Jurnal Kesehatan Masyarakat

Determinants of the Incident of Pneumonia in Toddlers in Bengkulu City in 2020

Nopia Wati[1✉], Oktarianita[2], Agus Ramon[3], Hasan Husin[4], Harsismanto J[4]
[1,2,3,4]Public Health Study Program, FIKES Universitas Muhammadiyah Bengkulu, Indonesia

Article Info

Abstract

The number of pneumonia cases in toddlers in Bengkulu City in 2018 reached 3,411. In 2017 there were 3,437 cases. In 2016 there were 31 people. The increase in pneumonia cases will affect the health status of infants and children in the future. This study aims to analyze the determinants of the incidence of pneumonia in children under five in Bengkulu City. The research method was cross-sectional, located in 4 health centers (Sukamerindu, Betungan, Telaga Dewa, and Kuala Lemembu). The sample in this study was 90 people. Data collection using a questionnaire. Data analysis by univariate and bivariate. Results, There is a relationship between immunization status (P-Value 0.000), exclusive breastfeeding (P-Value 0.004), history of ARI (P-Value 0.000), and residential density (p-value 0.004) with the incidence of pneumonia in children under five in Bengkulu City. The study concluded the significant relation between immunization status, exclusive breastfeeding, history of ARI, and residential density with the incidence of pneumonia in children under five in Bengkulu City. The most influential variable was exclusive breastfeeding.

Introduction

In Indonesia, pneumonia is the second leading cause of death in children under five after diarrhea. Basic Health Research Data (2018) shows the highest prevalence of pneumonia affects toddlers aged 12-23 years. The percentage reaches 1.6 percent in 2013 and increasing by 2.0 in 2018 (Riskesdas, 2018). Of the five provinces in Indonesia having the highest incidence of pneumonia, Bengkulu Province ranks second after Papua, followed by West Papua and West Java. The incidence rate in Papua is 3.6%, Bengkulu is 3.4%, West Papua is 2.9%, and West Java is 2.6% (Riskesdas, 2018).

Bengkulu City Health Profile (2018) showed that in 2018 the number of pneumonia cases in children under five in Bengkulu reached 3,411, for the number of cases handled as many as 876 (25.68%). In 2017 there were 3,437 patients, including 1,679 men and 1,758 women. The number of cases found and handled was 111 people (3.23%). It shows a high increase trend when compared to last year in 2016.

There were 31 people (0.95%) when compared to the previous five years. The incidence of pneumonia in toddlers is fluctuating. It can be seen from the number of patients found and treated every year. The number of cases every year in 2016 there were 31 cases. In 2015 there were 125 cases. In 2014 there were 35 cases. In 2013 26 cases. In 2012 46 cases (Dinkes Kota Bengkulu, 2018). From the City Health Office's data we found four puskesmas (public health center) areas in Bengkulu with high incidence rates. They are Sukamerindu, Betungan, Telaga Dewa, and Kuala Lemrubuk. So it needs to be investigated to find out what factors causing the high case numbers of pneumonia in toddlers in Bengkulu City. Based on the above background, the purpose of this study was to see the determinants of the incidence of pneumonia in toddlers in Bengkulu City.

Method

This study uses a quantitative approach. This type of research is an observational study

---

✉ Correspondence Address:
  Public Health Study Program, FIKES Universitas Muhammadiyah Bengkulu, Indonesia.
  Email : Nopia Wati, nopia@umb.ac.id

with a cross-sectional approach. This research took place in the working area of the Public Health Center with a high number of pneumonia cases, namely 4 (four) Sukamerindu, Betungan, Telaga Dewa, and Kuala Lempemberu. The population in this study were all mothers who had toddlers. The sample in this quantitative study was taken using the simple random sampling method. The calculation results in the minimum number of samples obtained is 90 people. The independent variables included mother's education, exclusive breastfeeding, immunization status, history of ARI, and residential density, while the dependent variable is the incidence of pneumonia in toddlers. Data was collected by distributing questionnaires. Furthermore, the data collected was analyzed by univariate, bivariate, and multivariate analysis.

