral Health Center, Karimun Regency, Riau Islands in 2020.

In accordance with the Decree of the Minister of Health of the Republic of Indonesia No. 829/Menkes/SK/VII/1999 concerning house health requirements, the minimum occupancy density of the bedroom is 8m², and it is not suggested to use more than two people, except for children under five years of age. Crowded living conditions increase the pollution factor in the house. Lack of ventilation and lack of understanding of clean and healthy living behavior can facilitate the transmission of either Acute respiratory infections (ARI) or pneumonia (11).

A healthy house must have enough floor space for its people, which means that the building's floor space must be proportionate to the number of occupants. Overcrowding will occur if the building space is not proportionate to the number of people. This is unhealthy since it reduces oxygen intake. If one family member has an infectious ailment, it will swiftly spread to other members of the family. The optimum building area is 2.5–3m² for each family member (12).

The "density of the occupants" referred to in this study

is the ratio between the floor area of the house and the number of family members in one residence. In general, the minimal standard rules are used to estimate occupant density. The density of inhabitants who fulfil health regulations is calculated by dividing the floor area by the number of occupants $> 8 \text{ m}^2/\text{person}$. If the ratio between floor area and the number of people is unbalanced, occupant density will not meet the health regulations. The ratio of occupants must be adjusted to the area of the house. As a result, crowded house conditions trigger the growth of bacteria and viruses.

Based on the study results, it showed that the respondent's house did not experience overcrowding. There were 17 people who did not experience pneumonia. However, six people had pneumonia even though there was no overcrowding. Other factors can cause this; for example, the ventilation factor of the house is not large enough so that bad air does not come out of the house, resulting in inhalation by children and pneumonia. There is also the fact that most of the respondents have a room area of less than 8 m^2 and a ventilation area of less than 10% occupied by two adults and two children. Also, other factors must be considered namely the type of floor, the type of wall, and the ownership of the smoke hole. Furthermore, when considering the inadequate housing density, 18 people experienced cases of pneumonia. In inadequate housing, seven children under five did not have pneumonia. The cleanliness of the parents maybe the reason. Even though the house is full of occupancy, the family always maintains good hygiene in terms of smoke and good ventilation, so it does not cause pneumonia. This study shows that there is a risk pneumonia of seven times more in children under five in the Meral Health Center Work Area, Karimun Regency, Riau Islands in 2020 because there are so many people living there.

⁴⁵ Based on the study results, it is known that 52.1% of respondents have inadequate occupancy density. So, we suggest that respondents maintain environmental health, especially in dense housing places. Improving this behaviour can be done by paying attention to a healthy home and a healthy environment, such as maintaining house cleanliness, opening windows often, paying attention to sanitation around the house, and maintaining personal hygiene.

¹ Relationship between floor type and the incidence of pneumonia in children under five ³

The relationship between floor type and the incidence of pneumonia in children under five in the Meral Public Health Center ², Karimun Regency, Riau Islands in 2020 shows that the chi-square statistical test analysis results are $p\text{-value} = 0.000 < 0.05$ with an OR of 55,000 (95% CI). This shows that there is a link between the type of floor and the number of children under five who get pneumonia.

Sari et al., (2018) said that there are various types of floors in the house; for example, the floor of the house is made of cement, tiles, ceramics, or ordinary compacted soil. The critical requirement here is that it is not dusty in the dry season and not muddy in the rainy season. Wet and dusty floors are a breeding ground for disease. The type of floor that is not waterproof causes moisture to accumulate and affects the floor of the house to be dusty. The dust will cause children under five to have difficulty in breathing because it can enter the respiratory tract. Among the bacteria often found are Streptococcus pneumonia, Staphylococcus aureus, Haemophilus influenza, and Streptococcus pyogenic. The secretions will later fall to the floor, be mixed in the air, be inhaled when breathing, and infect family members (13).

³⁴ Based on the results of this study, it was found that 54.2% of respondents did not have adequate type of floor, which resulted in the occurrence of pneumonia in children under five. The results showed that houses with an adequate floor type had 20 children under five who did not have pneumonia. However, two children under five had pneumonia. Other factors, such as poor ventilation and low occupancy, can contribute to this. Meanwhile, if viewed from the type of floor that is inadequate, four people do not have pneumonia. This can be caused because the mother is a cleaner; even though the type of floor is dirty with cement, she always keeps her house clean, including the floor. The respondent's house has a waterproof floor made of ceramic and plaster, which makes it easy to clean from dust. Some of the floors are still made of dirt, not waterproof and still dusty, which can cause pneumonia in children under five.

The study of Mahendrayasa's support that poor flooring in the house might be a breeding ground for germs and disease vectors, making the air in the room damp. The floor gets dusty throughout the summer, resulting in dust that is detrimental to the residents. The floor of the home should be composed of water-resistant materials such as tiles, cement, and ceramics (14).

¹ Relationship between wall type and the incidence of pneumonia in children under five ¹

The relationship between wall type and the incidence of pneumonia in children under five in the Meral Health Center Work Area ² Karimun Islands, and Riau Islands in 2020 shows that the chi-square statistical test results are $p\text{-value} = 0.023 < 0.05$ with an OR of 4.850 (95% CI). This indicates that there is a relationship between wall types ¹⁷ and the incidence of pneumonia in children under five. This study is in line with research which ³⁵ shows that there is a significant relationship between mother's educational status, mother's employment status, and the physical environment of the house (house walls) on pneumonia in children under five in the Dinoyo Public Health Center, Malang City (15).

