Journal of Midwifery and Nursing, 6 (2) (2024) pp. 404-410

Published by: IOCSCIENCE

Journal of Midwifery and Nursing

Journal homepage: www.iocscience.org/ejournal/index.php/JMN

The risk of physical environment on the incidence of pneumonia in the Puskesmas Remu Sorong City

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ARTICLE INFO

Article history:

Received Jan 6, 2024
Revised Feb 6, 2024
Accepted Feb 19, 2024

Keywords:

Lighting;
Physical building;
Pneunomia;
Residential density;
Ventilation.

ABSTRACT

Pneumonia is a respiratory infection that attacks the lungs, *the* World *Health Organisation* (WHO) recorded 2.5 million people died from pneumonia. Based on preliminary data collection, in January-June 2022 there were 17 cases and 34 controls, in the Remu Health Centre working area of Sorong City. The purpose ofthis study was to determine the risk of house building, house lighting, house humidity, house ventilation, and occupancy density on the incidence of pneumonia among under-fives in the Remu Health Centre working area of Sorong City. This type of research is analytic observation, with a *case control* design, using the *odds ratio* (OR) *test* to determine the magnitude of risk. This study was conducted in the Remu Health Centre working area of Sorong City on 22 September 22 October with a total sample of 51 children under five years old. The results showed that there was a risk, house building (OR=7.538), house lighting (OR=2.417), house humidity (OR=2.531), house ventilation (OR=3.714), occupancy density (OR=3.210), to the incidence of pneumonia. Conclusion House building, house lighting, house humidity, house ventilation area, and occupancy density are risk factors for the incidence of pneumonia among under-fives in the Remu Puskesmas working area of Sorong City.

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1. Introduction

Pneumonia is a form of respiratory infection that affects the lungs. The lungs are made up of small sacs called alveoli, which fill with air when a healthy person breathes. When a person has pneumonia, the alveoli fill with pus and fluid, which makes breathing painful and limits oxygen intake(World Health Organization, 2019)

Child mortality from preventable pneumonia is higher than from other diseases. However, analyses show that pneumonia claims the lives of more than 800,000 children under the age of five worldwide, or 39 children per second, with most deaths occurring in children under the age of two and nearly 153,000 deaths occurring in the first month of life . Based on the Indonesian Health(Sidhu & Mercado, 2020), data shows that the prevalence rate of pneumonia in children under five is very high, reaching 3.55 per 100 children under five. This means that 3-4 out of 100 toddlers suffer from pneumonia. In 2021, the mortality rate from pneumonia in young children was 0.16%. The mortality rate from pneumonia in the newborn group is almost double that in the1-4 years age group (Kemenkes RI, 2021)

Risk factors for pneumonia in under-fives are malnutrition, lack of exclusive breastfeeding, incomplete immunisation, LBW, nutritional status, low family economic status, population density, bringing children to the kitchen when cooking, mother's education, vitamin A deficiency, home ventilation, indoor air pollution, occupancy density, and also parental smoking activity . There are two factors associated with the incidence of pneumonia: instrinsic factors and extrinsic factors. Instrinsic factors is a factor that exists in toddlers, including toddler age, gender, low birth weight, status *immunisation*, breastfeeding. Meanwhile, extrinsic variables are factors that are not present in young children, including place of residence, type of house, ventilation, type of floor, lighting, occupancy density, stickiness, family salary, and maternal elements, including schooling, maternal age and maternal knowledge (Budihardjo & Suryawan, 2020).Floor conditions that are untiled and damp have the potential to become a breeding ground for bacteria, viruses, and fungi that cause pneumonia, while roofs that do not have ceilings cause the house space to become hot, dusty, and more humid (Masfufatun et al., 2018) The existence of ventilation also greatly affects the availability of oxygen in the room and occupancy density is an important factor in disease transmission (Yusela & Sodik, 2018)

2. Methods

This type of research is analytic observation, with a *case control* design. The study was conducted on 21 September-21 October 2022, with a ratio of cases and contol is 1:2. The case in this study were 17 toddlers with pneumonia in January-June 2022, and the control were 34 toddlers without pneumonia. The sampling technique of cases is total sampling and the control is purposive sampling. The Respondents in this study were the mother of the toddlers. The research instruments used for data collection were observation sheets, *lux meter*, *roll meter*and *thermohyrometer.* Data collection taken in this study was primary data and secondary data. Data analysis used was univariate analysis, namely age, education, occupation and bivariate analysis, namely looking at the risk of physical building of the house, house ventilation, house lighting, house humidity, occupancy density on the incidence of pneumonia in toddlers. This study was conducted in the Remu Health Centre working area of Sorong City.

