



**LITERATURE REVIEW: ANALYSIS OF FACTORS ASSOCIATED WITH THE
INCIDENCE OF PNEUMONIA IN TODDLERS (AGE > 12-59 MONTHS)**

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ABSTRACT

Pneumonia is a major cause of infant mortality in Indonesia. Pneumonia is influenced by intrinsic and extrinsic factors, such as immunization status, exclusive breastfeeding, nutritional status, home environment, and family socioeconomic status. Objective to analyze factors associated with the incidence of pneumonia in toddlers (aged > 12-59 months) through a literature review. Literature review of national journals published between 2021 and 2025. Databases from Google Scholar and PubMed with keywords "pneumonia in toddlers, pneumonia in toddlers case-control, risk factors for pneumonia in toddlers". Data were collected through searches of relevant accredited journals and then analyzed descriptively to identify general patterns of risk factors, including intrinsic variables (age, gender, immunization status, exclusive breastfeeding, low birth weight (LBW), nutritional status) and extrinsic variables (home ventilation, exposure to cigarette smoke, economic status, maternal education, and access to health services). The most dominant and consistent factors associated with pneumonia in toddlers include: incomplete immunization status, lack of exclusive breastfeeding, low birth weight (LBW) and preterm birth, unhealthy housing conditions (poor ventilation, high crowding, and exposure to cigarette smoke), poor nutritional status, and maternal education and low access to health services. The incidence of pneumonia in toddlers in Indonesia is the result of an interaction between individual, environmental, and economic factors.

Keywords: exclusive breastfeeding; immunization status; low birth weight; pneumonia; toddlers

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INTRODUCTION

Pneumonia is a lung infection that causes inflammation of the alveoli. It can be caused by various microorganisms such as bacteria, viruses, and fungi. In pneumonia, the alveoli, which normally absorb oxygen from the atmosphere, can fill with fluid, pus, or blood cells, disrupting normal breathing. Pneumonia is a leading cause of morbidity and mortality in children worldwide, particularly in children under five years of age. Mortality rates remain high, particularly in developing countries (Indarwati et al., 2023).

According to data from the World Health Organization (WHO), pneumonia is the single largest infectious cause of death worldwide. Pneumonia killed 740,180 people in 2019, and in 2020, pneumonia-related deaths increased to 450 million annually due to the COVID-19 outbreak. In 2021, deaths again increased to 510 million annually (WHO, 2021). Pneumonia affects children of

all ages, but the highest mortality rates occur in South Asia and sub-Saharan Africa (WHO, 2022). The incidence of pneumonia in toddlers (aged 0-59 months) is a serious health concern, especially in developing countries like Indonesia.

The incidence of pneumonia in Indonesia remains high and poses a significant public health problem. Data on pneumonia cases in Indonesia, based on the 2020 Indonesian Health Profile, indicates that the number of pneumonia cases in Indonesia reached 309,838. According to 2021 data, there were 278,261 cases of pneumonia in Indonesia, and in 2022, there were 310,871 cases. In 2024, the proportion of toddlers with pneumonia in Indonesia reached 300,143 cases (SSGI, 2024). Furthermore, data from the National Health Insurance Agency (BPJS Kesehatan) in 2023 shows that pneumonia ranks first as the disease with the highest medical costs, reaching IDR 8.7 trillion.

Central Kalimantan Province ranks 18th nationally with a proportion of pneumonia of 6,421 (SSGI, 2024). In 2023, the discovery of pneumonia sufferers in toddlers was 184 toddlers in Kapuas Regency (Kapuas Health Office, 2023). Based on data from the Medical Records of Dr. H. Soemarno Sosroatmodjo Kuala Kapuas Regional Hospital in 2024, pneumonia ranked first among the most common diseases in hospitalizations, namely 362 cases. Meanwhile, the number of cases occurring in toddlers (0-59 months) was 244 cases or 67.4% with an average of 20 cases per month. Medical record data from January-April 2025 showed that toddlers suffered from pneumonia as many as 98 cases with an average of 24 cases per month, and this figure is an increase from previous years.

