

Factors Associated with the Occurrence of Pneumonia in Children Under Five in Tarus, Central Kupang, East Nusa Tenggara

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ABSTRACT

Background: Pneumonia is an acute infection that attacks the lung tissue (alveoli) caused by various microorganisms such as viruses, fungi and bacteria. The risk factors for pneumonia are environmental factors, individual child factors, and behavioral factors. Environmental factors include indoor air pollution, physical condition of the house, and residential density. Individual child factors include age, gender, nutritional status, low birth weight, immunization and breastfeeding. Behavioral factors include smoking habits, habit of opening and closing windows, and habit of cleaning the house. The study aimed to analyze the factors associated with the incidence of pneumonia in children under five in Tarus Village, Central Kupang, East Nusa Tenggara.

Subjects and Method: An analytic survey study with a cross-sectional design was conducted in the Tarus Village, Kupang Tengah, Kupang, East Nusa Tenggara from August to September 2022. A total of 88 mothers of children under five aged 12-59 months in the Tarus Village, Kupang Tengah District, Kupang Regency, East Nusa Tenggara were selected for this study. The dependent variable is the incidence of pneumonia in children under five. The independent variables are the type of floor, lighting, ventilation, occupancy density, smoking habit, habit of opening windows, and habit of cleaning the house. Data were collected using a questionnaire and analyzed using the chi-square test.

Results: There is a relationship between house ventilation (OR= 5.83; 95% CI= 1.05 to 1.34; p= 0.003), house floor (OR= 4.65; 95% CI= 1.57 to 1.77; p= 0.001), house lighting (OR= 6.22; 95% CI= 1.09 to 1.25; p= 0.005), occupancy density (OR= 6.90; 95% CI=1.18 to 1.37; p= 0.001), window opening behavior (OR= 5.34; 95% CI= 1.26 to 1.46; p = 0.004), and house cleanliness (OR= 8.55; 95% CI= 1.07 to 1.22; p= 0.002) on the incidence of pneumonia.

Conclusion: House ventilation, house floors, lighting, occupancy density, window opening behavior, and house cleanliness are significantly related to the incidence of pneumonia.

Keywords: pneumonia, risk factors, children under five.

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BACKGROUND

Pneumonia in children under five is still a serious health problem, including in Indonesia. Pneumonia in children under five has

a high degree of disease severity, and can even result in death (Ranny, 2016). Nationally, the number of pneumonia cases in children under five in 2019 was 52.9% of

cases, decreased in 2020 to 34.8% of cases, and continued to decrease in 2021 to 31.4% of cases (Ministry of Health Republic Indonesia, 2021). Despite the decline in cases, pneumonia is still a major problem causing 73.9% of child deaths in 2020. Pneumonia ranks second, after diarrhea (25.2%), as the cause of death in the Toddler age group (12-59 months), which is 15.5% of cases (Ministry of Health Republic Indonesia, 2021). In addition, the decrease in pneumonia cases in children under five in 2020-2021 is due to the impact of the COVID-19 pandemic, where there is a stigma in people with COVID-19 which has affected the decrease in the number of visits by children under five for coughing or difficulty breathing at the community health center.

East Nusa Tenggara Province is one of the provinces with a high number of cases of pneumonia in children under five. The number of pneumonia cases in children under five in 2019 was 3,262 or 14.65%, decreased to 2,778 or 12.19% of cases in 2020, and continued to decrease to 1,861 or 11.6% of cases in 2021 (Provincial Health Office of East Nusa Tenggara, 2021).

Pneumonia is included in diseases caused by inadequate environmental conditions, both in quality and quantity, and people's low healthy behavior. Previous studies have documented the effect of housing conditions (dwelling) and the influence of behavior on the incidence of pneumonia in children under five. Tarus sub-district is the sub-district that has the highest cases of pneumonia in children under five. The number of cases of pneumonia in children under five in the Tarus Village in 2020 was 56 cases (Tarus Health Center, 2020). The purpose of this study was to analyze the factors associated with the incidence of pneumonia in children under five in the Tarus Village, Kupang, East Nusa Tenggara.