3. Results and Discussion

Table 1.
Characteristics of respondents

Characteristics	Case		Control	
	(F)	(%)	(F)	(%)
Age				
20-35	14	82.4	27	79.4
36-49	3	17.6	7	20.6
Jobs				
Housewife	15	88.2	27	82.4
PNS	0	0	1	2.9
Honorary	0	0	2	5.9
Self-employed	2	11.8	4	11.8
Education				
SD	1	2.9	1	2.9
SMP	3	17.6	7	20.6
SMU	10	58.8	22	26.7
D3	3	17.6	2	5.9
S1	0	0	2	5.9

Based on table 1 shows that respondent in the case group the most age 20-35 was 14 people (82.4%), while the control group the most age 20-35 was 27 people (79.4%). While in the case group the mosthousewives were 27 people (82.4%), the most control group was housewives were 15 people (82.4%) and the most case group was high school education as many as 10 people (58.8%), while the most control group was high school education as many as 22 people (64.7%).

Table 2
Characteristics of children under five years of age and gender of children with pneumonia

Characteristics of children under five	Incidence of Pneumonia			
	Case		Control	
	(F)	(%)	(F)	(%)
Age				
0 - 12 months	9	52.9	30	88.2
12- 59 months	8	47.1	4	11.8
Gender				
Male	8	47.1	16	47.1
Female	9	52.9	18	52.9
Total	17	100.0	34	100.0

Based on table 2, the age of toddlers in the case group is mostly 0-1month 9 toddlers (52.9%). The control group was 0-1 month 30 toddlers (88.2). Gender in the case group was 9 toddlers (52.8%). While the control group was 18 emale toddlers (52.9%).

Table 3.
Risk of house building on the incidence of pneumonia among children under five years

	Incidence of Pneumonia						
	Case		Control		Total		OR (CI)
House Building	(F)	(%)	(F)	(%)	(F)	(%)	
Qualified	8	47.1	21	61.7	29	58.7	7.578
Unqualified	9	52.9	13	38.2	22	41.3	(1.811-31.373)
Total	17	100.0	34	100.0	51	100.0	
Home Lighting							
Qualified	5	29.4	26	76.5	31	60.8	2.417
Unqualified	12	70.6	8	23.5	20	39.2	(0.590- 9,902)
Total	17	100.0	34	100.0	51	100.0	
Humidity							
Qualified	2	11.8	28	82.4	30	58.8	2.531
Unqualified	15	88.2	6	17.6	21	41.2	(1.568 8.964)
Total	17	100.0	34	100.0	51	100.0	
Home Ventilation							
Qualified	4	23.5	25	73.5	29	56.9	3.714
Unqualified	13	76.5	9	26.5	22	43.3	(1.288 - 3.964)
Total	17	100.0	34	100.0	51	100.0	
Residential Density							
Qualified	7	41.2	25	73.5	32	62.7	3.210
Unqualified	10	58.8	9	26.5	19	37.3	(1.217-4.605)
Total	17	100.0	34	100.0	51	100.0	