Factors associated with pneumonia in toddlers include nutritional status, immunization status, feeding patterns, and environmental factors. Toddlers with poor nutritional status are at higher risk of developing pneumonia. According to research conducted by Hasanah and Santik in 2021, there is a relationship between nutritional status and the incidence of pneumonia in toddlers (OR 5.342). Toddlers with poor nutritional status are 5.3 times more likely to develop pneumonia than children with good nutritional status (Hasanah & Santik, 2021). This is due to inadequate nutritional intake, which contributes to a weakened immune system, making children more susceptible to acute respiratory infections, including pneumonia.

Immunization status is also an important factor in preventing pneumonia. Basic immunizations, including the pneumonia, DPT, and measles vaccinations, have been shown to reduce the incidence of pneumonia in toddlers. Research conducted by Wati et al. (2021) found a significant association between immunization status and the incidence of pneumonia in children. An OR of 3.4 indicates that toddlers who are incompletely immunized are 3.4 times more likely to develop pneumonia than toddlers with complete immunizations (Wati, 2021). This suggests that toddlers frequently experience respiratory infections, and incomplete immunization contributes to the high incidence of pneumonia.

Feeding patterns, including exclusive breastfeeding, also play a crucial role in maintaining good nutritional status. Exclusive breastfeeding significantly impacts the nutritional status of toddlers and ultimately contributes to their lung health, potentially reducing the incidence of pneumonia. According to research conducted by Riyanto and Megasari (2021), there is a significant association between exclusive breastfeeding and the incidence of pneumonia in toddlers. Toddlers who are not exclusively breastfed are 2.3 times more likely to develop pneumonia (OR = 2.3) compared to toddlers who are exclusively breastfed (Riyanto & Megasari, 2021).

Home environmental conditions, including air ventilation, overcrowding, and smoke exposure, are other risk factors for pneumonia in toddlers. Toddlers exposed to cigarette smoke at home have a 1.4 times greater risk of developing pneumonia than toddlers not exposed to cigarette smoke (OR =

1.408). Environmental factors such as cigarette smoke exposure, poor sanitation, and housing also significantly impact the risk of pneumonia in toddlers. Exposure to cigarette smoke and an unclean environment have been linked to an increased risk of respiratory tract infections (Budihardjo & Suryawan, 2020).

According to research conducted by Ardiana and Budiono (2025), access to health care facilities is associated with the incidence of pneumonia in toddlers. Difficult access to health care facilities increases the risk of pneumonia in toddlers by 3.3 times ($OR = 3.3$). The distance between health care facilities and the child's residence can influence the incidence of pneumonia in toddlers. Areas with inadequate service coverage, such as clinics, community health centers, and hospitals, can delay the identification and treatment of toddlers with pneumonia (Ardiana & Budiono, 2025). Based on the above background, it can be seen that the risk factors for pneumonia are highly diverse. Therefore, research on the analysis of pneumonia risk factors is crucial to determine the most significant factors causing pneumonia in Kapuas Regency, allowing for the development of more effective prevention programs. This study aims to analyze factors associated with the incidence of pneumonia in toddlers (aged > 12-59 months) through a literature review.

