

Relationship of Pneumonia Characteristics with Pneumonia Severity Among Children Under 5 Years At Siti Khodijah Muhammadiyah Sepanjang Hospital in 2019-2020

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ABSTRACT

Background/aim: Globally, pneumonia is the leading cause of morbidity and mortality in children younger than five years old. Several studies reveal that age, gender, vaccination status, and nutritional status are associated with severity and mortality in children with pneumonia, so further research is needed. This study aims to determine the characteristic of pneumonia such as age, gender, vaccination status, and nutritional status with the severity of pneumonia among children below five years old at Siti Khodijah Muhammadiyah Hospital. Material and Methods : A retrospective cross-sectional study using medical record data among children below five years old who were treated with a final diagnosis of pneumonia/bronchopneumonia at Siti Khodijah Muhammadiyah Hospital during January 2019 to December 2020 were obtained. The data were analyzed by *Chi-square* test and multivariate analyzed was performed including variables that were significant at $p < 0,05$ in bivariate analyzed. Result : The characteristic related to the severity of pneumonia among children below five years old are age ($P = 0.042$) and nutritional status ($P = 0.015$). Children under five with underweight are 4,700 times more likely to have severe pneumonia than those with overweight. Children aged 1-12 months are at risk for severe pneumonia 3.239 times greater than those aged 36-60 months. This study concluded that younger age and underweight were risk factors for severe pneumonia. Originality/ Value/ Implication : The paper provides a new interpretation of existing sources on the characteristics of pneumonia patients and offers new insights into the topic area by emphasizing its relationship with severity of pneumonia.

Keywords: *pneumonia, characteristic features, severity, pediatric*

ABSTRAK

Secara global, pneumonia merupakan penyebab utama morbiditas dan mortalitas pada anak yang berusia kurang dari lima tahun. Beberapa penelitian mengungkapkan bahwa usia, jenis kelamin, riwayat imunisasi, dan status gizi merupakan faktor yang terkait terhadap derajat keparahan dan kematian pada anak-anak dengan pneumonia, sehingga perlu dilakukan penelitian lebih lanjut. Penelitian ini bertujuan untuk mengetahui hubungan karakteristik pasien pneumonia yaitu usia, jenis kelamin, riwayat imunisasi, dan status gizi dengan derajat keparahan pneumonia pada anak balita di Rumah Sakit Siti Khodijah Muhammadiyah Sepanjang. Penelitian cross sectional pendekatan retrospektif menggunakan data rekam medis anak balita yang dirawat dengan diagnosis akhir pneumonia/bronkopneumonia di RS Siti Khodijah Muhammadiyah selama Januari 2019 hingga Desember 2020. Data dianalisis menggunakan uji *Chi-square* dan analisis multivariat digunakan pada variabel yang memiliki signifikansi $p < 0,05$ dalam analisis bivariat. Karakteristik yang berhubungan dengan keparahan pneumonia pada balita adalah usia ($P=0,042$) dan status gizi ($P=0,015$). Anak balita dengan berat badan kurang memiliki kemungkinan 4.700 kali lebih besar untuk menderita pneumonia berat dibandingkan mereka yang kelebihan berat badan. Anak usia 1-12

bulan berisiko terkena pneumonia berat 3,239 kali lebih besar dibandingkan usia 36-60 bulan. Studi ini menyimpulkan bahwa usia yang lebih muda dan berat badan yang kurang merupakan faktor risiko pneumonia berat. Makalah ini memberikan interpretasi baru dari sumber yang ada tentang karakteristik pasien pneumonia dan menawarkan wawasan baru ke dalam area topik dengan menekankan hubungannya dengan tingkat keparahan pneumonia.

Kata kunci : *pneumonia, gambaran karakteristik, derajat keparahan, anak*

INTRODUCTION

Pneumonia is very susceptible to attack children under the age of five, where the majority of cases are caused by the bacterium *Streptococcus pneumoniae* (Gritly et al., 2018). Children under five years who have pneumonia when treated in the wrong way or treated too late will worsen the disease and cause death (Susanti, 2017). Globally, pneumonia is the leading cause of morbidity and mortality in children younger than five years (Gupta, 2012). Every year around one million children under five in the world die from pneumonia, mainly in Africa and Southeast Asia (WHO & UNICEF, 2014).