Based on table 3 had shown that the house buildings in the case group that unqualified are 9 houses (52.9%), While in the control group that qualified as many as 29 houses (58.7%). The Odds ratio test results is 7.578, with Confidence Interval (CI) 0.811 -31.373, which means that the Odds Ratio is significant and can represent the entire population. The home lighting in the case group that unqualified are 12 houses (70.6%), While in the control group that qualified as many as 31 houses (60.8%). The Odds ratio test results

is 2.417, with CI (0.590- 9,902). The humidity in the case group that unqualified are 15 houses (88.2%), While in the control group that qualified as many as 30 houses (58.8%). The Odds ratio test results is 3.714, with CI (1.568 8.964). The home ventilation in the case group that unqualified are 13 houses (58.8%), While in the control group that qualified as many as 29 houses (56.9%). The Odds ratio test results is 2.531, with CI (1.288 - 3.964), The resindetial density in the case group that unqualified are 10 houses (88.2%), While in the control group that qualified as many as 32 houses (62.7%). The Odds ratio test results is 3.210, with CI (1.217-4.605)

Discussion

The risk of house humidity on pneumonia, the statistical test results concluded that OR=7.538. Thus it is stated that house building is a risk for the incidence of pneumonia in the Remu Health Centre working area of Sorong City. An important part of an inhabited house is the physical building of the house, such as the type of floor condition, type of wall, type of floor and ceiling of the house, a poor house building will affect the health of the occupants of the house there will also be the emergence of diseases caused by the house building, such as unhealthy living behaviour, unkempt will increase the occurrence of disease transmission and health problems, one of which is pneumonia. Thus, the physical building part of the house must be made as well as possible because it is very important for human health (Restiana et al., 2021)

The research of Nurjayanti that the physical building conditions of houses and those that do not meet health standards are risk factors for the transmission of various types ofdiseases, including pneumonia. The type of floor condition, type of wall, type of floor and ceiling of an unqualified house are factors that cause pneumonia (Nurjayanti et al., 2022). Environment factor were associateds with high prevalence of pneumonia among toddler in Somalia (Adawe et al., 2023). The risk of the physical building of the house on the incidence of pneumonia in toddlers due to the walls of the house, the floor of the house and the ceiling house, it is known that the condition of the walls, most people still use plywood and boards, only a small part of the house has a wall, but it is not followed by poor maintenance, so it will become a breeding ground for disease. Therefore, itwould be nice if the walls of the house must be plastered and painted so that they are not easily damaged and quickly damp. (Harahap, 2021)

Odds ratio test results of the risk of house humidity on pneumonia was OR = 2.417. Qualified home lighting is between 60-120 lux. unqualified homes are home lighting below 60 Lux or above 120 Lux, from the results of the study indicate that the lack of lighting in the house has a risk and can cause the occurrence of pneumona disease thus the lighting of the house must be good and qualified, because a house that lacks lighting will reduce discomfort, but it is also a good place for germs to grow.

The results of this study are in line with the research of Zhuge et al. who stated that lighting has a risk of pneumonia (OR =3.414) and children under five who live in homes with unqualified lighting have a risk of pneumonia of 3.414 times greater than children under five who live in homes with qualified lighting (Zhuge et al., 2018). Based on the researcher's observation findings, thereare still many houses that do not have enough lighting to meet the standards. This is because the windows and ventilation systems in the houses are not wide enough and are rarely opened every day, and there is noglass tile in the respondent's house, the lamp in the house is only fitted in the middle of the house and the incoming light is not blocked by trees, buildings or high walls, the minimum lighting for a healthy houseis 60 lux-120 which is suitable for human needs. The lack of light entering the house will be a breeding ground for disease seeds.

The statistical test results of risk of house humidity on pneumonia concluded OR = 2.531**.** Thus, humidity is a risk factor for the incidence of pneumonia in the Remu Health Centre working area of Sorong City. Humidity is closely related to the growth and proliferation of bacteria that cause pneumonia, such as *Streptococcus* pneumonia bacteria, athumidity (40%-70%) allows the growth of microorganisms to be inhibited or even not develop at all ordie, but at temperatures <40%-70% and sticky can grow and multiply quickly. This is what endangerstoddlers but people who are in the house because the more often toddlers or people who are in the housewith very humid conditions for a long period of time, the toddlers or residents of the house will be exposedto risk factors for pneumonia.