METHOD

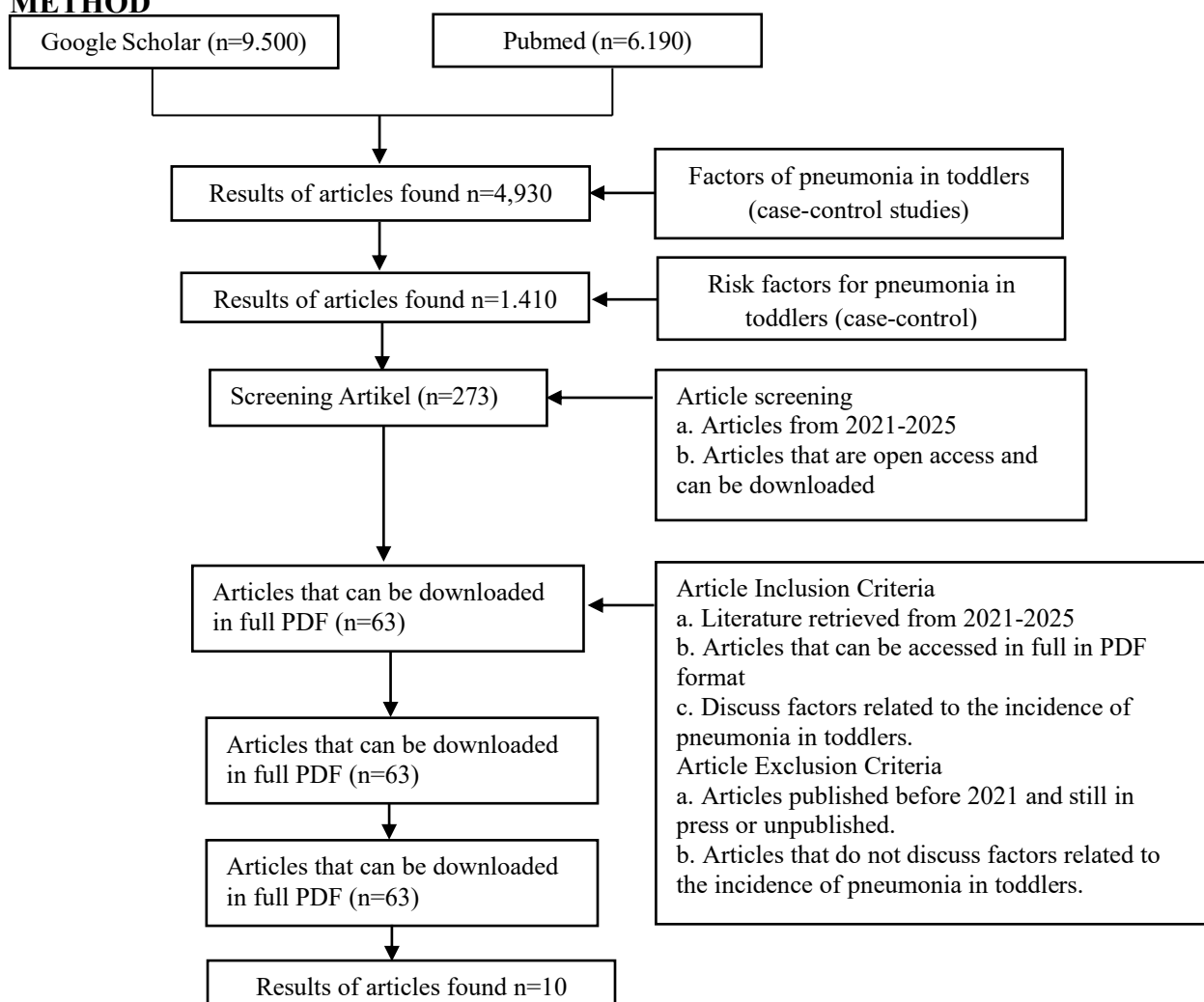


Figure 1 article search flow

This research is a literature review. Systematic review is a term used to refer to a specific research methodology used to collect and evaluate research related to a specific topic. The databases used in this article search were Google Scholar and PubMed, using the keywords "pneumonia in toddlers, pneumonia in toddlers, case-control, risk factors for pneumonia in toddlers," which were conducted by previous researchers, both domestic and international. The literature to be reviewed was selected

based on inclusion a) The literature retrieved ranges from 2021 to 2025, b) Articles that can be accessed in full PDF format, c) Discuss factors related to the incidence of pneumonia in toddlers. And exclusion criteria, including a) Articles published before 2021 and still in press or unpublished and b) Articles that do not discuss factors related to the incidence of pneumonia in toddlers. Data was collected through searching relevant accredited journals and then reviewed or analyzed descriptively.