Result and Discussion

From the results of univariate data analysis, data on the frequency distribution of the determinants of the incidence of pneumonia in Toddlers in Bengkulu City in 2020 were as follows:

Table 1. Frequency Distribution Of The Determinants Of The Incidence Of Pneumonia in Toddlers in Bengkulu City In 2020

Pneumonia Incident	N	%
Pneumonia	52	57.8
Not Pneumonia	38	42.2
Education		
Low	13	14.4
High	77	85.6
Exclusive Breast Feeding		
No	36	40.0
Yes	54	60.0
Immunization Status		
Incomplete	58	64.4
Complete	32	35.6
ARI History		
Yes	47	52.2
No	43	47.8
Residential Density		
Dense	35	38.9
Not Dense	55	61.1

Source : Primary Data, 2020

Table 1 above shows the incidence of pneumonia in toddlers from 90 respondents. There are 52 children under five (57.8%) suffering from pneumonia and 38 (42.2%) not suffering from pneumonia. On average, there are 77 mothers of children under five with high education (85.6%). There are still mothers of toddlers who do not give exclusive breastfeeding as many as 36 people (40%). The average immunization status of toddlers was 58 children (64.4%) and had a history of ARI as many as 47 (52.2%). There are still houses with a dense residential of 35 houses (38.9%). The results of bivariate data analysis are as follows:

Table 2. Determinants of Pneumonia Incidence in Toddlers in Bengkulu City in 2020

	\multicolumn{4}{c}{Pneumonia Incident}	\multicolumn{2}{c}{Total}	p-value	POR (95% CI)
	Yes	%	No	%	n	%		
Education								
Low	9	69,2	4	30,8	13	100	0,548	1,779
High	43	55,8	34	44,2	77	100		(0,504 – 6,277)
Exclusive Breast Feeding								
No	28	77,8	8	22,2	36	100	0,004	4,375
Yes	24	44,4	30	55,6	54	100		(1,689 – 11,330)
Immunization Status								
Incomplete	44	75,9	14	24,1	58	100	0,000	9,429
Complete	8	25	24	75	32	100		(3,465 – 25,654)
ARI History								
Yes	40	75,5	13	24,5	53	100	0,000	6,410
No	12	32,4	25	67,6	37	100		(2,259 – 16,250)
Residential Density								
Dense	32	74,4	11	25,6	43	100	0,004	3,927
Not Dense	20	42,6	27	57,4	47	100		(1,602 – 9,625)
Total	52	100	38	100	90	100		

Source : Primary Data, 2020

Table 3. Final Model of Multivariate Analysis

Variable	B	P-Value	Exp(B) OR	95,0% C.I.for EXP(B)
				Lower	Upper
Exclusive Breast Feeding	1.338	0,027	3.810	1.160	12.509
Immunization Status	1.241	0,066	3.459	0.923	12.955
ARI History	1.683	0,005	5.382	1.640	17.661
Constant	-3.727	0,000	.024	0.024	

Source : Primary Data, 2020

Based on the results of multivariate analysis with logistic regression test, the equation for the risk of contracting Pneumonia in Toddlers in Bengkulu City, with the following equation model:

$$y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3$$

$$y = -3{,}727 + 1{,}338(X_1) + 1{,}241(X_2) + 1{,}683(X_3)$$

Remark =
α = Constant (-3,727)
β_1 = Exclusive Breast Feeding Coefficient (1,338)
β_2 = Immunization Status Coefficient (1,241)
β_3 = ARI History Coefficient (1,683)
X_1 = Exclusive Breast Feeding Independent Variable (1 or 2)
X_2 = Immunization Status Independent Variable (0 or 1)
X_3 = ARI History Independent Variable (1 or 2)