Based on data from the Ministry of Health of the Republic of Indonesia in 2018 it shows; The incidence per 1000 children under five in Indonesia is 20.06%, almost the same as the 2017 data, which is 20.56%. In 2013 the highest incidence of pneumonia per 1000 children under five was in the 12-23 month age group as many as 21.7% of cases (Kemenkes RI, 2013). Based on data from the Indonesian Ministry of Health in 2018 cases of pneumonia in children under five in East Java were 92,913. The mortality rate for children under five is 67 cases (Kemenkes RI, 2019)

Based on an analysis of multivariable data published in 2016, the factors that were independently associated with severe pneumonia were younger age, low body weight, unsafe drinking water sources, status and education level of parents. Then for factors that

were independently associated with death in children with pneumonia, namely age <11 months, low body weight, unsafe drinking water sources, severity of disease, and the presence of at least one comorbid disease such as congenital heart disease, thalassemia, syndrome nephrotic syndrome, Down syndrome, protein energy deficiency (PEM) and tuberculosis. Symptoms such as cough (n = 3482, 96%), fever (n = 2702, 74%) and difficulty in breathing (n = 1595, 44%) often appeared in children with pneumonia. retractions (n = 1159, 52%) and convulsions (38%, n = 841) were frequently found in severe pneumonia (Saha et al., 2016).

A study conducted in Kenya in 2017, stated that pneumonia in children aged 2-11 months with a respiratory rate of 70 breaths/minute and a very low z-score had a higher risk of death (Tuti et al., 2017). However, these findings still need to be re-evaluated. In Indonesia, not many studies have found a relationship between the characteristics of pneumonia patients and the severity of pneumonia in children under five. The researchers plan to investigate risk factors that may worsen the severity of pneumonia under these conditions.

MATERIAL AND METHODS

This study is an observational analysis. The type of study uses a retrospective cross-sectional study. The population taken was all medical records of children under five with a final diagnosis of pneumonia or bronchopneumonia at the Siti Khodijah Muhammadiyah Hospital 2019-2020 with a total sample of 102 samples taken sequentially.

The dependent variable was the severity of pneumonia in children under five, which consisted of mild/moderate pneumonia and severe pneumonia. While the independent variables of this study were age, gender (male and female), vaccination status, and nutritional status. The age was differentiated into 1-12 months, 13-36 months, and 37-60 months. nutritional status was categorized as normal weight (Z-score -2 SD to $+2$ SD), underweight (Z-score -3 SD to < -2 SD), severely underweight (Z-score < -3 SD), and overweight (Z-score $> + 2$ SD). Vaccination status was divided into complete and incomplete vaccination status.

The case group's inclusion criteria in this study are children aged 1 to 60 months with a final diagnosis of pneumonia or bronchopneumonia, the patient/guardian is willing to be involved in the research, and hospitalized at Siti Khodijah Muhammadiyah Hospital. While the exclusion criteria in this study are patient who have congenital heart disease, malignancy, immunodeficiency, secondary infection or infection other than pneumonia, Down's Syndrome, Pneumonia et causa COVID-19, medical records that do not provide complete information, and damaged medical record data. The minimum size of the research sample is 96 people using the Slovin sample size formula.

RESULT

Children who suffered from pneumonia in 2 years from 2019-2020 were recorded in the medical records at Siti Khodijah Muhammadiyah Hospital a total of 119 patients have been obtained. After screening for inclusion and exclusion, the results obtained were 102 samples of children under five.

3.1. Univariate Analysis

Characteristics of the subjects of this study can be identified based on age, gender, immunization history, nutritional status, and severity of pneumonia.

Table 1. Characteristics of pneumonia patients at Siti Khodijah Muhammadiyah Hospital

Characteristics	Frequence	Precentage
Age		
1 – 12 months	65	63,7%
13 – 36 months	29	28,4%
37 – 60 nonths	8	7,8%
Gender		
Male	65	63,7%
Female	37	36,3%
Vaccination status		
Complete	73	71,6%
Incomplete	29	28,4%
Nutritional Status		
severely underweight	0	0,0%
underweight	10	9,8%
normal	83	81,4%
overweight	9	8,8%

Pneumonia Severity		
mild/moderate	84	82,4%
severe pneumonia	18	17,6%

Based on the results of the analysis on age characteristics, it can be seen that of the 102 subjects, 65 of them were aged 1 to 12 months (63.7%), 29 children aged 13 to 36 months (28.4%), and 8 other children (7.8%) aged 37 to 60 months. The data in Table 1 shows that 65 children (63.7%) were male, and 37 other children (36.3%) were female. 73 children had complete immunizations (71.6%) and 29 others were incomplete (28.4%). The subjects in this study were dominated by children with normal nutritional status, as many as 83 children (81.4%), 10 underweight children (9.8%), and 9 others with overweight (8.8%). A total of 84 children were included in the mild/moderate pneumonia group (82.4%) and 18 other children were included in the severe pneumonia group (17.6%).