RESULT

Table 1.
Results of a Review of 10 Articles Concerning Factors Associated with the Incidence of Pneumonia in Toddlers

Author and Title	Risk Factors	Research	Results Findings
Namira Wadjir Sangadji, et al. (2022) JCA Health Science The Relationship Between Gender, Immunization Status, and Nutritional Status and the Incidence of Pneumonia in Toddlers at the Cibodasari Community Health Center in 2021	Gender, immunization status, nutritional status	There was a significant association between gender and pneumonia incidence ($p=0.027$). Male toddlers were at higher risk due to their greater outdoor activity. Immunization and nutritional status also contributed to pneumonia incidence	The study found that only gender was significantly associated with pneumonia incidence in toddlers, with boys being at higher risk than girls. Meanwhile, immunization status (complete/incomplete) and nutritional status (normal/deficient/excessive) did not show a significant association with pneumonia incidence.
Junaidi, Irawaty A. Kahar, Taruli Rohana, et al. (2021) Journal of Healthcare Technology and Medicine Factors Associated with the Incidence of Pneumonia in Children Aged 12–59 Months in the Padang Rubek Community Health Center Work Area, Nagan Raya Regency, 2021	Exclusive breastfeeding, smoking habits, low birth weight (LBW), maternal education, knowledge, attitudes, and practices.	These factors were significantly associated ($p<0.05$) with pneumonia, with the dominant factor being the mother's attitude towards maintaining child health. The importance of health promotion and the role of village midwives in pneumonia prevention were emphasized.	This study found that the incidence of pneumonia in children aged 12–59 months was significantly associated with several factors, namely smoking habits inside the home, use of mosquito coils, children's nutritional status, and housing density. Children exposed to cigarette smoke, living in crowded homes, using mosquito coils, and having poor nutritional status were at higher risk of developing pneumonia than other children.
Vivi Ninda Sutriana, Mei Neni Sitaresmi, Abdul Wahab (2021) Clinical and Experimental Pediatrics “Risk factors for childhood pneumonia: a case-control study in a high prevalence area in Indonesia”	Exclusive breastfeeding, basic immunization status (EPI), indoor air pollution, history of low birth weight (LBW), nutritional status (wasting & stunting), child's age and sex, maternal education, vitamin A supplementation	The study showed that the risk of pneumonia in toddlers increased significantly in children who were not exclusively breastfed (OR 7.95), had incomplete immunizations (OR 4.47), were exposed to indoor air pollution (OR 7.12), had a history of LBW (OR 3.27), and were wasting (OR 2.77). Age, sex, maternal education, stunting, and vitamin A were not associated with pneumonia.	The study found that not being exclusively breastfed, incomplete basic immunizations, and indoor air pollution were the main factors increasing the risk of pneumonia in toddlers. A history of low birth weight (LBW) and wasting also contribute to increased risk, while age, gender, maternal education, stunting, and vitamin A levels do not have a significant effect.
Zalfa Azzachra Hudmawan, Asep Suryana, Nissa Noor Annashr (2023) Indonesian Community Health Journal The Relationship between Host and Environmental Factors and the Incidence of Pneumonia in Toddlers in the Work Area of the Cilembang Community Health Center (UPTD) in	Gender, exclusive breastfeeding, immunization, family income, maternal education, exposure to cigarette smoke, and residential density.	All factors were significantly associated ($p<0.05$). Toddlers who are not exclusively breastfed, have incomplete immunizations, live in crowded homes, and are exposed to cigarette smoke are at high risk. Family education and the implementation of healthy homes are recommended	This study found that the incidence of pneumonia in toddlers is influenced by host and environmental factors. Factors shown to be significantly associated with pneumonia were gender, exclusive breastfeeding, immunization status, family income, maternal education, exposure to cigarette smoke, and residential density. Toddlers who are not exclusively breastfed, have incomplete immunizations, live in crowded homes, are exposed to cigarette smoke, and come from families with low incomes and education have a higher risk of developing pneumonia.

