Knowledge, Smoking Behavior, and Physical Environment's Effect on the Pneumonia Incidence among Toddlers in Belu District

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Abstract
Introduction: Pneumonia is an infectious disease caused by a virus that can affect adults and children, but is more susceptible to occur in children. This study aimed to analyze the influence of knowledge, smoking behavior, and environmental conditions on the incidence of pneumonia among toddlers in the Belu District.
Methods: This research is analytic observational research using a case-control design. The total sample is 64 people categorized into 32 cases and 32 controls. The sample size was obtained using the Lemeshow formula using a comparison of 1: 1 for cases and controls. Data analysis used bivariate analysis (Chi-Square and Odd Ratio) and multivariate analysis (Logistic Regression)
Results: The chi-square test results show that the significant variables are knowledge (p= 0.012, OR= 5000), smoking behavior (p= 0.001, OR= 6.600), occupancy density (p= 0.006, OR= 4.879), ventilation (p= 0.003, OR= 5.727). The results of the logistic regression test showed that the variables that had a major influence were smoking behavior (p= 0.001 OR = 10.546), and ventilation (p= 0.009 OR= 6.330).
Conclusion: The Factors affecting the incidence of pneumonia among toddlers in the Belu district are smoking behavior and home ventilation. Smoking behavior had the greatest influence on the occurrence of pneumonia based on the results of multivariate analysis.

Keywords: Pneumonia, Toddlers, Knowledge, Smoking behavior, Home Physical Environment

Introduction

Pneumonia is a disease caused by a virus. Pneumonia can affect both adults and children but is more common in children.[1] An untreated upper respiratory tract infection can spread to the lower respiratory tract. Lower respiratory tract infections are commonly associated with pneumonia, tuberculosis, bronchitis, lung abscesses, and chronic conditions such as asthma and chronic obstructive pulmonary disease. In 2019 pneumonia caused deaths in children aged 1-5 years, with 740,180 deaths. The highest number of

deaths occurred in southern Asia and sub-Saharan Africa.[2]

Based on the results of the 2018 Riskesdas report, the prevalence of pneumonia in Indonesia diagnosed by health workers and their symptoms was 4.0%. The provinces with the highest prevalence rate of 7.0% were Papua and East Nusa Tenggara, and the provinces with the lowest pneumonia prevalence rate of 2.0% were the Islands of Indonesia.[3] Meanwhile, the prevalence of pneumonia in 2018 based on health worker diagnosis was 2.0%, with the highest prevalence in Papua at 3.5%, followed by Bali with the lowest prevalence at 1.0%.[4]

The East Nusa Tenggara health report shows that pneumonia detection fluctuated from 2014-2019. In 2014 there were 3,714 cases (13%), in 2015 there were 3,079 cases (4.94%), in 2016 there were 3,683 cases (5.87%) and in 2017 there were 6,059 cases (9.99%), in 2018 there were 3,529 cases (33.4%), in 2019 there were 5,137 cases (18.6%). West Sumba ranked the highest in the trend of infant pneumonia detection in 2019, followed by Central Sumba and Kupang. (5) On the other hand, the Belu district itself ranks 12th out of 21 provinces in East Nusa Tenggara. There were 46 recorded cases of pneumonia in Belu district in 2021. Pneumonia cases were more prevalent in the <5 years age group, with a percentage of 36.52% and 33.48% in cases >5 years. There were also 19 cases of pneumonia deaths in infants under the age of 1 to 5 years.

Poor knowledge, smoking behavior, and the physical environment of the home play an important role in the occurrence of disease. In general, lack of knowledge affects a person's actions to perform healthy behaviors. In addition, smoking behavior and a non-conducive home environment make disease-causing bacteria or viruses survive longer and enter the respiratory tract. Based on data from the Public Works and Housing of Belu Regency, there are 13,967 uninhabitable houses in 2021 and 4,169 families are currently homeless and living in the homes of relatives. In addition, based on socio-economic survey data, the percentage of people who smoke every day in Belu district is 13.44% and those who smoke not every day is 5.89% per year 2021.[5]

In a previous study, it was found that there was a significant relationship between these factors and the incidence of pneumonia in toddlers. Low maternal knowledge about pneumonia and its prevention can impact several risky behaviors such as disease prevention and smoking behavior. The higher the mother's knowledge, the better the prevention.[6] Another study showed that unqualified housing density had a 13.214 times greater risk of pneumonia, unqualified ventilation had a 15.725 times greater risk of pneumonia, and unqualified floor type had an 11.915 times greater risk of pneumonia. It can be concluded that the knowledge, smoking behavior, and physical environment of the house have a relationship with the incidence of pneumonia in toddlers.[7] Children can be protected from pneumonia, can be prevented with simple interventions, and can be treated with medication. Looking at these pneumonia cases, the researcher aims to analyze the effect of the following factors consisting of knowledge, smoking behavior, and physical house on the incidence of pneumonia in toddlers in the Belu district area.