3.2. Bivariate Analysis

3.2.1. Relationship between Age and Severity of Pneumonia in Children Under 5 Years

Old at Siti Khodijah Hospital Muhammadiyah

Table 2. Relationship between Age and Severity of Pneumonia in Children Under 5 Years

Old

		Age			P
		1-12 months	13-36 months	37-60 months	
Severity of pneumonia	Mild/moderate pneumonia	49 (58,3%)	28 (33,3%)	7 (8,3%)	0,042
	Severe pneumonia	16 (88,9%)	1 (5,6%)	1 (5,6%)	
Contingency Coefficient = 0,242					

The contingency coefficient value was obtained at 0.242 which indicates a weak relationship between age and the severity of pneumonia. The results of the chi-square test obtained a significance value of 0.042 ($p < 0.05$). So it can be concluded that there is a significant relationship between age and the severity of pneumonia.

3.2.2. Relationship between Gender and Severity of Pneumonia in Children Under 5 Years Old at Siti Khodijah Hospital Muhammadiyah

Table 3. Relationship between Gender and Severity of Pneumonia in Children Under 5 Years Old

		Age		P
		Male	Female	
Severity of pneumonia	Mild/moderate pneumonia	53 (61,3%)	31 (36,9%)	0,775
	Severe pneumonia	12 (66,7%)	6 (33,3%)	
Contingency Coefficient = 0,28				

Based on the results of the analysis, the contingency coefficient value was 0.028, which means a very weak relationship between gender and the severity of pneumonia. The significance value of the chi-square test obtained is 0.775 ($p > 0.05$), which means that there is no significant relationship between gender and the severity of pneumonia.

3.2.3. Relationship between Vaccination Status and Severity of Pneumonia in Children Under 5 Years Old at Siti Khodijah Hospital Muhammadiyah

Table 4. Relationship between Vaccination Status and Severity of Pneumonia in Children Under 5 Years Old

		Vaccination Status		P
		complete	incomplete	
Severity of pneumonia	Mild/moderate pneumonia	62 (73,8%)	22 (26,2%)	0,278
	Severe pneumonia	11 (61,1%)	7 (38,9%)	
Contingency Coefficient = 0,107				

The contingency coefficient value obtained is 0.107, which means that there is a weak relationship between vaccination status and the severity of pneumonia. The significance value obtained was 0.278 ($p > 0.05$), which means that there was no significant relationship between the vaccination status and the severity of pneumonia.

3.2.4 Relationship between Nutritional Status and Severity of Pneumonia in Children Under 5 Years Old at Siti Khodijah Hospital Muhammadiyah

Table 5. Relationship between Nutritional Status and Severity of Pneumonia in Children Under 5 Years Old

		Nutritional Status			P
		overweight	Normal	underweight	
Severity of pneumonia	Mild/moderate pneumonia	7 (8,3%)	72 (85,7%)	5 (6,0%)	0,015
	Severe pneumonia	2 (11,1%)	11 (61,1%)	5 (27,8%)	
Contingency Coefficient = 0,276					

The contingency coefficient value obtained is 0.276, which means that there is a weak relationship between nutritional status and the severity of pneumonia. The significance value of the chi-square test was 0.015 ($p < 0.05$), which means that there is a significant relationship between nutritional status and the severity of pneumonia.

3.3. Multivariate Analysis

The results of bivariate analysis using the chi-square test showed that age and nutritional status had a significant relationship with the severity of pneumonia.

3.3.1. Multinomial Regression Analysis Relationship between Age and Nutritional Status with Pneumonia Severity in Children Under 5 Years Old at Siti Khodijah Hospital Muhammadiyah

Table 6. Multinomial Regression Analysis Relationship between Age and Nutritional Status with Pneumonia Severity

Independent variable	Categories	B	Exp (B)	95% CI for Exp (B)		P
				Lower	Upper	
Age	1 – 12 months	1,175	3,239	2,160	9,409	0,012
	14 – 36 months	1,038	1,354	0,036	3,508	0,191
Status Gizi	Under weight	1,547	4,700	1,013	21,808	0,048
	Normal	0,667	1,949	0,228	16,643	0,542
Constants -0,292						
Nagelkerke R Square = 0,213						

From the results of the multinomial logistic regression analysis, it was found that the Exp (B) value of the nutritional status variable was 4.700. So it can be said that children under five who have less nutritional status will be at risk of severe pneumonia 4,700 times greater than children who have more nutrition. The significance value obtained was 0.048 ($p < 0.05$). So it shows that nutritional status has a significant effect on severe pneumonia.