Author and Title	Risk Factors	Research	Results Findings
Tasikmalaya City.			
Noufal Rizqullah, Zulmansyah, Mirasari Putri (2021) Journal of Health and Science Integration (JKS)	Immunization status (Hib, DPT, Measles, PCV)	There was a significant relationship between Hib, DPT, and measles immunizations and pneumonia (p=0.000). Children with complete immunizations were more protected from the risk of severe pneumonia.	This study found that basic immunization status was significantly associated with the incidence of pneumonia in hospitalized toddlers. Toddlers with incomplete immunizations, particularly for Hib, DPT, and measles, had a significantly higher risk of pneumonia compared to toddlers with complete immunizations. The study also noted that all toddlers had not received the PCV vaccine, thus providing suboptimal protection against pneumonia.
Relationship between Basic Immunization Status and Pneumonia in Inpatient Toddlers at Respati Tasikmalaya Women's Hospital			
Yanuar Fajrul Falah, Suhartono, Sakundarno Adi, Akhmad Mukhidin (2025) Journal of Community Health Epidemiology (JEKK)	Room ventilation, floor type (earthen/rough concrete), use of firewood for cooking, history of low birth weight (LBW), PCV immunization status, smoking behavior of family members, and burning trash.	The study found that pneumonia in toddlers was significantly influenced by three main factors: smoking behavior of family members (OR 3.788), burning trash (OR 2.462), and use of firewood for cooking (OR 2.434). Other factors such as home ventilation, floor type, history of low birth weight (LBW), and PCV immunization were not significantly associated with pneumonia incidence.	The study found that home environmental factors were the main cause of pneumonia in toddlers. Three important findings were family members' smoking behavior, burning trash, and the use of firewood, which significantly increased the risk of pneumonia. Other factors such as ventilation, floor type, LBW, and PCV immunization were not proven to have an effect.
Risk Factors for Pneumonia in Toddlers at the Sruweng Community Health Center, Kebumen Regency.			
Uswatun Hasanah, Yunita Dyah Puspita Santik (2021) Indonesian Journal of Public Health	Nutritional status, exclusive breastfeeding, maternal occupation, housing density, socioeconomic status, ventilation, home hygiene, and handwashing.	All factors showed a significant association (p<0.05), with the dominant factor being house cleaning habits (OR=5.950). Home environmental conditions and family behaviors significantly influenced this association.	This study found that pneumonia incidence in toddlers was influenced by both intrinsic and extrinsic factors. Significantly associated intrinsic factors were nutritional status and exclusive breastfeeding. Associated extrinsic factors were socioeconomic status, maternal occupation, housing density, exposure to cigarette smoke, use of mosquito coils, and home hygiene and ventilation. Toddlers with malnutrition, not exclusively breastfed, living in crowded homes, exposed to cigarette smoke, and living in unclean and poorly ventilated homes were at higher risk of pneumonia.
Intrinsic and Extrinsic Factors Associated with Pneumonia Incidence in the Rembang Community Health Center Area			
Agus Riyanto, Mona Megasari (2021) Journal of Health Sciences (JK)	Exclusive breastfeeding, DPT-HB-HIB immunization.	There is a significant association between exclusive breastfeeding and DPT-HB-HIB immunization (p<0.05). Toddlers without exclusive breastfeeding have a 2.3-fold higher risk, while those without complete immunization have a 2.4-fold higher risk.	This study shows that toddlers who are not exclusively breastfed and do not receive complete DPT-HB-HIB immunization have a higher risk of pneumonia. Not exclusively breastfeeding increases the risk approximately twofold, and incomplete immunization also significantly increases the risk. Both factors have been shown to play an important role in protecting toddlers from pneumonia.
Pneumonia in Toddlers Not Exclusively Breastfed and DPT-HB-HIB Immunization			
Iin Ardiana, Irwan Budiono (2025) Indonesian Journal of Public Health and Nutrition (IJPHN), Vol. 5 No. 1, pp. 30–40	Gender, immunization status, birth weight, history of breastfeeding (breast milk), vitamin A intake, history of preterm birth, family smoking (exposure to cigarette smoke), maternal education, maternal occupation, and access to health facilities.	The results showed a significant association between immunization status, birth weight, history of preterm birth, and access to health facilities with pneumonia in children (p<0.05). The dominant factors were immunization and access to health services. Other variables were not significantly related.	This study shows that the incidence of pneumonia in children aged 12–59 months in East Java is influenced by several important determinants. Factors that were significantly associated were immunization status, low birth weight, history of preterm birth, and access to health services. Children with incomplete immunizations, low birth weight or premature births, and inadequate access to healthcare services are at higher risk of developing pneumonia. However, other factors such as gender, maternal occupation, breastfeeding history, vitamin A intake, family smoking, and maternal education did not show a significant association in this study.
Determinants of Pneumonia Incidence in Children Aged 12–59 Months in East Java Province (2023 Indonesian Health Survey)			

