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Determinants of pneumonia severity in children: Basic immunization status, exclusive breastfeeding and cigarette smoke exposure

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Abstract

Background: Pneumonia is one of the leading infectious diseases causing death in children under five, following diarrhea. Pneumonia has resulted in the deaths of 740,180 children under five in Indonesia. Various factors can exacerbate the severity of pneumonia in children, such as basic immunization status, exclusive breastfeeding, and exposure to cigarette smoke.

Objective: This study aims to analyze the relationship between basic immunization status, history of exclusive breastfeeding, and exposure to cigarette smoke with the severity of pneumonia in children under five.

Methods: This research was conducted using an analytical observational method with a cross-sectional approach. The dependent variable is the severity of pneumonia. The independent variables are basic immunization status, history of exclusive breastfeeding, and exposure to cigarette smoke. The study sample comprised 35 children who met the inclusion and exclusion criteria, selected using consecutive sampling techniques. The research was conducted in the Seruni ward of Soewandhie Hospital, Surabaya, utilizing medical records and questionnaires. The data were analyzed using Fisher's Exact Test and Chi-square with a 95% CI ($\alpha = 0.05$).

Results: The majority of children experienced "pneumonia," with 23 children (65.7%). Statistical analysis showed no significant relationship between basic immunization status (p=0.632), history of exclusive breastfeeding (p=0.530), and exposure to cigarette smoke (p=0.618) with the severity of pneumonia in children under five.

Conclusion: There is no relationship between basic immunization status, history of exclusive breastfeeding, and exposure to cigarette smoke with the severity of pneumonia in children under five at Soewandhie Hospital.

Keywords: Pneumonia severity; Basic immunization status; Exclusive breastfeeding; Passive smoker; Children under five; Child health

1. Introduction

According to WHO data from 2021, there were 5 million deaths of children under five globally, with pneumonia, diarrhea, malaria, prematurity, and birth complications being the main causes[1]. Pneumonia is an inflammatory lung disease caused by bacterial, viral, or fungal infections[2]. WHO data indicates that 740,180 children under five died due to pneumonia[3]. In Indonesia, pneumonia is a leading cause of death in children under five, with 12.5% of these deaths attributed to pneumonia. There were 997,304 cases of pneumonia in Indonesian children under five, with 144,170 cases in East Java. Of the 265,325 children aged 1-5 years with pneumonia, 29.8% had severe pneumonia[4].

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Pneumonia in children can be classified based on chest x-ray results and clinical symptoms. A child is diagnosed with pneumonia if their respiratory rate is ≥40 breaths per minute, with or without chest indrawing. Severe pneumonia is diagnosed if the child shows symptoms of pneumonia along with central cyanosis, loss of consciousness, lethargy, seizures, persistent vomiting, severe distress syndrome, or other general danger signs. Children are categorized as "not pneumonia" if they do not exhibit clinical symptoms of pneumonia or severe pneumonia[5].

The severity of pneumonia in children can be influenced by several factors, including basic immunization status, exclusive breastfeeding, and exposure to cigarette smoke. Previous studies have found associations between basic immunization status and exclusive breastfeeding with pneumonia severity in children[6,7]. A meta-analysis study also found that exposure to cigarette smoke is a risk factor for more severe pneumonia in children[8]. Based on the research conducted by Setyoningrum and Musiko (2020), there was also a relationship between exclusive breastfeeding and pneumonia severity in children[9]. Therefore, this study aims to analyze the relationship between basic immunization status, history of exclusive breastfeeding, and exposure to cigarette smoke with pneumonia severity in children at Soewandhie Hospital, Surabaya.

2. Material and Method

This study employed an analytical observational method with a cross-sectional approach. The dependent variable was pneumonia severity, while the independent variables included basic immunization status, history of exclusive breastfeeding, and exposure to cigarette smoke. The sample consisted of children hospitalized for pneumonia in the Seruni ward of Soewandhie Hospital during October-November 2023. Consecutive sampling was used to select the sample. Inclusion criteria included undergoing treatment during the study, having a family member available for an interview, and agreeing to participate as respondents. Exclusion criteria included children who had died and those with comorbid conditions such as asthma, congenital heart disease, and anemia. This study received ethical clearance from Soewandhie Hospital with number 024/KE/KEPK/2023.

