Community Research of Epidemiology (CORE)

VOLUME 6 ISSUE 1, DECEMBER 2025
Page 37-45

p-ISSN: 2774-9703 e-ISSN: 2774-969X
Homepage : http://journal.uin-alauddin.ac.id/index.php/corejournal
10.24252/corejournal.v6i1.61893

Factors associated with the incidence of respiratory infections in toddlers at the Puuwatu Community Health Center, Kendari

Faktor yang terkait dengan insidensi infeksi pernapasan pada balita di Puskesmas Puuwatu, Kendari

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Abstract

Acute Respiratory Infection (ARI) remains one of the leading causes of morbidity in children under five. Several factors contribute to ARI incidence, including basic immunization status, exclusive breastfeeding, and family smoking habits. This study aimed to determine the relationship between these factors and the incidence of ARI among children aged 0–5 years in the working area of BLUD UPTD Puuwatu Public Health Center in 2025. The study employed an analytical design with a cross-sectional approach, involving 174 children as respondents. Data were analyzed using the Chi-Square test. The results showed no significant relationship between basic immunization status and ARI incidence (p = 0.097), while a significant association was found between exclusive breastfeeding and ARI incidence (p = 0.000), as well as between family smoking habits and ARI incidence (p = 0.00). In conclusion, the most influential factors for ARI incidence were exclusive breastfeeding and exposure to family members who smoke. It is recommended that health workers strengthen education regarding the importance of exclusive breastfeeding and the dangers of cigarette smoke exposure, and that parents provide exclusive breastfeeding while keeping children away from smoking environments.

Abstrak

Infeksi Saluran Pernapasan Akut (ISPA) masih menjadi salah satu penyebab utama morbiditas pada balita. Berbagai faktor dapat memengaruhi kejadian ISPA, di antaranya status imunisasi dasar, pemberian ASI eksklusif, dan kebiasaan merokok dalam keluarga. Penelitian ini bertujuan untuk mengetahui hubungan faktor-faktor tersebut dengan kejadian ISPA pada balita usia 0–5 tahun di wilayah kerja BLUD UPTD Puskesmas Puuwatu Tahun 2025. Metode penelitian menggunakan desain analitik dengan pendekatan cross sectional, dengan jumlah sampel 174 balita. Analisis data dilakukan menggunakan uji Chi-Square. Hasil penelitian menunjukkan bahwa tidak terdapat hubungan antara status imunisasi dasar dengan kejadian ISPA (p = 0,097), terdapat hubungan signifikan antara pemberian ASI eksklusif dengan kejadian ISPA (p = 0,000), serta terdapat hubungan signifikan antara keberadaan anggota keluarga perokok dengan kejadian ISPA (p = 0,000). Kesimpulannya, faktor yang paling berpengaruh terhadap kejadian ISPA adalah riwayat pemberian ASI eksklusif dan kebiasaan merokok dalam keluarga. Disarankan kepada tenaga kesehatan untuk meningkatkan edukasi mengenai pentingnya ASI eksklusif dan bahaya paparan asap rokok, serta kepada orang tua untuk memberikan ASI eksklusif dan menghindarkan balita dari lingkungan perokok.

Keywords :

acute respiratory infection; breast feedings; smoking; toddler; risk factors

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Submit (2025/10/08) ; Revised (2025/12/02); Accepted (2025/12/18) ; Available Online (2025/12/24)

INTRODUCTION

Acute respiratory infections (ARI) are one of the main causes of high morbidity and mortality rates among toddlers, both in developed and developing countries (Setiawati et al., 2021). Children under the age of five are more susceptible to disease than adults because their immune systems are still developing. One of the most common infectious diseases experienced by toddlers is ARI (Abainpah et al., 2025). This disease is defined as an infection of the respiratory tract caused by various infectious agents such as bacteria, viruses, rickettsia, fungi, and parasites that are transmitted through droplets (Kementerian Kesehatan RI, 2024).

Acute Respiratory Tract Infection (ARTI) is an infectious syndrome of the respiratory tract that appears suddenly and lasts for a short period of time (generally ≤14 days), affecting the upper respiratory tract and, in some cases, progressing to the lower respiratory tract (Ektare et al., 2022). Clinically, ARI is generally characterized by fever, runny nose/rhinorrhea or nasal congestion, coughing for less than two weeks, and sore throat. In toddlers, ARI not only causes acute complaints, but also leads to increased visits to health services, eating and sleeping disorders, and the risk of complications such as otitis media or lower respiratory tract infections that may require treatment. The high frequency of occurrence and its recurring nature in the community make ARI often referred to as a persistent health problem or a "forgotten pandemic." (Ayyub, 2025).