Author and Title	Risk Factors	Research	Results Findings
Putu Melynia, Ni Wayan Manik Parwati, Ni Putu Riza Kurnia Indriana (2024) Jurnal Medika Usada, Vol. 7 No. 1, February 2024. Analysis of Intrinsic Factors Associated with the Incidence of Pneumonia in Toddlers at Community Health Center I, South Denpasar	Age, gender, nutritional status, history of low birth weight (LBW), immunization status, history of exclusive breastfeeding, vitamin A provision.	The results showed that immunization status and history of exclusive breastfeeding were significantly associated with the incidence of pneumonia ($p<0.05$). Meanwhile, age, gender, nutritional status, low birth weight (LBW), and vitamin A provision were not significantly associated. It was concluded that complete immunization and exclusive breastfeeding play an important role in preventing pneumonia in toddlers.	This study found that of the various intrinsic factors examined, only two factors were significantly associated with the incidence of pneumonia in toddlers: immunization status and history of exclusive breastfeeding. Toddlers with incomplete immunizations and those not exclusively breastfed have a higher risk of developing pneumonia. Other intrinsic factors such as age, gender, nutritional status, birth weight, and vitamin A administration did not show a significant relationship in this study.

DISCUSSION

Overview of Risk Factors for Pneumonia in Toddlers

Based on a review of twelve research journals conducted in various regions of Indonesia (2021–2025), pneumonia in toddlers is a lower respiratory tract infection influenced by various intrinsic (child-related) and extrinsic (environmental and family-related) factors. The most consistent risk factors identified across studies include immunization status, exclusive breastfeeding, nutritional status, home environmental conditions (ventilation and density), and exposure to cigarette smoke. Nearly all studies indicate that pneumonia remains a public health problem due to its contribution to morbidity and mortality among toddlers. For example, research by Agus Riyanto & Mona Megasari (2021) and Putu Melynia et al. (2024) confirmed that children who are not exclusively breastfed and fully immunized have a higher risk of developing pneumonia.

Intrinsic Factors Associated with Pneumonia

Intrinsic factors include inherent characteristics of the child, such as age, gender, nutritional status, low birth weight (LBW), history of premature birth, as well as immunization status and breastfeeding history. Several studies (such as Selvany et al., 2024 and Namira Sangadji et al., 2022) found that boys are more susceptible to pneumonia than girls, possibly because boys are more active and more frequently exposed to polluted outdoor air. Meanwhile, immunization status is the variable that most consistently shows a significant association in almost all studies (Noufal Rizqullah et al., 2021; Agus Riyanto et al., 2021; Melynia et al., 2024; Ardiana & Budiono, 2025). Children with incomplete immunizations have a 2–5 times higher risk of developing pneumonia than children with complete immunizations.