This type of wall consists of various basic materials categorised into adequate and inadequate. The Decree of the Minister of Health of the Republic of Indonesia Number 829/Menkes/SK/VII/1999 concerning the requirements for residential housing stated that the type of wall is not see-through, made of weather-resistant material, flat, and equipped with ventilation for air circulation. The walls of a good house are made of bricks, but the walls of tropical houses, especially in rural areas, are mostly made of boards, woods, and bamboo. This is due to the low economic status of rural communities. Houses whose walls are not tight, such as board, wood, and bamboo, can cause respiratory diseases.

The bedroom and living room walls are equipped with ventilation to regulate air circulation. Meanwhile, the bathroom and laundry area walls must be waterproof and easy to clean (16). The type of wall that is according to the standards and is safe must be made of permanent and waterproof material. The wall type that does not match the standards, makes the air in the house to become damp, allowing germs to proliferate. In addition, the wall type that does not meet the requirements causes dust particles to stick easily, and if inhaled by residents of the house, especially children under five, it can trigger respiratory tract irritation such as pneumonia. A damp and wet house result from water absorbed by the walls and a lack of morning sunlight (8).

The study results showed that houses of the respondents made up of bricks, did not experience pneumonia. Meanwhile, seven respondents whose houses have adequate wall types suffer from pneumonia. This can be due to inadequate ventilation. So, we should not only look at one aspect as other factors must be considered. In addition, in case of inadequate walls of the house, eight people did not have pneumonia. This can happen if parents keep the house clean and healthy. If the houses are clean, then pneumonia does not affect the inhabitants even if the walls are made of wood.

Based on observations in the field, it is seen that the respondent's houses were built of either brick or wood. Walls that are not permanent allow air to enter through the gaps along with bacteria and viruses. This study also showed that there is a possible link between the type of wall and the number of cases (was five times higher) of pneumonia among children under five.

Relationship between presence smoke hole and the incidence of pneumonia in children under five

The relationship between presence of smoke hole in the house respondents and the incidence of pneumonia in children under five shows that the results of the chi-square statistical test analysis are $p = 0.006 < 0.05$ with an OR of 7,000 (95% CI). This shows that there is a link between the presence of smoke hole and the number of children under five who get pneumonia.

Tile roofs are commonly used in both urban and rural areas. Besides tile roofs being suitable for tropical regions, they must also be affordable by the community, and even people can make their own. However, many rural communities cannot afford it. Then the roof of tassel leaves or coconut leaves are used. Aside from being costly, zinc asbestos roofs are unsuitable for country homes (8). Based on the results of this study, it is suggested to pay attention to the maintenance of smoke holes in the houses. About 37.5% of respondents do not have adequate smoke holes, so if the respondents do not notice this, this can cause pneumonia in children under five.

Again, burning that occurs in the kitchen of the household is a human activity which causes air pollution. This will affect the health, if the level of impurities increases and impact the air quality which in turn causes indoor pollution. Air pollution in the house will trigger irritation of the respiratory tract. Children under five with low immunity are susceptible to pneumonia. The kitchen chimney reduces the pollution in the house. Indoor air pollution from biomass fuels has been shown to increase the risk of pneumonia in children by about 80%. The kitchen must also have ventilation so that the smoke from the combustion during the cooking can be replaced with fresh air. Kitchen smoke vents can reduce aerosols and air pollution (17).

Fuels are a common air pollutant in households. Fuel is one of the sources of pollution in the house that can interfere with human breathing. Smoking fuels such as wood and charcoal that produce smoke can cause respiratory problems. In this aspect, this study has limitations; namely, pneumonia is not only influenced by home sanitation, indoor pollution factors, and behaviour but can also be influenced by several other factors, such as outdoor pollution.

Based on the study results, it is shown that 20 people had adequate smoke holes and did not experience pneumonia. Later, ten people had inadequate smoke holes and developed pneumonia. These conditions could be triggered by other factors, namely the type of wood used for the wall. Meanwhile, there are still respondents whose floors are made of cement, and the ventilation area of the respondent's house is not adequate. There were four people with inadequate smoke hole and did not experience pneumonia. This can be caused by other things, such as the amount of ventilation, the number of suitable homes, the type of wall, and the cement.

Based on field observations, it was found that most of the respondents had houses with adequate kitchens. This is because most respondents use LPG gas stoves for cooking, so they do not use smoke holes, while some use firewood stoves. Previous study found that there is high prevalence of childhood pneumonia with house

undergoing renovation (18,19). Thus it can be seen that decrease in incidence of pneumonia was influenced directly by healthy behavior, physical quality of the house, and active standby village strata. Other factors such as family smoking activities must be considered regarding increased incidence of pneumonia in children under five.

Recommendations

It is recommended that the public follow the development of information from health workers or other sources of information regarding risk variables that impact the occurrence of pneumonia. The public can find ways to support prevention efforts. In addition, the community is expected to open windows every day in the morning and afternoon to notice the quality of the house's state, one of which is by improving home ventilation, adjusting the room area to the number of occupants, stopping smoking in the house, and cleaning the floor more often.

It is recommended for health workers to provide information in the form of counselling to the community regarding the risk factors that influence the incidence of pneumonia so that people are more aware of and can take prevention measures starting from healthier behaviour changes. In addition, the community should improve the house's cleanliness, how the house's physical environments fit the standards, and hold a meeting in an area for counseling. Media such as slides and films, brochures, and even banners may be used as health promotions to raise awareness of the need to pay attention to the physical environment of the house as a method of avoiding pneumonia in children under the age of five. In addition, this is a consideration for the Health Service, Meral Health Center in the pneumonia prevention programme for children under five from low-income families.

CONCLUSION

It can be concluded that there is a relationship between ventilation area, occupancy density, floor type, wall type and presence of smoke holes in the house with the incidence of pneumonia in children under five in the Meral Health Center Work Area, Riau Islands.

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