3. Result

The study included 35 children who met the inclusion criteria from a population of 45 children diagnosed with pneumonia at Soewandhie Hospital in 2023, with 10 children excluded for various reasons.

Table 1 Exclusion Criteria

Year	Population	Exclusion	Sample
2023	45 children	1 child unwilling to participate, 1 child with congenital heart disease, 2 children with asthma, 6 children with anemia	35 children

Table 2 Frequency of pneumonia degree in children

Category	Frequency (f)	Percentage (%)
Pneumonia	23	65.7
Severe Pneumonia	12	34.3
Total	35	100

Most children were categorized as having "pneumonia," with 23 children (65.7%). A child is categorized as having "pneumonia" if they exhibit clinical symptoms such as a respiratory rate ≥40 breaths per minute and/or chest indrawing.

Table 3 Frequency of independent variable in children with pneumonia

Variable	Frequency (f)	Percentage (%)
Basic immunization status		
Complete	18	51.4
Incomplete	17	48.6
Total	35	100
Breastfeeding history		
Exclusive	10	28.6
Non-exclusive	25	71.4
Total	35	100
Exposure to cigarette smoke		
Not exposed	23	65.7
Exposed	12	34.3
Total	35	100

The table above presents the distribution of basic immunization status, breastfeeding history, and exposure to cigarette smoke among the children. There is no significant difference in the number of children with pneumonia who received complete basic immunization compared to those who did not (51.4% vs. 48.6%). The majority of children with pneumonia at Soewandhie Hospital did not receive exclusive breastfeeding (71.4%). Most children were not passive smokers (65.7%).

Table 4 Analysis of Basic Immunization Status with Pneumonia Severity in Children

Category	Basic Immunization Status		p-value
	Complete (n=18)	Incomplete (n=17)	
Pneumonia	10 (55.6%)	13 (76.5%)	0.632
Severe Pneumonia	8 (44.4%)	4 (23.5%)	
Total	18 (100%)	17 (100%)	

Based on the chi-square analysis, a p-value of 0.632 was obtained. This value is higher than the alpha threshold of 0.05, indicating that there is no significant relationship between basic immunization status and the severity of pneumonia in children under five at Soewandhie Hospital, Surabaya.

Table 5 Analysis of Exclusive Breastfeeding with Pneumonia Severity in Children

Category	Exclusive Breastfeeding		p-value
	Yes (n=10)	No (n=25)	
Pneumonia	8 (80%)	15 (60%)	0.530
Severe Pneumonia	2 (20%)	10 (40%)	
Total	10 (100%)	25 (100%)	

Based on the chi-square analysis, a p-value of 0.632 was obtained. Since this value is greater than the alpha level of 0.05, it can be concluded that there is no significant association between basic immunization status and the severity of pneumonia in children under five at Soewandhie Hospital, Surabaya.

Table 6 Analysis of Exposure to Cigarette Smoke with Pneumonia Severity in Children

Category	Exposure to Cigarette Smoke		p-value
	Yes (n=12)	No (n=23)	
Pneumonia	7 (58.3%)	16 (69.6%)	0.618
Severe Pneumonia	5 (41.7%)	7 (30.4%)	
Total	12 (100%)	23 (100%)	

Based on the Fisher's Exact Test analysis, a p-value of 0.618 was obtained. Since this value is greater than the alpha level of 0.05, it can be concluded that there is no significant association between exposure to cigarette smoke and the severity of pneumonia in children under five at Soewandhie Hospital, Surabaya.

4. Discussion

4.1. Basic Immunization Status and Severity of Pneumonia in Children Under Five

The results of this study indicate that there is no relationship between basic immunization status and the severity of pneumonia. These findings are consistent with research conducted by Albuhairi et al. (2021) and Stefani (2021), who also found no association between basic immunization status and pneumonia severity in children under five[10,11]. Immunizations that can prevent pneumonia include the PCV and DPT-Hb-HiB vaccines. The PCV vaccine targets specific diseases, thereby reducing the severity and mortality rates associated with pneumonia. However, previous studies have found differing results, indicating a relationship between basic immunization status and pneumonia severity in children[12].