Exclusive breastfeeding has also been repeatedly found to be an important determinant. Exclusive breastfeeding provides natural immunity against respiratory tract infections through antibodies and immunological substances. Research by Agus Riyanto & Mona Megasari (2021) reported that toddlers who are not exclusively breastfed are 2.3 times more likely to develop pneumonia. A similar finding was found by Putu Melynia et al. (2024). Furthermore, low birth weight (LBW) and premature birth also significantly influence the incidence of pneumonia (Ardiana & Budiono, 2025; Junaidi et al., 2021). Babies born with low birth weight or prematurely have an immature immune system, making them more susceptible to respiratory tract infections.

Extrinsic Factors: Environment and Socioeconomics

Home environmental factors and family behavior are other important factors. Inadequate home ventilation increases the risk of pneumonia by up to 15.8 times. Uswatun Hasanah & Yunita Santik (2021) and Zalfa Hudmawan et al. (2023) also found that residential density, exposure to cigarette smoke, and low family income were significantly associated with the incidence of pneumonia. Densely populated environments and poor ventilation lead to poor air circulation, making it easier for germs to thrive. Furthermore, family behaviors such as smoking indoors worsen the air quality

children breathe. Socioeconomic factors and maternal education also play a significant role, as reported by Hudmawan et al. (2023). Mothers with low education tend to have limited knowledge about parenting and disease prevention, including the importance of immunization and caring for sick children.

The Role of Nutritional Status and Vitamin A

Several studies link poor nutritional status to an increased risk of pneumonia. Malnourished children have a lower immune system against infection. Although not all studies show significant results (Putu Melynia et al., 2024; Ardiana & Budiono, 2025), physiologically, nutritional status is a factor that influences the body's immunity. Similarly, vitamin A supplementation plays a role in maintaining the integrity of the respiratory tract mucosa, although the statistical relationship is not always significant.

Health Care Factors

Interesting findings from research by Ardiana & Budiono (2025) indicate that access to health care facilities is also a dominant factor in the incidence of pneumonia. Children living in areas with limited access to health care are at higher risk of pneumonia due to delayed diagnosis and treatment. This factor illustrates the importance of the primary health care system (community health centers) in the early detection and treatment of pneumonia in toddlers. Overall, the results of this review indicate that the causes of pneumonia in toddlers are multifactorial. Immunization and exclusive breastfeeding have been shown to be most consistently associated with the incidence of pneumonia across various studies, both at the local and provincial levels. Furthermore, home environmental factors and family behavior also contribute significantly to the risk of this disease. Therefore, pneumonia prevention efforts must be carried out comprehensively through: increasing complete basic immunization coverage for infants and toddlers, encouraging exclusive breastfeeding for the first six months, improving the quality of the home environment (ventilation, density, and smoke-free living) and increasing health education for mothers and families about the danger signs of pneumonia and the importance of access to health services.

CONCLUSION

Pneumonia in toddlers remains a major health problem in Indonesia. A review of ten journals published between 2021 and 2025 found that pneumonia is a significant cause of morbidity and mortality in toddlers, influenced by a combination of intrinsic (from within the child) and extrinsic (from the environment, socioeconomic status, and family behavior) factors. Intrinsic factors associated with pneumonia include immunization status, exclusive breastfeeding, low birth weight (LBW) and premature birth, nutritional status, and gender. Extrinsic factors contributing to pneumonia include home environment conditions, exposure to cigarette smoke, maternal socioeconomic status and education, and access to health services. Family behavioral factors also play a significant role.

Smoking indoors, not maintaining a clean environment, and not washing hands before contact with children have been shown to increase the risk of pneumonia. Conversely, clean and healthy living behaviors (PHBS), good air ventilation, and home cleanliness can be protective factors against respiratory infections. Pneumonia in toddlers is a preventable disease through simple and sustainable interventions at the family and community levels. The key to reducing pneumonia incidence is complete immunization, exclusive breastfeeding, improved home environments, balanced nutrition, and equitable access to healthcare services.

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