SUBJECTS AND METHOD

1. Study Design

This quantitative research that uses an analytical survey method with a cross-sectional research design conducted in Tarus Village, Central Kupang District, Kupang, East Nusa Tenggara, from August to September 2022.

2. Population and Sample

The population in this study were all children under five in Tarus Village. The sample size in this study was 88 respondents. The sampling technique was carried out using simple random sampling.

3. Study Variables

The dependent variable is the incidence of pneumonia in children under five. The independent variables are the type of floor, lighting, ventilation, occupancy density, smoking habit, habit of opening windows, and habit of cleaning the house.

4. Operational Definition of Variables

The incidence of Pneumonia, children under five are those diagnosed by health workers at the health center who have pneumonia. Data were obtained by interviewing health center staff using a questionnaire.

Ventilation is all the holes that can be used as air exchange. Data obtained by measuring Roll Meter.

The type of floor is the bottom (base, base) of a room or building in the respondent's house. Data obtained by observation by researchers.

Home lighting is natural lighting or intensification of sunlight that can illuminate all parts of the house. Data obtained by observation and Lux meter.

Occupancy Density is the number of people who meet the requirements based on the area of the bedroom. Data obtained by observation and interviews using a questionnaire.

Smoking behavior is the habit of family members to smoke cigarettes and or have

smoked in the house. Data obtained by interview using an observation questionnaire. **The behavior of opening windows** is the habit of opening windows in every house every day, from morning to evening. Data obtained by interview using a questionnaire and observation.

The behavior of cleaning the house is the habit of cleaning the house from dust and dirt in all parts of the house. Data collected using questionnaire.

5. Study Instruments

The data in this study were obtained from primary data and secondary data. Primary data were obtained directly in the field through interviews using questionnaires and measuring devices to determine ventilation area, house lighting, occupancy density, window opening behavior and house cleaning behavior. Secondary data was obtained from related agencies, namely the Tarus Health Center, namely data on the number of children under five and pneumonia cases in the working area of the Tarus Health Center, Central Kupang District, Kupang, East Nusa Tenggara.

6. Data Analysis

Univariate analysis was conducted to describe the characteristics of each research

variable in this case ventilation, floor type, house lighting, occupancy density, smoking behavior, window opening behavior and house cleaning behavior. While bivariate analysis was performed to see the relationship between the independent and dependent variables using the chi-square test.

RESULTS

1. Sample Characteristic

Table 1 shows that the majority of children under five had suffered from pneumonia in the last three months (81.8%). most of the respondents had house ventilation that did not meet the requirements (75.0%). most of the respondents have the type of floor that meets the requirements (67.0%). almost all respondents had house lighting intensity that didn't meet the requirements (83.0%). most of the respondents have unqualified occupancy density (72.7%). the majority of respondents have family members who smoke in the house (87.5%). most of the respondents have the behavior of not opening windows every day (63.2%). the majority of respondents had less cleaning behavior (85.1%).

Table 1. Sample Characteristics

Characteristics	Categories	Frequency (n)	Percentage (%)
Pneumonia cases	Suffer	72	81.8
	Not Suffering	16	18.2
Ventilation	Eligible	22	25.0
	Not Eligible	66	75.0
Type of floor	Eligible	59	67.0
	Not Eligible	29	33.0
House lighting	Eligible	15	17.0
	Not Eligible	73	83.0
Occupancy Density	Eligible	24	27.3
	Not Eligible	64	72.7
Smoking behavior	Smoking	77	87.5
	Not smoking	11	12.5
Window Opening Behavior	Yes	32	36.4
	No	56	63.6
House Cleaning Behavior	Good	13	14.8
	lacking	75	85.2

2. Bivariate Analysis

Table 2 showed the result of bivariate analysis using chi-square. Table 2 showed the

results of the bivariate analysis, there is a relationship between home ventilation and the incidence of pneumonia.

Table 2. Relationship between Variables and the Incidence of Pneumonia in children under five in Tarus Village, Central Kupang District, Kupang Regency in 2022.