This study is in line with the research of (Hou et al., 2020). The statistical test results showed a significant relationship between humidity and the incidence of pneumonia in toddlers (OR = 2.213). At certain temperatures it is possible for growth to be inhibited or even not grow at all or die but can also grow and multiply very quickly which results in pneumonia in toddlers . There is a risk between temperature and humidity on the occurrence of pneumonia in toddlers in the Remu Health Centre working area of Sorong City. This is due to houses with inadequate ventilation that prevents light from entering the house and causes an increase in humidity in the house, and most likely due to the times in the area that cause *microorganisms that* cause pneumonia to grow and enter the body through the air so that it can cause infection for residents of the house (Febrianti et al., 2021)

The risk of house ventilation on the incidence of pneumonia, the analysis result show that the children under five years living in houses that ventilation area not qualified had a 3, 714 greater risk to have suffering pneumonia than those who living in the houses qualified ventilation. This is in line with (Febrianti et al., 2021)research which also report the effect of ventilation on the occurance of pneumonia in children un der five years (OR: 13.50x). Home ventilation has a very important role as a means of circulating fresh air into the house and dirty air in the house is made to leave the house with the aim of maintaining air humidity in the house. Home ventilation is related to the humidity of the house that supports the survival of viruses and bacteria at risk of pneumonia, ventilation that is not in accordance with its proper function will result in respiratory system disorders, especially pneumonia

This study in line with Indah's research in Sidoarjo that unqualified ventilation has a risk of pneumonia of 56. 731 times greater than children under five who live in homes with qualified ventilation area (Indah et al., 2022) Also with the research of Adawe et al, that there is a statistically significant risk between house ventilation area and the incidence of pneumonia in toddlers who live i n houses with unqualified ventilation area have a chance of getting pneumonia compared to toddlers who live in houses with qualified ventilation area (Adawe et al., 2023)The research of Ozughalu that the housing condition specially ventilation status were found statistically significant with pneumonia in Nigeria (Ozughalu, 2022)

Home ventilation is more in the living room, while in the lounge and rooms there are not many or even very rare windows in the family room. Respondents rarely open the windows every day, which can worsen the air quality in the house. However, there were toddlers who did not get pneumonia even though the ventilation area did not meet the requirements, and there were toddlers who got pneumonia even though the ventilation area met the requirements. This is because the incidence of pneumonia is not only influenced by the ventilation area, but is influenced by many interrelated factors, such as the attitude of mothers who do not maintain cleanliness at home, the nutritional status of young children who are missing and furthermore the situation with insufficient vaccination can increase the risk factors for pneumonia in infants. (Kózka et al., 2020)

The risk of occupancy density on pneumonia, the results of the statistical test concluded OR = 3.210 Thus there is a risk of residential density on the incidence of Pneumonia in toddlers in the Remu Health Centre working area of Sorong City. Density is the process of transmission and transfer of disease getting faster and easier, so that occupancy that does notmeet the requirements because of the large number of occupants with a narrow living area causes a lack of air exchange in the house which can affect air quality in the house.

This study is in line with the research of Wang et al, which stated that respondents' houses classified as dense occupancy had a risk of 8.954 times greater for the occurrence of under-five pneumonia compared to houses classified as occupancy density that met the standards (Wang et al., 2020). The risk of overcrowding in this study is calculated based on thefloor area per number of occupants and is said to be crowded if the calculation results show that if the house area is >8cm and more than 2 people live there, it is said to be crowded. However, the research found that a large number of respondents' houses did not have an area proportional to the number of people living there. This causes the house to be crowded and humid, triggering the breeding of diseases to accelerate (Trisiyah & W, 2018)

4. Conclusions

The conclusion of this study is that there are risk factors for the physical building of the house, house lighting, house humidity, house ventilation and occupancy density on the incidence of pneumonia intoddlers in the Remu Health Centre Working Area of Sorong City. It is suggested that the results of this study can provide information on the incidence of pneumonia, the importance of having a physical house building, house lighting, house humidity, house ventilation, and occupancy density, in the incidence of pneumonia in children under five years old in the Remu Health Centre working area of Sorong City. The implication and contribution of the research is suggested to government to implementation the program of the pneumonia prevention based on health environment especially the physical environment of the house.

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