Methods

This study is an observational analytic study that aims to observe and examine the relationship between two or more variables with a case-control design. In a case-control study, outcomes are first determined in cases, and controls are selected. The design of a case-control study is essentially retrospective. The researchers look back and compare the two groups in terms of risk factors and other stressors.[8] The population in this study was 869 children aged 1-5 located in Belu district. The case group was obtained from medical records at health centers in the Belu district while the control group was obtained using a simple random sampling technique. The total sample of 64 people was divided into 32 cases and 32 controls. The tool used in this study was a questionnaire as a guideline for interviewing respondents. The questionnaire was used to measure the level of knowledge of mothers. The

questionnaire contained questions on knowledge about pneumonia, prevention of pneumonia, and the behavior of mothers and family members in their daily lives. Measuring tools such as meters and hygrometers to take measurements on the physical environment of the respondent's house. A hygrometer was used to measure the humidity in the house and a roller meter to measure the ventilation area and the respondent's room. This study used bivariate and multivariate analysis, bivariate analysis was used to determine the relationship between the dependent variable and the independent variable. Multivariate analysis is used to analyze more than two variables and find which variables have the most influence on disease incidence.[9] The analysis conducted in this study used the Chi-square test and Logistic regression test. The sample size in the study was determined using the Lemeshow formula.[10]

$$n = \frac{\left(Z_{1-\alpha/2}\sqrt{2\,P_2(1-P_2)} + Z_{1-\beta}\sqrt{P_1(1-P_1) + P_2(1-P_2)}\right)^2}{(P_1 - P_2)^2}$$

Keterangan :

$Z_{1-\alpha/2}$ = Standard normal spread value , value 1.96 (value Z_α at CI 95%, $\alpha = 0,05$)

$Z_{1-\beta}$ = Standard normal spread value, value 0.842 (value Z_β at power of test 80%)

P_1 = Proportion of exposure to the case group (0,46) (Dewi et al., 2019)

P_2 = Proportion of exposure to the control group (0,18) (Dewi et al., 2019)

$$n = \frac{\left(1,96\sqrt{2 \cdot 0,18(1-0,18)} + 0,84\sqrt{0,46(1-0,46) + 0,18(1-0,18)}\right)^2}{(0,46-0,18)^2}$$

$$n = \frac{2,4938}{0,0784}$$

$$n = 31,8 = 32$$

Figure 1. Sample size formula

Results

Table 1 shows that most toddlers with pneumonia were 2 years old, totaling 12 people (37.5%) and the fewest toddlers with pneumonia were 4 years old, totaling 3 people (9.3%).

Based on Table 2 below, it is known that the highest percentage of respondents in this study had the latest Senior high school education of 64.1% and the smallest percentage had the latest elementary school education of 1.6%.

Knowledge

Table 3 shows that respondents who have less knowledge were more in the case group at 62.5% compared to the control group with a percentage of 28.1%. Based on the results of the chi-square test analysis, obtained a p-value of 0.012 and the Odd ratio value obtained was 5,000 (1,709-14,628).

Smoking behavior

Table 3 shows that respondents who have family members who smoke were more numerous in the case group at 75% compared to the control group with a percentage of 32.2%. Based on the results of the chi-square test, a p-value of 0.001 and the Odd ratio value obtained was 6,600 (2,208-19,728).

Occupancy density

Table 3 shows that respondents who have houses with unqualified residential density were more in the case group at 65.6% compared to the control group with a percentage of 28.1%. The chi-square test results obtained a p-value of 0.006 and the odd ratio value obtained was 4,879 (1,688-14,098).

Ventilation

Table 3 shows that respondents who have unqualified ventilation were more in the case group at 75% compared to the control group with a percentage of 34.4%. the results of the chi-square test obtained a p-value of 0.003 and the odd ratio value obtained is 5,727 (1,940-16,912).

Floor-type

Table 3 shows that respondents who have unqualified floor types have a percentage of 4.7% compared to respondents who have qualified floor types with a percentage of 95.3%. the results of

the chi-square test obtained a p-value of 1,000 and an odd ratio value of 2,067 (0.178-24.006).

Humidity

Table 3 shows that respondents who have unqualified house humidity have a percentage of 25% compared to respondents who have suitable humidity with a percentage of 75%. The chi-square test results obtained a p-value of 0.386 and an odd ratio value of 1.970 (0.617-6.286).

Table 4 shows that, based on the multivariate analysis results in the table below, it is known that several variables have a joint influence on the incidence of pneumonia in children under five years old, namely smoking behavior, occupancy density, and house ventilation. Of the three influential variables, the smoking behavior variable had the greatest influence on the incidence of pneumonia in toddlers with a p-value = 0.000 and an OR of 10.456.