Variables	Category	Pneumonia				OR	95% CI	p
		Yes		No				
		n	%	n	%			
Ventilation	Eligible	13	59.1	9	40.9	5.83	1.05 to 1.34	0.003
	Not Eligible	59	89.4	7	10.6			
Type of floor	Eligible	43	72.9	16	27.0	4.65	1.57 to 1.77	0.001
	Not Eligible	29	100	0	0			
Lighting	Eligible	8	53.3	7	46.7	6.22	1.09 to 1.25	0.005
	Not Eligible	64	87.7	9	12.3			
Occupancy Density	Eligible	14	58.3	10	41.7	6.90	1.18 to 1.37	0.001
	Not Eligible	58	90.6	6	9.4			
Smoking Behavior	Eligible	63	81.8	14	18.2	1.00	0.05 to 0.20	1.000
	Not Eligible	9	81.8	2	18.2			
Window Opening	Yes	21	65.6	11	34.4	5.34	1.26 to 1.46	0.004
	No	52	91.1	5	8.90			
House Cleaning	Good	6	46.2	7	53.8	8.55	1.07 to 1.22	0.002
	Lacking	66	80.0	9	12.0			

It can be seen in table 2, there is a relationship between home ventilation and the incidence of pneumonia. Families whose house ventilation did not meet the requirements increased the incidence of pneumonia by 5.83 times compared to families who had adequate house ventilation, and the results were statistically significant (OR= 5.83; 95% CI= 1.05 to 1.34; p= 0.003).

Families whose floors did not meet the requirements increased the incidence of pneumonia by 4.65 times compared to families who had floors that met the requirements, and the results were statistically significant (OR= 4.65; 95% CI= 1.57 to 1.77; p= 0.001).

Families whose house lighting did not meet the requirements increased the incidence of pneumonia by 6.22 times compared to families who had adequate lighting, and the results were statistically significant (OR= 6.22; 95% CI= 1.09 to 1.25; p= 0.005).

Families with dense residential environments increased the incidence of pneumonia by 6.90 times compared to families whose residential environments met density requirements, and the results were statistically significant (OR= 6.90; 95% CI=1.18 to 1.37; p= 0.001).

Families who did not open their windows increased the incidence of pneumonia by 5.34 times compared to families who opened their windows, and the results were statistically significant (OR= 5.34; 95% CI= 1.26 to 1.46; p= 0.004).

Families who did not keep their homes clean increased the incidence of pneumonia by 8.55 times compared to families who kept their homes clean, and the results were statistically significant (OR= 8.55; 95% CI= 1.07 to 1.22; p= 0.002).

DISCUSSION

1. The Relationship between Ventilation and the Incidence of Pneumonia in Children under five.

The results showed that most of the respondents had house ventilation that did not meet the requirements (<10% of the floor area) with the location of the ventilation being too high, the vents were covered with plastic and some were covered with boards or plywood. The results of this study indicate that the majority of respondents with adequate home ventilation tend to have children under five suffering from pneumonia (59.1%). The same tendency was shown in respondents with inadequate home ventilation where the majority of respondents tended to have children under five suffering from pneumonia (89.4%).

Home ventilation has a function as a means of air exchange in the house so that fresh air circulates into the house and dirty air leaves the house. A house that is not equipped with ventilation facilities will cause the supply of fresh air inside the house to be very minimal. Sufficient fresh air at home is necessary for the life of the occupants, because inadequate air supply will affect the physiological function of the respiratory equipment for the occupants, especially infants and children under five years. Efforts to increase ventilation, especially in homes occupied by dense households, can also reduce the risk of children getting pneumonia.

This study is also in line with Hartati's study (2011) which stated that there was a relationship between house ventilation that did not meet the requirements and the incidence of pneumonia in children under five at Pasar Rebo Hospital in 2011. Children under five who lived in homes with no ventilation had a 2.5 times chance of developing pneumonia compared to toddler living at home in a well-ventilated home.

2. The relationship between the type of floor and the incidence of pneumonia in children under five

The results of this study indicate that all respondents have a type of floor that does not meet the requirements (<10% of the floor area) with the type of floor the house occupied by the respondent is a type of cemented floor and a dirt floor. Most of the respondents with floor types that met the requirements tended to have children under five suffering from pneumonia (72.9%). The same tendency was shown in some respondents with floor types that did not meet the requirements where all respondents tended to have children under five suffering from pneumonia (100%). The floor is the covering wall of the lower room.