In table 2, from 13 mothers with low education, there were nine (69.2%) who suffered from pneumonia with a p-value = 0.548 > 0.005. So, there was no significant relationship between mother's education and the incidence of pneumonia in toddlers in Bengkulu City. The POR value was 1.779 (0.504 – 6.277), which means that mothers with low education have a 1.779 times risk of their children suffering from pneumonia compared to those with higher education. Mother's education is one of the factors that can indirectly affect the incidence of pneumonia in infants and toddlers. Higher formal education of a mother can receive better knowledge or information than a mother with lower education so that mothers with higher education can take better care of their children (Sonego et al., 2015). The study result showed that from mothers with low education, there were nine toddlers (69.2%) who suffered from

pneumonia. With a p-value = 0.548> 0.005. So there was no significant relationship between the mother's education and the incidence of pneumonia in toddlers in Bengkulu City. A Mother with low education has a risk of 1.779 times for their children to suffer from pneumonia compared to those with higher education.

The result is not in line with other studies mentioning a significant relationship between the mother's education and the incidence of pneumonia in toddlers. The mothers with low education have twice the risk of their toddlers suffering from pneumonia compared to mothers with high education with a p-value (0.001) (Mondal & Paul, 2020). However, the result is in line with a study stating there was no relationship between mother's education and the incidence of pneumonia in toddlers at the Semowo Health Center with a p-value (0.299) (Astuti & Koesyanto, 2011). According to (Abbey et al., 2016), lack of awareness and introduction of pneumonia can cause children to get pneumonia. It may be due to the lack of education of caregivers so that their knowledge about prevention and treatment measures about pneumonia is also inadequate.

Of the 90 research respondents, mothers who did not give exclusive breastfeeding to their children, 28 toddlers (77.8%) suffering from pneumonia, with p-value = 0.004 <0.05, so there was a significant relationship between exclusive breastfeeding and the incidence of pneumonia in toddlers in Bengkulu City. The POR value was 4.375 (1.689 – 11.330), which means that mothers who do not give exclusive breastfeeding have a 4.375 times risk of their children suffering from pneumonia compared to those who give. The results of the multivariate analysis of variables that have an Exp (B) value, namely the Exclusive Breastfeeding variable with an Exp (B) value of 3.810 (1.160 – 12.509), means that exclusive breastfeeding to infants has an effect of 3.810 times on the incidence of pneumonia in toddlers in Bengkulu City. Exclusive breastfeeding is breastfeeding only to infants until six months without providing other food or fluids. The content in the breast milk that babies drink is sufficient and essential to the baby's health. Even newborns who receive only a low amount of the first milk (colostrum)

do not need additional fluids because babies are born with enough fluids in their bodies (Mustikarani et al., 2019). Breast milk contains immune substances against infections, including proteins, lactoferrin, immunoglobulins. It also contains antibodies against bacteria, viruses, fungi, and others. Therefore, exclusive breastfeeding reduces infant mortality rates due to various common diseases that afflict children, such as pneumonia, pulmonary inflammation, speeding up recovery when sick, and helping to space births (Bham et al., 2016).

Previous researchers supported this result who stated that suboptimal breastfeeding increases the risk of pneumonia morbidity and mortality in all age groups. In particular, mortality from pneumonia was higher in infants who do not get breast milk than exclusively breastfed infants aged 0-5 months (RR: 14.97; 95% CI: 0.67-332.74) and in infants who do not get breast milk compared to infants and young children aged 6-23 months (RR: 1.92; 95% CI: 0.79-4.68) (Lamberti et al., 2013). In addition, exclusive breastfeeding at six weeks of age significantly reduces the likelihood of hospitalization for suspected pneumonia in rural Vietnam (Odds Ratio (OR) 0.39, 95% Confidence Interval (CI) 0.20 to 0.75) (Hanieh et al., 2015).