Table 1. The Frequency Distribution of Pneumonia Cases and Controls in Toddlers

No.	Age (Year)	Cases		Control		
		n	%		n	%
1	1	6	18.7		2	6.25
2	2	12	37.5		4	12.5
3	3	7	21.8		7	21.8
4	4	3	9.3	10		31.2
5	5	4	12.5		9	28.1
N (Totally)		32	100	32		100

Table 2. Distribution of Respondent Education (Mother of Toddlers)

Mother's Education	N	%
Elementary School	1	1.6
Junior High School	16	25
Senior High School	41	64.1
College/University	6	9.4

Table 3. Results of Bivariate Analysis of Risk Factors for the Incidence of Pneumonia in Toddlers

Variable	Incidence of Pneumonia				p-value	OR 95% CI
	Cases		Control			
	n	%	n	%		
Knowledge						
Lack	20	62.5	9	28.1	0.012	5.000 (1.709-14.628)
Good	12	37.5	23	71.9		
Smoking Behaviour						
Yes	24	75	10	32.2	0.001	6.600 (2.208-19.728)
No	8	25	22	68.8		
Occupancy density						
Unqualified	21	65.6	9	30	0.006	4.879 (1.688-14.098)
Qualified	11	34.4	23	34		
Ventilation						
Unqualified	24	75	11	34.4	0.003	5.727 (1.940-16.912)
Qualified	8	25	21	65.5		
Floor-type						
Unqualified	2	6.2	1	3.1	1.000	2.067 (0.178-24.006)
Qualified	30	93.8	31	96.9		
Humidity						
Unqualified	10	31.2	6	8.8	0.386	1.970 (0.617-6.286)
Qualified	22	68.8	26	1.2		

Table 4. The analysis of multivariate risk factors for the incidence of pneumonia

No.	Risk factors	OR	CI 95%	P
1	Knowledge	4.116	0.954-17.751	0.051
2	Smoking Behaviour	10.546	2.474-44.955	0.000
3	Occupancy Density	3.976	0.992-15.935	0.047
4	Ventilation	6.330	1.582-25.327	0.006

Discussion

Based on the results of this study conducted through bivariate analysis, shows that the factors of knowledge, smoking behavior, occupancy density, and home ventilation have a significant relationship. From the multivariate test results, it was found that several factors jointly influenced the incidence of pneumonia, which included smoking behavior, and home ventilation. Smoking behavior had the greatest influence based on the results of multivariate analysis conducted with an odd ratio is 10.546. Knowledge plays a major role in making a person do the right thing and helps make important decisions to prevent pneumonia in children.[11] Researchers found that the case and control groups had different educational backgrounds. Most respondents completed senior high school (SMA) education with the percentage at 64.1% followed by respondents who graduated from junior high school at 25%. The results of the analysis showed that in the case group, 62.5% had poor knowledge, compared to the control group with 28.1% who had poor knowledge. Several things make respondents have less knowledge, such as they did not actively participate in health socialization and respondent did not correctly understand the information conveyed by officers. Based on the results of the analysis conducted in this study, the p-value obtained was 0.012, which means that there is a significant relationship between the knowledge variable and the incidence of pneumonia in toddlers. The Odd ratio value was 5.000 which means that respondents with poor knowledge were 5 times more at risk of pneumonia in their toddlers than those with good knowledge. Good knowledge can lead to positive behavior in mothers who care for children, such as maintaining a healthy lifestyle to prevent children from getting sick and keeping the home environment clean. The results of this study are in line with Sri Ajeng's research which states that knowledge has a significant relationship with the incidence of pneumonia (p-value 0.003). According to her, the more knowledge mothers have about

pneumonia, the lower the morbidity and mortality rates due to pneumonia in infants.[12]

The presence of family members who smoke in the house allows pneumonia to occur. Exposure to tobacco smoke affects the incidence of pneumonia in toddlers. When inhaling tobacco smoke, the gases in tobacco smoke can paralyze some airway cells, allowing pathogens to enter.[13] Researchers found respondents' families who had a smoking habit with a percentage of 53.1% and non-smoking at 46.9%. Family members who smoke admitted that they often smoke inside the house, sometimes when accompanied by toddlers to play or walk outside or inside the house. They accompanied the toddler when the toddler's mother was doing heavy housework and took a long time such as washing clothes, going to the market, and cooking. The interview results showed that the family member who smoked was the father of the baby, while the rest were relatives such as uncles and siblings who lived in the same house as the respondent. The average number of cigarettes consumed per day was 3-10 cigarettes. The results of the analysis in this study showed a p-value of 0.001, which means that smoking behavior has a significant relationship with the incidence of pneumonia in toddlers, and the odd ratio value obtained was 6.600, which means that toddlers who have smoking family members are at risk of pneumonia 6.6 times greater than toddlers who do not have smoking family members. Respondents who smoked admitted that they often smoked when accompanying toddlers to play or walk outside and inside the house. Respondents accompanied the toddler for a long time when the toddler's mother was doing housework. In addition, the smoking behavior variable had the greatest influence on the risk of pneumonia in children under five years old based on the regression test with an odd ratio value of 10.456. The results of this study are also in line with research conducted by Dea Septi rahayu et al (which concluded that there is a relationship between smoking behavior and the incidence of pneumonia in toddlers with a p-value = 0.029.[14]