According to data from the World Health Organization (WHO), millions of infants die each year from ARI. This disease is the leading cause of death among infants, with a very high mortality rate, especially among children under five years of age, with a mortality rate of 98%. This is especially true in countries with high infant mortality rates, around 40 per 1,000 live births, which means that 15%–20% of infant deaths each year are caused by ARI. To date, ARI is still among the top ten causes of death worldwide (WHO, 2023).

Respiratory tract infections (RTIs) remain the leading cause of infant mortality in Indonesia. In 2021, there were approximately 3,000 cases of RTIs in toddlers. However, the number of cases increased sharply in 2022, reaching between 50,000 and 70,000 cases. This trend continues, and in 2023 the number of ARI cases in Bali is estimated to reach around 200,000 (Kemenkes RI, 2023a). The 2023 Indonesian Health Survey also shows a significant increase in the prevalence of ARI, more than double that of the 2018 Riskesdas data. While in 2018 the prevalence of ARI was 12.8%, in 2023 it increased to 34.2% (Kemenkes, 2023)

Data from the Southeast Sulawesi Provincial Health Office also shows fluctuations in ARI cases in recent years. In 2020, there were approximately 18,600 ARI cases with a prevalence of 4.66%. This number increased in 2021 to 38,629 cases with a prevalence of 8.9%. This upward trend continued in 2022, with the number of cases in adults reaching 39,235 and the prevalence rising to 9.78% (Dinkes Provinsi Sulawesi Tenggara, 2023). Data from the Kendari City Health Office shows that the number of ARI cases in toddlers increased from 5,644 cases in 2022 to 9,353 cases in 2024, with a total of 23,508 cases during that period. The Puuwatu Community Health Center recorded the highest number of ISPA cases in toddlers in Kendari City over the last three years, with a total of 3,644 cases from 2022 to 2024 (Dinkes Kota Kendari, 2024).

The factors that influence the incidence of ARI in toddlers are diverse, including immunization status, exclusive breastfeeding, and family environment, including family members' smoking habits (Sarna et al., 2025). Children with parents who smoke are at greater risk of developing respiratory diseases such as influenza, asthma, pneumonia, and other respiratory tract disorders. Toddlers who live with parents who smoke become passive smokers and are constantly exposed to cigarette smoke. Research shows that children of parents who smoke are up to 7.83 times more likely to develop ARI than toddlers whose parents do not smoke (Shafwan et al., 2025a).

Another factor contributing to the increased risk of ARI is the lack of exclusive breastfeeding. Exclusive breastfeeding supports the baby's immune system, making them more resistant to infections, including ARI. Babies who are not exclusively breastfed are more susceptible to respiratory diseases because they do not have the natural protection provided by the antibodies contained in breast milk (Fatimah et al., 2022). Early breastfeeding (EBI) immediately after birth provides significant benefits because colostrum contains 10–17 times more immune substances than mature breast milk. In addition, exclusive breastfeeding has been proven to reduce the risk of infection in infants (Shafwan et al., 2025b).

If ARI is not treated immediately, it can develop into more severe conditions such as meningitis, lung infection, respiratory failure, loss of consciousness, and even death (Asa, 2023). The Indonesian government has been working to reduce the incidence of ARI, especially among infants and toddlers, through the ARI Disease

Table 1. Respondent Characteristics

Characteristics	Number	Percentage (%)
Incidence of ARI		
Yes	95	54.6
No	79	45.4
Toddler Age		
0-1 year old	48	27.6
2-3 year old	68	39.1
4-5 year old	58	33.3
Sex of Toddlers		
Male	96	55.2
Female	78	44.8
Complete Basic Immunization		
Complete	69	39.7
Incomplet	105	60.3
Exclusive Breastfeeding		
Yes	104	59.8
No	70	40.2
Family history of smoking		
Yes	117	67.2
No	57	32.8

Control Program (P2 ISPA), which has been running since 1984. Efforts include health education for the community, standard management, active case detection, and the development of a healthy environment (Haerani et al., 2020). One of the main strategies for preventing ARI in toddlers is active family involvement in recognizing the early signs and symptoms of the disease. That way, toddlers can be taken to a health professional immediately to receive appropriate treatment and prevent complications (Shafwan et al., 2025b).