The value of Exp (B) of the normal nutritional status variable is 1.949. So it can be said that children under five who have normal nutritional status will be at risk of developing severe pneumonia and have a risk of 1.949 times greater than children who have more nutrition. The significance value obtained is 0.542 ($p > 0.05$). So it shows that normal nutritional status has no significant effect on severe pneumonia.

The Exp value (B) for the variable age less than 1 year (1-12 months) is 3,239. So it is said that children aged 1 to 12 months are at risk of experiencing severe pneumonia 3.239 times greater than children aged 36-60 months. The significance value obtained was 0.012 ($p < 0.05$). So that children aged 1 to 12 months have a significant effect on severe pneumonia.

The value of Exp (B) for the variable age 14-35 months is 1.354. So it is said that children aged 14 to 35 months are at risk of developing severe pneumonia 1.354 times greater than children aged 36-60 months. The significance value obtained is 0.191 ($p > 0.05$). So that children aged 14 to 35 months had no significant effect on severe pneumonia.

From several variables, the most at high risk for severe pneumonia are underweight children. The value of Nagelkerke's R Square in this analysis is 0.213%, which means that these 2 risk factors can represent a variation of the risk factors for severe pneumonia by 21.3%, while the other 78.7% are explained by factors not studied. The child's probability of severe pneumonia is obtained by the following equation:

$$y = -0,292 + 1,175(0 - 12 \text{ months}) + 1,547(\text{underweight})$$

$$y = 2,43$$

Thus the probability is obtained :

$$p = \frac{1}{(1 + 2,7^{-2,43})} = 0,918$$

Then the probability of children under five with underweight and age less than 1 year with severe pneumonia is 91.8%.

DISCUSSION

4.1. Relationship between Age and Severity of Pneumonia in Children Under 5 Years Old

The age of the subjects in this study was divided into 3 groups, infants aged 1 month – 12 months, 13 months – 36 months, and 37 months to 60 months. The highest frequency was found in the age group 1-12 months (63.7%), followed by the age group 13-36 months (28.4%), and the age group 37-60 months (7.8%). The results of this study are in line with research conducted by Kaunang et al (2016) and Monita et al (2015) which

stated that the majority of pneumomia patients were children aged < 1 year. Monita et al found that the majority of children with pneumonia were in the age group 2 to < 12 months (43.8%). Research conducted by Kaunang et al at Prof. RSUP. Dr. R. D. Kandou Manado also found that the infant age group <1 year was the age group with the highest frequency in pediatric pneumonia patients, which was 68.4% (Kaunang et al., 2016; Monita et al., 2015).

Based on the results of bivariate analysis with Chi Square test showed a relationship between age and severity of pneumonia ($p = 0.042$; p value <0.05). The results of statistical tests explained that children aged 1-12 months had a 3.239 times risk of causing a more severe degree of pneumonia than children aged 37-60 months ($p = 0.012$; p value <0.05). In this study, children aged 1-12 months had a significant effect on severe pneumonia. This study is in line with research conducted by Saha et al which stated that age was one of the factors associated with the severity and mortality rate of pneumonia. The independent factors associated with severe pneumonia were age 2-5 months (95% CI: 1.26–2.01) and 6-11 months (95% CI: 1.10–1.56). Saha et al reported that 36.8% of children aged 2-5 months had severe pneumonia (Saha et al., 2016)

This finding is also supported by a study conducted by Chen et al who found a relationship between age and the severity of pneumonia. The study stated that younger children had the highest risk of developing more severe pneumonia (23.54%) and requiring ICU care (20.98%), whose incidence decreased significantly with age. Children aged between 6 months and 1 year have several significant predictors that affect the development of pneumonia to a severe degree and require ICU referral including low

birth weight, premature birth, formula feeding, having CHD, abnormal x-ray results, cyanosis on admission to hospital, and abnormal lymphocyte counts (Chen et al., 2021) Hartati et al also reported an association between age and the incidence of pneumonia. The results of the bivariate analysis showed a significant relationship between the age of the child and pneumonia. Children under five who are 1 year old have a 3.24 times risk of developing pneumonia when compared to toddlers aged > 1 – 5 years (95% CI: 1.58 – 6.64) (Hartati et al., 2012)