Occupancy density can affect indoor air quality, increase the risk of illness, and encourage the spread of disease among family members.[15] Based on the findings obtained in the field, 46.9% of respondents have dense occupants. This is due to the narrow living space and many respondents living with relatives or family members. The results of the analysis test in this study showed that the p-value was 0.006. The magnitude of the risk of under-fives developing pneumonia can be seen from the odd ratio value of 4.879, which means that respondents who have houses with dense occupancy are at a 4.8 times greater risk of pneumonia in toddlers than respondents who have houses with uncrowded occupancy. The results of this study are in line with a study by Sri Meywati et al., which examined the effect of physical conditions at home on the incidence of pneumonia in children under 5 years old and found a relationship between housing density and the incidence of pneumonia (p-value = 0.000). The results of this study suggest that living in a house with a high occupancy rate increases the risk of pneumonia in young children. The unsatisfactory occupancy rate is due to the area of living space that is not proportional to the number of families who inhabit it.

Ventilation is a physical part of the house and the ventilation area that qualifies for healthy living is if it has a ventilation area of 10% of the floor area.[16] The p-value in this study was 0.003, which means that there is a significant relationship between ventilation and the incidence of pneumonia in toddlers. The Odds ratio value was 5.727, which means that respondents who have houses with unqualified ventilation are at a 5.7 times greater risk of pneumonia in toddlers than respondents who have houses with qualified ventilation. This means that toddlers living in homes with poor ventilation are five times more likely to get pneumonia. A survey conducted at the study site found that 54.7% of respondents had unqualified ventilation. Several types of ventilation have been found. Some respondents still use wooden ventilation, while others use permanent glass ventilation. Ventilation systems that cannot be opened or that do not meet the standards allow disease viruses and pollutants to stay longer inside. This study is in line with Anwar and Dharmayanti's research which found that household ventilation is a risk factor for pneumonia, with a p-value of 0.000. In addition, the results of this study are in line with another study conducted by Padmonobo et al. (2012) approved the relationship of ventilation area with the incidence of pneumonia. The study found an association between ventilation and pneumonia, where toddlers who had ventilation that did not meet the standards had a risk of 2.218 times greater than toddlers who lived in homes with adequate ventilation.[17]

The physical environment of the house is not only the density of occupancy and ventilation but the type of floor and humidity are also included in the physical environment has the same role in influencing the incidence of pneumonia in toddlers.[18] Based on the results of this study's analysis, floor type, and humidity did not have a significant relationship with the incidence of pneumonia in toddlers. The results of the analysis on the humidity variable obtained a p-value of 0.386 (>0.05), which means that humidity does not have a significant relationship with the incidence of pneumonia. The results of this study are in line with research conducted by Koni Agustyana et al, which states that there is no relationship between floor type and the incidence of pneumonia in toddlers (p-value = 0.715). The results of this study are in line with research conducted by Koni Agustyana et al, which states that floor type had no significant relationship with the incidence of pneumonia in toddlers (p-value = 0.715).[19] And reinforced by research by Delima Kurnia Sari et al (2018) which said that humidity had no significant relationship with the incidence of pneumonia (p-value = 1,000).[20] Even so, the floor of the house and humidity must always be considered, the types of floors that do not meet the requirements such as floors made of soil or materials that are not waterproof while the types of floors that meet the requirements are floors made of ceramics, cement or waterproof materials.

Conclusion

This study found factors that were affecting the incidence of pneumonia in

toddlers. Based on the results of the analysis, the factors that simultaneously affected the incidence of pneumonia were smoking behavior (p= 0,001) and home ventilation (p=0,009).

Ethics approval

This study has been approved by the Health Research Ethics Commission of the Faculty of Public Health, Nusa Cendana University. The statement of passing the ethical review of this research is marked with the ethical number 2022516-KEPK released on January 9, 2023.

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Not applicable

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Author Contribution

GCS collected data using the questionnaire and measuring instruments and analyzed the data to determine the relationship between knowledge, smoking behavior, and the physical environment of the house with the incidence of pneumonia in toddlers in the Belu district area.

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