Of 90 respondents with incomplete immunization status, 44 toddlers (75.9%) suffered from pneumonia, with p-value = 0.000, so there was a significant relationship between immunization status and the incidence of pneumonia in toddlers in Bengkulu City. The POR value was 9,429 (3,465 – 25,654), which means that toddlers who are not fully immunized have a 9.429 times risk of suffering from pneumonia compared to those who get full immunization. From the multivariate results, the immunization status had an influence on the incidence of pneumonia in toddlers with an Exp (B) value of 3.459 (95% CI = 0.923 - 12.955), which means that immunization status in toddlers had an effect on 3.459 times on the incidence of pneumonia in Bengkulu City.

Immunizations help prevent babies from developing infections that directly cause pneumonia, such as Haemophilus influenza type B (Hib). It can also prevent infections causing pneumonia as a complication of the

disease (eg, measles and pertussis). DPT immunization is one of the effective immunizations to reduce factors that increase mortality from pneumonia (Azab et al., 2014). Pneumonia remains the top cause of morbidity and mortality. Risk factors include young age, malnutrition, immunosuppression, tobacco smoke, or exposure to air pollution. The better methods, for specimen collection and molecular diagnostics, have improved microbiological diagnosis showing that pneumonia is caused by several interacting organisms, so immunization is urgently needed to prevent this disease (Marangu & Zar, 2019). These results are relevant with previous studies stating a very low incidence of pneumonia in the Pune and Sangli districts of Maharashtra. Partial immunization emerged as the most influenced risk factor. The low incidence and lack of association of pneumonia with known risk factors may be due to better literacy rates among mothers and better immunization coverage (Gothankar et al., 2018).

The results of this study are in line with (Zhang et al., 2013), showing that toddlers who do not receive immunizations have the opportunity to experience pneumonia. Subsequent research stated a significant relationship between immunization status and the incidence of pneumonia in children under five (Vignari, 2020). According to (Almirall et al., 2015), prevention strategies promoting effective vaccines or identify and act on modifiable risk factors are very important in reducing pneumonia-related deaths in children under five.

Of the 90 research respondents, 40 children (75.5%) had pneumonia, with a p-value = 0.000, so there was a significant relationship between a history of ARI and the incidence of pneumonia in children under five in Bengkulu City. The POR value is 6.410 (2.259 – 16.250), which means that toddlers with a history of ARI have a 6.410 times risk of suffering from pneumonia compared to those without an ARI history. From the results of the multivariate analysis, the history of ARI affected the incidence of pneumonia in toddlers. It has an effect of 5,382 times on the incidence of pneumonia in toddlers in Bengkulu City.

Acute Respiratory Infection (ARI),

especially pneumonia, is still the most cause of morbidity and mortality in infants and toddlers. Pneumonia is an acute infection that affects the lung tissue (alveoli) and has cough symptoms, shortness of breath, rales, and infiltrates on X-rays. The occurrence of pneumonia in children often coincides with an acute infectious process in the bronchi, which is often called bronchopneumonia (Saha et al., 2016). The results are in line with previous studies stating the presence of concomitant disease or ARI (OR = 1.902; 95% CI, 1.043–3.469; P = 0.036). Then there is a significant relationship with the incidence of pneumonia in toddlers, so it is necessary to develop an intervention to reduce the burden of pneumonia in toddlers in Egypt (Fadl et al., 2020). Another opinion states that co-residents with upper respiratory tract infections (ARI) also influence the occurrence of pneumonia in toddlers (Bekele et al., 2017).

Of the 90 respondents, 32 people (74.4%) who lived in dense residential areas had pneumonia, with a p-value = 0.004, so there was a significant relationship between a history of ARI and the incidence of pneumonia in toddlers in Bengkulu City. The POR value is 3.927 (1.602 – 9.625), which means that toddlers who live in dense residential have a 3.927 times risk of suffering from pneumonia compared to those who are not. The density of the house occupancy is closely related to the air ventilation of the house. Residential conditions that are too dense and lack air ventilation can increase the air temperature in the house so that the house feels hotter because of the water vapor produced by the body's metabolism and objects in the room. The more residents gather in a room, the more likely the risk of disease transmission will be, especially for babies who are relatively susceptible to disease transmission. The theory is in line with the study showing that Toddlers who lived in dense residential, 32 people (74.4%) suffering from pneumonia, with a p-value = 0.004. So there was a significant relationship between residential density and the incidence of pneumonia in toddlers in Bengkulu City and have a risk of 3,927 times of suffering from pneumonia compared to those who are not dense. The results of this study are in line with research finding a significant relationship between residential density and

the incidence of pneumonia (p-value 0.000). Children who live in densely populated homes have 3.6 times the chance compared to those living in non-dense houses.