The floor construction of the house must be tight and always dry so that it is easy to clean from dirt and dust and can avoid rising soil which can cause increased humidity in the room. To prevent water from entering the room, the floor of the house should be raised 20 cm from the ground. The floor of the house is made of water-resistant materials so that the floor does not become damp and is always wet, such as tiles, cement and ceramics. House floors that do not meet the requirements can lead to germs and disease vectors living and breeding, causing humid indoor air, and in summer the floor becomes dry so that it can cause dust that is harmful to the occupants.

The results of this study are also in line with research conducted by Padmonobo et al. (2012) which showed that there was a relationship between the condition of the floor of the house that did not meet the requirements and the incidence of pneumonia in children under five in the Working Area of the Jatibarang Health Center, Brebes Regency. Padmonobo's research shows that there are house floors that are

still made of earth, planks and concrete. Types of dirt floors and floors that have not been plastered will cause dusty conditions in the house. This dusty situation is a form of indoor air pollution.

3. Relationship between house lighting and the incidence of pneumonia in children under five

The results showed that the majority of respondents had house lighting that did not meet the requirements with narrow house sizes, doors and windows that were not always opened and trees that blocked sunlight from entering the house. Most of the respondents with adequate home lighting tend to have children under five suffering from pneumonia (53.3). The same trend was shown in the majority of respondents with inadequate home lighting who had children under five suffering from pneumonia (87.7%). Home lighting meets the requirements if the lighting intensity is more than 60 Lux – 120 Lux but if the light intensity is less than 60 Lux it will be an excellent medium for the proliferation of bacteria, viruses or fungi that cause pneumonia. Sunlight is very important because it can kill pathogenic bacteria in the house, for example bacteria that cause pneumonia and tuberculosis.

Therefore, a healthy house must have access to sufficient light. Letting the morning sunlight into the house can also kill germs because the morning sunlight contains a lot of ultraviolet light which is believed to be germicidal/kills microorganism.

This research is in line with research conducted by Yulianti (2012) which states that there is a significant relationship between house lighting and the incidence of pneumonia in children under five in the working area of the Pangandaran Health Center, Ciamis Regency. This is because the respondents did not take advantage of ventilation, for example the respondents' win-

dows were mostly made of wood and were more often closed. Most of the respondents have very small windows and they are located in the corner of the room, so that the sunlight that enters is uneven, there are sides of the room that are not exposed to sunlight, thus increasing the risk of pneumonia.

4. Relationship between occupancy density and the incidence of pneumonia in children under five

The results of this study indicate that almost all respondents have a residential density that does not meet the requirements with the number of bedrooms not proportional to the number of family members. One bedroom is occupied by more than 2 family members, that is, in one bedroom there are 3-6 family members. This can increase the risk of contracting pneumonia. Some of the respondents with the required occupancy density tended to have children under five suffering from pneumonia (58.3%). The same trend was shown in almost all respondents with unqualified occupancy densities who tended to have children under five suffering from pneumonia (90.6%).

The level of occupancy density that does not meet the requirements is due to the area of the house that is not proportional to the number of families occupying the house. This residential density allows bacteria and viruses to be transmitted through breathing from one occupant to another. The more occupants of the house gather in one room, the more likely they are to get the risk of disease exchange occurring, but it is easier, especially infants under five who are relatively susceptible to disease.

This research is in line with Pi's research (2018) which shows that there is a significant relationship between occupancy density and the incidence of pneumonia in children under five in the working area of

the Alak Health Center, Kupang City. This is because there are still many houses whose occupancy density does not meet the requirements. Most houses with more than one occupant in one room and this can facilitate the transmission of disease from person to person.