Pneumonia is still a major cause of morbidity and mortality in children younger than five years. Identifying risk factors associated with the development of pneumonia severity in children, especially in children with certain age groups, is useful for guiding clinical practice and improving pneumonia patient outcomes. The incidence of pneumonia increases with the younger the child. Age is a risk factor for death in children under five with pneumonia. Several studies say that children under five have immune systems that are not optimal. In children under five, the respiratory system also does not function properly when compared to older children. So that children under five are very easy to get respiratory problems, one of which is pneumonia. Children aged 1-<2 years will have a different immune system when compared to children aged 2-<3 years. Children aged 1-<2 years tend to have a natural immune system and a respiratory system that is not yet optimal. While children aged 2-<3 years in general have received complete basic immunizations so that the immune system of children aged 2-<3 years is better than children aged 1-<2 years (Fadl et al., 2020; Puspitasari & Syahrul, 2015; Tuti et al., 2017)

4.2. Relationship between Gender and Severity of Pneumonia in Children Under 5 Years Old

Based on the results of bivariate analysis, a significance value of 0.775 ($p>0.05$) was obtained. There is no significant relationship between gender and the severity of pneumonia in children under five. This finding is in line with the research conducted by Chen et al which stated that gender had no relevant relationship to the severity of pneumonia in most age groups. However, in boys between 1 and 2 years of age it was significantly associated with a reduced risk of pneumonia becoming severe or a lower risk of ICU admission (Chen et al., 2021). Sonogo et al also showed that there was no relationship between gender and mortality in children who had acute respiratory infections. Furthermore, Sonogo et al added that female sex was significantly associated with an increase in mortality from acute respiratory infections by 15%. This is likely due to gender inequalities in the quality of health care provided. However, the evidence to support this theory is still weak and studies are needed to support this hypothesis (Sonogo et al., 2015)

Gender is one of the factors that influence the incidence of pneumonia. Several studies reported that the frequency of pediatric pneumonia patients was more in boys than girls. Hartati et al stated that male children under five had a 1.24 times greater risk of developing pneumonia compared to female children under five OR = 1.24; 95% CI (1.63 < OR < 2.45). that the majority of male children under five did not receive exclusive breastfeeding and measles immunization at the age of 9 months compared to female children under five. These factors may increase the incidence of pneumonia in male

children (Hartati et al., 2012) It also can influenced by differences in the diameter of the respiratory tract in boys and girls. Boys have smaller respiratory tract diameters than girls in the early years of a child's life. The existence of differences in the hormonal system in children under five who are male and female can also affect the toddler's immune system. Therefore, boys are more susceptible to viral and bacterial infections that cause pneumonia in children under five (Fadl et al., 2020; Puspitasari & Syahrul, 2015).

In one study, female sex was associated with an increased risk of death in acute respiratory infections. In a study conducted by Naheed et al in Bangladesh, it was found that the risk of death from childhood pneumonia was higher in girls compared to boys without any difference in the quality of care provided (Naheed et al., 2019). This result is different from the statement by Sonego et al, which is about the possibility of gender inequality in the quality of health care provided (Sonego et al., 2015)Naheed et al reported that girls with severe pneumonia had four times the risk of death compared to boys (OR: 4.37, 95% CI: 3.24-5.89). Most of the girls admitted to Bangladeshi hospitals had severe pneumonia (21.5%). Then it was found that the community's low priority for bringing a female child to the hospital when she had pneumonia. This indicates that there may be a lack of public knowledge about pneumonia and awareness to take children to health care facilities (Naheed et al., 2019).

4.3. Relationship between Vaccination Status and Severity of Pneumonia in Children Under 5 Years Old

Based on the results of the bivariate analysis with the Chi Square test, the significance value obtained was 0.278 (p value > 0.05), which means that there is no significant relationship between vaccination status and the severity of pneumonia. The results of this study are in line with research conducted by Saha et al who found that there was no significant relationship between vaccination status and mortality in pediatric pneumonia patients. The vaccination in question is the provision of Pentavalent vaccination (DPT-HB-Hib) (Saha et al., 2016). A meta-analysis also reported no significant association between immunization status and pneumonia (Fonseca Lima et al., 2016).