This study is supported by (Almirall et al., 2015), stating a relationship between housing density and the incidence of pneumonia for toddlers aged 12 - 59 months with 3.77 times greater risk of occurring in toddlers who live with dense housing than those who live in less dense housing. A house is considered dense when it is not only occupied by one family, but can be two to three families. It can affect the level of residential density even though the house has a large building area. Density is a prerequisite for the disease transmission process. The denser it is, the easier and faster the transfer of disease, especially airborne diseases. Therefore, the residential density is a variable playing a role in the incidence of pneumonia in toddlers. This study is in line with research (Pramudiyani & Prameswari, 2011), finding a relationship between room occupancy density and the incidence of pneumonia in toddlers with p = 0.001.

Conclussion

There is a relationship between exclusive breastfeeding (p-value = 0.004), immunization status (p-value = 0.000), history of ARI (p-value = 0.000) and occupancy density (p-value = 0.004) with the incidence of pneumonia in toddlers in Bengkulu City in 2020. The mother's education variable has no significant relationship with the incidence of pneumonia in toddlers in Bengkulu City in 2020. From the results of multivariate analysis, the most influential variable on the incidence of pneumonia in toddlers is the history of ARI with the largest Exp(B) value of 5,382. (1,640 – 17,661). It means that a history of ARI in toddlers risks 5,382 times on the incidence of pneumonia in toddlers in Bengkulu City. From the results of multivariate analysis, the most dominant variable influencing the incidence of pneumonia in toddlers was exclusive breastfeeding with an OR value of 3.810 (1.160 – 12.509).

References

Abbey, M., Chinbuah, M. A., Gyapong, M., Bartholomew, L. K., & Van Den Borne, B., 2016. Community Perceptions and Practices of Treatment Seeking for Childhood Pneumonia: A Mixed Methods Study in a Rural District, Ghana. *BMC Public Health*, 16(1), pp.1–10.

Almirall, J., Bolibar, I., & Serra-Prat, M., 2015. Risk Factors for Community-acquired Pneumonia in Adults: Recommendations for Its Prevention. *Community Acquired Infection*, 2(2), pp.32.

Astuti, N.S., & Koesyanto, H., 2011. Faktor Ibu Balita yang Berhubungan dengan Kepatuhan Follow Up Penderita Pneumonia. *KEMAS: Jurnal Kesehatan Masyarakat*, 6(2), pp.127–133.

Azab, S.F.A.H., Sherief, L.M., Saleh, S.H., Elsaeed, W.F., Elshafie, M.A., & Abdelsalam, S.M. 2014. Impact of the Socioeconomic Status on the Severity and Outcome of Community-Acquired Pneumonia Among Egyptian Children: A Cohort Study. *Infectious Diseases of Poverty*, 3(1), pp.1–7.

Bekele, F., Sinaga, M., Quadri, J.A., Kumar, A., Shariff, A., & Malik, T., 2017. Factors associated with Outcomes of Severe Pneumonia in Children Aged 2 Months to 59 Months at Jimma University Specialized Hospital, Southwest Ethiopia. *Current Pediatric Research*, 21(3), pp.447–454.

Bham, S.Q., Saeed, F., & Shah, M.A., 2016. Knowledge, Attitude and Practice of Mothers on Acute Respiratory Infection in Children Under Five Years. *Pakistan Journal of Medical Sciences*, 32(6), pp.1557–1561.