This discrepancy might be attributed to the productive age of the children's parents. The respondent characteristics showed that 62.9% of the mothers were aged 20-35 years, and 71.4% of the fathers were aged 25-40 years. An individual's age influences their cognitive maturity, which in turn affects their attitudes and behaviors, particularly regarding health. Positive attitudes tend to result in positive health behaviors, while negative attitudes tend to result in negative health behaviors. Previous studies have found a relationship between a mother's age and her knowledge level regarding basic immunizations for children under five[13]. Additionally, previous research included children with comorbid conditions, such as congenital heart disease and anemia, which can affect the immune system's response to immunizations and lead to more severe pneumonia symptoms. Comorbidities can diminish the effectiveness of immunizations, thereby exacerbating the severity of pneumonia when an infection occurs[14].

4.2. History of Exclusive Breastfeeding and Severity of Pneumonia in Children Under Five

The analysis results indicated no relationship between a history of exclusive breastfeeding and the severity of pneumonia in children under five. This finding aligns with the research conducted by Albuhairi et al. (2021), which also found no association between exclusive breastfeeding and pneumonia severity[10]. Conversely, Sunkonkit (2020) found that exclusive breastfeeding is associated with a reduced risk of severe pneumonia in children under five, particularly in infants under six months old, reducing the risk of severe pneumonia by half[7]. Similarly, Setyoningrum and Musiko (2020) found a relationship between exclusive breastfeeding and pneumonia severity in children under five[9].

Previous studies also included samples with comorbid conditions, which can exacerbate pneumonia severity. Findings indicate a relationship between comorbid conditions and pneumonia severity, as well as between exclusive breastfeeding and pneumonia severity, with significant p-values of <0.001 vs. 0.007[9]. These results suggest that comorbidities have a greater influence on pneumonia severity in children under five. Age also plays a critical role, with younger children being more vulnerable to severe pneumonia. This study included children aged 12-59 months, with 51.4% being 12-23 months old. The lack of exclusive breastfeeding affects pneumonia severity in infants under six months, but this significance diminishes with age. Thus, no association was found between exclusive breastfeeding and pneumonia severity in children over six months old[14].

4.3. Exposure to Cigarette Smoke and Severity of Pneumonia in Children Under Five

Statistical analysis showed no relationship between exposure to cigarette smoke and the severity of pneumonia in children under five at Soewandhie Hospital, Surabaya. This finding is consistent with previous studies, which also found no association between cigarette smoke exposure and the presence of pneumonia-causing bacteria as a trigger for

severe pneumonia in children[15]. Moreover, the p-values of 0.459 vs. 0.683 indicate no relationship between family smoking history and pneumonia severity[10,16]. However, this contradicts the study by Permatasari (2023), which found that paternal smoking behavior increases the risk of severe pneumonia in children tenfold[8]. Similar results were found in a study conducted in Vietnam, which reported that exposure to cigarette smoke increases the risk of severe pneumonia in children fourfold compared to those not exposed. Stefani (2021) also found that family smoking behavior is a significant factor in the severity of pneumonia in children[11].

The maturity of a child's respiratory system is an important indicator of pneumonia severity. An immature respiratory system is more susceptible to infections, resulting in more severe symptoms compared to children with a mature respiratory system. Factors affecting respiratory system maturity include birth weight and prematurity. This study found that 3 out of 35 children (8.6%) had low birth weight (LBW) and 4 out of 35 children (11.4%) were premature. Chen (2021) found that LBW and prematurity are significant factors influencing pneumonia severity in children due to an underdeveloped immune system and respiratory system, making them more vulnerable to severe health issues[14,17]. Additionally, children with a history of LBW are at greater risk for malnutrition, which can further exacerbate pneumonia severity[18,19,20].

5. Conclusion

This study found no significant relationship between basic immunization status, exclusive breastfeeding, and exposure to cigarette smoke with pneumonia severity in children under five at Soewandhie Hospital. Future research should consider larger sample sizes and other influencing factors.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of Ethical Approval

Ethical clearance was approved by the Ethics Committee of the Soewandhie Regional Hospital, Surabaya, East Java, Indonesia Number 024/KE/KEPK/ 2023, on September 26, 2023.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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