Although numerous studies have addressed risk factors for ARI in toddlers, most have not identified interrelated factors within the context of specific community health center (Puskesmas) settings, such as those at Puuwatu Community Health Center. Furthermore, few studies have in-depth explored how risk factors such as cigarette smoke exposure and breastfeeding interact to influence the incidence of ARI in toddlers in this area. Based on the above description, this study aims to analyze the relationship between immunization, exclusive breastfeeding, and family smoking habits with the incidence of ARI in toddlers in Puuwatu, Southeast Sulawesi.

METHODS

This study used a quantitative method with a cross-sectional design. The purpose of the study was to identify risk factors associated with ARI in children aged 0–5 years. The study was conducted from July 30 to August 4, 2025, at the Puuwatu Community Health Center (UPTD Puskesmas Puuwatu). The study population included all children aged 0–5 years in the working area, totaling 316 children, while the sample consisted of 174 children calculated using the Slovin formula, with accidental sampling used as the sampling technique.

Data collection will be conducted through two main methods: questionnaires and medical data recording. Primary data will be obtained through interviews with parents or caregivers of toddlers with ARI, using a validated questionnaire. ARI is measured based on the medical diagnosis recorded in the patient's medical record at Puuwatu Community Health Center, as well as interviews with the toddler's parents regarding the clinical symptoms experienced. Breastfeeding history is measured by interviewing the toddler's parents or caregivers regarding breastfeeding history. Cigarette smoke exposure in the home environment is measured through interviews with parents or caregivers regarding smoking habits at home and around the toddler. The toddler's immunization status is measured by checking the toddler's immunization status through recording in the Health Card (KMS) book or medical record. In addition, secondary data will be obtained from the medical records of toddlers treated at Puuwatu Community Health Center during the study period. This medical data recording aims to obtain information related to the ARI diagnosis, length of treatment, and other factors recorded in the medical record, such as comorbidities or history of previous visits to health facilities.

Table 2. Immunization completeness, exclusive breastfeeding, family history of smoking, and the incidence of ARI

Variable	Incidence of acute respiratory infections				Total	P-Value	PR 95% CI
	Yes		No				
	n	%	n	%			
Immunization coverage							1,686
Incomplet	43	62.3	26	37.7	69	0.097	0.907-3.131
Complet	52	49.5	53	50.5	105		
Exclusive breastfeeding							4,598
Not breast milk	23	32.9	47	67.1	70	0.000	2.401-8.805
Yes	72	69.2	32	30.8	104		
Family history of smoking							3,707
There is	76	65	41	35	117	0.000	1.899-7.237
None	19	33.3	38	66.7	57		

Data were collected through questionnaires administered directly to the parents or guardians of the children. The questionnaires had previously undergone validity and reliability testing with 30 mothers who had children, with results of p-value = 0.003 and Cronbach's alpha of 0.97. Furthermore, the data were analyzed using the Chi-Square statistical test, both univariate and bivariate, at a 95% confidence level (a=0.05) using SPSS version 25.0. This study has obtained an ethical approval letter from the Health Research Ethics Committee (KEPK) of the Regional Board of the Indonesian Public Health Experts Association (IAKMI) of Southeast Sulawesi Province with Number: 54/KEPK-IAKMI/VI/2025.

RESULTS

Table 1 show that more than half of the toddlers experienced acute respiratory infections (54.6%), while 45.4% did not. Based on age distribution, toddlers aged 2–3 years formed the largest group (39.1%), followed by those aged 4–5 years (33.3%) and 0–1 year (27.6%). The majority of the toddlers were male (55.2%), while females accounted for 44.8%. Most toddlers had incomplete basic immunization status (60.3%), whereas only 39.7% had received complete immunization. Exclusive breastfeeding was reported in 59.8% of the children, while 40.2% did not receive exclusive breastfeeding. In addition, a high proportion of toddlers (67.2%) had a family history of smoking, indicating potential exposure to household risk factors.

Table 2 show a relationship between certain factors and the incidence of ARI in toddlers. Based on data regarding immunization completeness, toddlers with complete immunizations showed a lower incidence of ARI (37.7%) compared to toddlers with incomplete immunizations (62.3%). However, the p-value for immunization completeness was 0.097, indicating that this difference was not statistically significant, as the p-value was greater than 0.05. For the exclusive breastfeeding variable, the results were highly significant, with a p-value of 0.000. Toddlers who were exclusively breastfed had a lower incidence of ARI (30.8%) compared to toddlers who were not breastfed (69.2%). This indicates that exclusive breastfeeding is closely associated with a reduced risk of ARI in toddlers. Finally, regarding the variable of family smoking history, it was found that toddlers living with families with active smokers had a higher incidence of ARI (65.0%) compared to toddlers not exposed to cigarette smoke (33.3%). The highly significant p-value (0.000) indicates a strong association between exposure to cigarette smoke at home and the incidence of ARI in toddlers.