5. The relationship between smoking behavior and the incidence of pneumonia in infants

The results of this study indicate that the majority of respondents have smoking and non-smoking behavior in homes with family members who smoke more than 1 person, namely 2-3 people. Family members who smoke are usually not close to children under five so that the smoking habit variable has no significant relationship with the incidence of pneumonia in children under five. Another factor of smoking behavior has no relationship because the walls of the house where the respondent lives still use ducks so that exposure to cigarette smoke is not related to the incidence of pneumonia in children under five. The majority of respondents who have family members with smoking and non-smoking behavior tend to have children under five who suffer from pneumonia (81.8%).

Cigarette smoke is one of the parameters of the chemical quality of indoor air. Cigarette smoke can produce gases and dust that stay in the house for quite a long time. Cigarettes are one of the parameters of the chemical air quality in the house. Cigarette smoke is the most dominant cause of indoor pollution. Some of the gases produced from smoking behavior such as SO₂, NO₂, CO and CO₂. In addition, PM_{2.5} and PM₁₀ dust particles are also produced which can cause respiratory problems. One of them is pneumonia. This research is also in line with research (Putri, 2017) which shows that there is no significant relationship between the smoking habits of family

members and the incidence of pneumonia in children under five in the working area of the Tawanghari Health Center, Sukoharja Regency. Putri's research shows that the smoking habits of family members are not close to those of children under five.

6. Relationship between window opening behavior and the incidence of pneumonia in children under five

The results of this study indicate that almost all respondents have the behavior of not opening the window every day with the behavior of their parents who do not open the window every day for fear of dust contaminating their house, forgetting and feeling hot if the window is continuously opened. Another factor is the respondent's house whose windows are still covered with corrugated iron, boards and plywood because it is still under construction and there are permanent house windows which are not opened every day. Most of the respondents with the behavior of opening windows every day tend to have children under five who suffer from pneumonia (65.6%).

The same trend was shown by almost all respondents who did not open the windows every day who had children under five suffering from pneumonia (91.1%). The habit of opening windows will make it easier for light and air circulation to enter the house. The incoming light and air circulation will affect the temperature and humidity of the room. Temperature and humidity are closely related to the growth and proliferation of pneumonia etiological factors in the form of bacteria, viruses and fungi.

The results of this study are in line with Kusmawati et al. (2015) which stated that there was a relationship between the habit of opening windows and the incidence of pneumonia in children under five in the working area of the South Magelang Health

Center, Magelang City in 2015. Kusmawati's research showed that most respondents did not have the habit of opening windows in morning and afternoon, also caused by improper room arrangement so that the window cannot be used. House windows or ventilation that are never or rarely opened will cause an increase in CO₂. In addition, germs will be trapped inside the house and it is difficult to get out, thus increasing the risk of respiratory infections for the occupants of the house.

7. The relationship between cleaning behavior and the incidence of pneumonia in children under five

The results of this study indicate that the majority of respondents have less behavior in cleaning the house every day with the habits of parents who are busy and tired of taking care of their children so they don't clean the house and also mop the floor of the house (rough) with a bucket of washing water. Most of the respondents with good behavior in cleaning the house tend to have children under five who don't suffer from pneumonia (53.8%). A different trend was shown in the majority of respondents who had less behavior in cleaning the house and had children under five suffering from pneumonia (80.0%).

Houses that are rarely cleaned cause dirt in the form of dust and if air or dust is inhaled it will stick to the lower respiratory tract. If dust in the air is inhaled continuously, it will cause the elasticity of the lungs to decrease, causing children under five to have difficulty breathing. The results of this study are in line with research by Sartika (2012) which showed that there was a relationship between cleaning habits and the incidence of pneumonia in children under five in Kubu Raya District in 2011. Dusty floors are a form of air pollution in the house. Dust in the air when inhaled will stick to the lower respiratory tract. This

accumulation will cause the elasticity of the lungs to decrease, making it difficult for children under five to breathe. Someone who does not have the habit of cleaning the house less than 2 times a day has a 23.327 times greater risk compared to respondents who have the habit of cleaning the house more than 2 times a day.

AUTHOR CONTRIBUTION

Bendelina Rafael served as the lead researcher. Petrus Romeo, Enjelita M. Ndoen provided advice and input in data analysis and article writing.

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This study is self-funded.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

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