Dinkes Kota., 2018. *Profil kesehatan Kota Bengkulu.* Bengkulu

Fadl, N., Ashour, A., & Yousry, M.Y., 2020. Pneumonia among Under-five Children in Alexandria, Egypt: A Case-Control Study. *Journal of the Egyptian Public Health Association*, 95(1).

Gothankar, J., Doke, P., Dhumale, G., Pore, P., Lalwani, S., Quraishi, S., Murarkar, S., Patil, R., Waghachavare, V., Dhobale, R., Rasote, K., Palkar, S., & Malshe, N., 2018. Reported Incidence and Risk Factors of Childhood Pneumonia in India: A Community-based cross-Sectional Study. *BMC Public Health*, 18(1), pp.1111.

Hanieh, S., Ha, T.T., Simpson, J.A., Thuy, T.T., Khuong, N.C., Thoang, D.D., Tran, T.D., Tuan, T., Fisher, J., & Biggs, B.A., 2015. Exclusive Breast Feeding in Early Infancy Reduces the Risk of Inpatient Admission for Diarrhea and Suspected Pneumonia in rural

Vietnam: A Prospective Cohort Study Global health. *BMC Public Health*, 15(1), pp.1–10.

Lamberti, L.M., Zakarija-Grković, I., Fischer Walker, C.L., Theodoratou, E., Nair, H., Campbell, H., & Black, R.E., 2013. Breastfeeding for Reducing the Risk of Pneumonia Morbidity and Mortality in Children Under Two: A Systematic Literature Review and Meta-analysis. *BMC Public Health*, 13(Suppl.3).

Marangu, D., & Zar, H. J., 2019. Childhood Pneumonia in Low-and-middle-income Countries: An Update. *Paediatric Respiratory Reviews*, 32, pp.3–9.

Mondal, D., & Paul, P., 2020. Effects of Indoor Pollution on Acute Respiratory Infections Among Under-five Children in India: Evidence from a Nationally Representative Population-based Study. *PloS One*, 15(8).

Mustikarani, Y.A., Rahardjo, S.S., Qadridjati, I., & Prasetya, H., 2019. Contextual Effect of Village on the Risk of Pneumonia in Children Under Five in Magetan, East Java. *Journal of Epidemiology and Public Health*, 4(2), pp.117–126.

Pramudiyani, N., & Prameswari, G., 2011. Hubungan antara Sanitasi Rumah dan Perilaku dengan Kejadian Pneumonia Balita. *KEMAS: Jurnal Kesehatan Masyarakat*, 6(2), pp.71–78.

Riskesdas., 2018. *Riset Kesehatan Dasar.* Jakarta. Kemenkes RI

Saha, S., Hasan, M., Kim, L., Farrar, J.L., Hossain, B., Islam, M., Ahmed, A.N.U., Amin, M.R., Hanif, M., Hussain, M., El-Arifeen, S., Whitney, C.G., & Saha, S.K., 2016. Epidemiology and Risk Factors for Pneumonia Severity and Mortality in Bangladeshi Children <5 Years of Age Before 10-valent Pneumococcal Conjugate Vaccine Introduction. *BMC Public Health*, 16(1), pp.1–12.

Sonego, M., Pellegrin, M. C., Becker, G., & Lazzerini, M., 2015. Risk Factors for Mortality from Acute Lower Respiratory Infections (ALRI) in Children Under Five Years of Age in Low and Middle-income Countries: A Systematic Review and Meta-analysis of Observational Studies. *PLoS ONE*, 10(1), pp.1–17.

Vignari, M., 2020. Non-ventilator Health Care-associated Pneumonia (NV-HAP): NV-HAP Risk Factors. *American Journal of Infection Control*, 48(5).

Zhang, Q., Guo, Z., Bai, Z., & MacDonald, N.E., 2013. A 4 Year Prospective Study to Determine Risk Factors for Severe Community Acquired Pneumonia in Children in Southern China. *Pediatric Pulmonology*, 48(4), pp.390–397.