DISCUSSION

Basic Immunization Status and the Incidence of Respiratory Tract Infections

Immunization of toddlers is one of the most important preventive measures to protect children from various infectious diseases, including Acute Respiratory Infections (ARI). ARI can originate from infectious diseases that can actually be prevented by immunization, such as diphtheria, pertussis, and measles, and is also part of efforts to eradicate ARI (Andriani & Basri, 2021). Complete immunization of infants and toddlers is highly recommended to reduce the risk of death from ARI, as it can prevent the disease from developing into a more severe form (Fatimah, 2022).

The high number of toddlers suffering from ARI

with incomplete immunization history shows that basic immunizations such as diphtheria and measles not only serve to boost toddlers' immunity against ARI, but also help prevent triggers that can cause ARI. However, the incidence of ARI in infants is not entirely determined by the completeness of basic immunizations, because immunization is essentially aimed at boosting children's immunity, not entirely preventing exposure to ARI (Rita & Yundelfa, 2022).

Based on the results of research at the Puuwatu Community Health Center, of the 174 toddler respondents, 27 toddlers had ARI and 15 did not. Analysis of the relationship between complete basic immunization status and the incidence of ARI showed that 15 toddlers (35.7%) had complete immunization, while 12 toddlers (28.6%) had incomplete immunization. The Chi-Square test results showed a p-value = 0.180 > α (0.05). This indicates that there is no statistically significant relationship between the completeness of immunization and the incidence of ARI in toddlers in the working area of the Puuwatu Community Health Center..

This study is in line with the results of previous research (Lazamidarmi, Sitorus, & Listiono, 2021), which showed a p-value of 0.110 > 0.05. This means that both this study and the previous study indicate that basic immunization status has no significant relationship with the incidence of ARI in toddlers. Most cases of ARI in toddlers are often accompanied by complications from measles. In fact, measles is one of the risk factors for ARI that can actually be prevented by immunization. Therefore, measles and diphtheria immunizations do not directly increase immunity to ARI, but rather play a role in preventing the factors that trigger ARI (Lazamidarmi et al., 2021).

Although complete immunization is expected to provide greater protection against ARI, the results of this study indicate that complete immunization is not significantly associated with a decrease in the incidence of ARI in toddlers. It is possible that other factors, such as the environment, air quality, nutrition, and access to health facilities, play a greater role in the incidence of ARI in toddlers.

Exclusive Breastfeeding and the Incidence of Respiratory Tract Infections

Exclusive breastfeeding is an important measure to support the health of toddlers, including protecting them from various infectious diseases, such as Acute Respiratory Infections (ARI). The results of this study indicate that exclusive breastfeeding is associated with the incidence of ARI in infants in the working area of the Puuwatu Community Health Center, Kendari City, with a p-value of 0.000. Infants who are exclusively breastfed have a lower risk of developing ARI, as breast milk can boost the immune system and help infants resist pathogens that cause ARI, such as bacteria and viruses.

Exclusive breastfeeding provides various health benefits for infants, one of which is boosting the immune system. Breast milk contains antibodies, enzymes, and white blood cells that help protect infants from infections, including ARI. This study shows that infants who are exclusively breastfed are less likely to experience ARI compared to infants who are not exclusively breastfed (Mir et al., 2022).

Breast milk plays an important role in the immune system of toddlers, especially in protecting them from acute respiratory infections (ARI). Mucosal immunity in the upper respiratory tract is the first line of defense that prevents the entry of pathogens such as viruses and bacteria. Breast milk contains various immunological components, such as immunoglobulin A (IgA), lactoferrin, and immune cells that can protect the infant's respiratory tract. IgA, in particular, plays a major role in protecting the respiratory tract mucosa by binding to pathogens and inhibiting their attachment to the respiratory tract epithelium (Mattar et al., 2019).

In addition, breast milk also contains immune cells, such as T and B lymphocytes, which play a role in facilitating the immune response to pathogens. These components help strengthen mucosal immunity and prevent inflammation of the respiratory tract that can occur due to infection. The reduced incidence of respiratory infections in exclusively breastfed infants may be associated with better protection against respiratory tract inflammation, which is often a major factor in the development of respiratory diseases (Vidal-Batres et al., 2024).