On the other hand, two studies have found an association between incomplete immunization and severe acute lower respiratory infections and mortality (Leis et al., 2012; Sonogo et al., 2015). Sonogo et al found that immunization can reduce the risk of death in acute lower respiratory infections. Monita et al found that incomplete immunization status was associated with the risk of pneumonia in children aged 6-59 months, with a risk of 2.39 times greater than complete immunization status. This difference may be due to the expansion of the vaccination program and social improvement in Indonesia, particularly in the Sidarjo area. Then the completeness of the data, and misclassification of immunization status may also make it difficult to find a relationship between immunization and the severity of pneumonia. The protection

provided by immunization programs to children should be further investigated specifically and additional risk factors should be re-examined.

4.4. Relationship between Nutritional Status and Severity of Pneumonia in Children Under 5 Years Old

Based on the results of the Chi Square test analysis in table 5.8 above, the results obtained are the significance value $p = 0.015$ (p value < 0.05), therefore there is a significant relationship between nutritional status and the severity of pneumonia in toddlers. This finding is in line with the results of the bivariate analysis conducted by Artawan et al which showed that there was a significant relationship between nutritional status and the severity of pneumonia in children under five ($p=0.02$ and PR IK 95% 2.176 (1.094 to 4.329)). Children with malnutrition have a 2,176 times higher risk of causing a more severe degree of pneumonia (Artawan et al., 2016). This finding is also reinforced by a study conducted by Susila et al at the Wangaya District Hospital which found a significant relationship between nutritional status and the severity of pneumonia in children under five and children with malnutrition had a 3.27 times greater chance of causing severe pneumonia (Susila et al., 2021)).

Research by Saha et al also found that children under five with severe pneumonia were mostly younger, namely < 11 months ($p < 0.001$) and had less nutrition according to body weight (Saha et al., 2016)). Christi et al reported that underweight and severely underweight children had a significantly increased risk of death in pneumonia cases. In addition, there are also factors that contribute to an increased risk of death, namely

immunodeficiency associated with malnutrition, high rates of comorbidities, delayed diagnosis due to lack of sensitivity to clinical signs of pneumonia, and delays in bringing patients to health care facilities (Chisti et al., 2009)

Many studies have reported a strong relationship between malnutrition and mortality in respiratory tract infections. Children who are malnourished will affect the function of the body's defense system, especially immunoglobulin A (IgA). In children with malnutrition, the level of IgA in the body will decrease. Secretory IgA is a major component of the mucosal immune response that protects the upper respiratory tract against infection with pathogenic organisms; therefore, the decrease in IgA levels observed in malnourished children may be responsible for the reduced immune response to respiratory infections which can further exacerbate the degree of infection in the respiratory system. In addition, several studies have shown that malnutrition can impair cytokine production, which may also be associated with impaired cell-mediated immunity in malnourished children (Rodríguez et al., 2011)

In this study, the four patient characteristics identified as related to the severity of pneumonia were found to be two characteristic variables of children under five that had the most influence on the severity of pneumonia, namely age and nutritional status. Based on the Nagelkerke R Square value in this analysis, it was obtained 0.213%, meaning that these two risk factors could represent a variation of the risk factors for severe pneumonia by 21.3% while the other 78.7% were explained by factors not studied. In this study, the probability of underweight children and aged less than 1 year having severe pneumonia was 91.8%. The most high-risk factor for severe pneumonia in children under five at Siti

Khodijah Muhammadiyah Hospital is the malnutrition factor for children under five (Exp (B) = 4,700).

This study is the first to link the characteristics of pneumonia in children under five such as age, gender, and history based on the severity of pneumonia in Indonesia, especially in Sidoarjo district. However, studies linking nutritional status with the severity of pneumonia in children under five have been widely studied in the world, including Indonesia. There is a comparison in this study with previous research, namely in classifying nutritional status according to weight for age that is more specific, where the nutritional status is divided into 4 groups, namely severely underweight, underweight, normal, and overweight. While previous research by Susila Suryawan, & Widi (2021), Artawan, Purniti, & Sidiartha (2016), Saha et al (2016), and Chisti et al (2009) on average only classified nutritional status into two groups of normal and malnutrition. Of course, this research is still not perfect and has limitations. Among them was the first to find no risk factors associated with mortality due to the low incidence of death in the study population. Furthermore management was not in this study so there are no conclusions regarding therapeutic strategies and disease progression.

5. CONCLUSION

There is a significant relationship between age and nutritional status with the severity of pneumonia in children under five at Siti Khodijah Muhammadiyah Hospital. Younger age and underweight are risk factors for more severe pneumonia

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