Valentina's research (2011) in the journal (Susilawati et al., 2024) on “The Relationship between Knowledge, Immunization Status, and Exclusive Breastfeeding History with the Incidence of ARI in Toddlers at the Sindang Beliti Ilir Community Health Center, Rejang Lebong District in 2023” shows that children who are not exclusively breastfed are 2.7 times more likely to develop acute respiratory infections than children who are exclusively breastfed.

The results of the study at the Puuwatu Community Health Center also showed the same thing. Of the 42 toddler respondents, 27 children had ARI and 15 did

not. Analysis of the relationship between exclusive breastfeeding and the incidence of ARI showed that 7 infants (16.7%) who were exclusively breastfed had ARI, while 20 infants (47.6%) who were not exclusively breastfed had ARI. The Chi-Square test results gave a p-value = 0.020 < 0.05, so H_0 was rejected and H_1 was accepted. Thus, there was a significant relationship between a history of exclusive breastfeeding and the incidence of ARI in toddlers.

These findings are consistent with other research conducted by Fitri Wahyuni, Ulvi Mariati, and Titi Septi Zuriati (2020) on the relationship between exclusive breastfeeding and the incidence of ARI in children aged 12–24 months. They concluded that children who did not receive exclusive breastfeeding had a greater risk of developing ARI compared to children who were exclusively breastfed, with an ARI incidence p-value of 0.007 (Wahyuni et al., 2020). Exclusive breastfeeding provides protective substances that are very beneficial for babies, such as lysozyme enzymes that can destroy bacterial cell walls, lactoferrin that acts as a bacteriostatic agent to inhibit bacterial growth, and immunoglobulin IgA (sIgA) that supports the baby's mucosal immune system. These substances help boost the baby's immune system, protecting them from viral and bacterial infections that cause respiratory tract infections (Priyantini et al., 2023).

Although exclusive breastfeeding is associated with the incidence of ARI, other factors such as environmental sanitation, air pollution, and nutritional status also play a role in the incidence of ARI in toddlers. Therefore, in addition to supporting exclusive breastfeeding, it is important to pay attention to other factors that can improve health and prevent ARI in toddlers.

Smoking and the Incidence of Respiratory Tract Infections

Smoking in the home environment, especially in families with toddlers, can increase the risk of toddlers developing acute respiratory infections (ARI). Cigarettes contain various harmful substances that can damage the respiratory tract and worsen the condition of a toddler's immune system. Research shows that exposure to cigarette smoke at home is a significant factor in the incidence of ARI in toddlers in the working area of the Puuwatu Community Health Center in Kendari City, with a p-value of 0.000.

Cigarette smoke contains thousands of harmful chemicals, including nicotine, carbon monoxide, and tar, which can damage the respiratory tract. In toddlers, the developing respiratory system is more vulnerable to the adverse effects of cigarette smoke. Exposure can cause inflammation of the respiratory tract, facilitate infection, and worsen existing respiratory tract infections (WHO, 2024)

Continuous exposure to cigarette smoke can interfere with the immune system function of toddlers, making them more susceptible to infection. A weakened immune system reduces the body's ability to fight bacteria and viruses that cause respiratory tract infections, making toddlers more vulnerable to respiratory tract infections (Wulandari et al., 2025).

Toddlers who live in homes with parents who smoke are more frequently exposed to cigarette smoke in enclosed environments, which can increase their risk of developing respiratory infections due to their underdeveloped immune systems and more sensitive respiratory tracts. Cigarettes smoked indoors can pollute indoor air and worsen air quality, which in turn increases the risk of toddlers developing respiratory infections.

Cigarette smoke makes toddlers more susceptible to ARI because it “disrupts the front line” of the respiratory tract (mucosal immunity) and causes the respiratory tract to be in a state of low-grade chronic inflammation. In mucosal immunity, the respiratory tract is normally lined with mucus and moved by cilia (fine hairs) to sweep viruses/bacteria out—this is the mucociliary clearance mechanism. Exposure to cigarette smoke damages cilia function, changes the composition and viscosity of mucus, and reduces the effectiveness of this cleansing process. As a result, pathogens remain attached to the epithelium longer and colonize more easily. Cigarette smoke also weakens other local defense components: alveolar macrophage and neutrophil activity becomes less effective (phagocytosis decreases), and the secretory antibody response in the mucosa (especially IgA) can be disrupted, so that the “gatekeeper antibodies” on the mucosal surface are not optimal (Abubakar et al., 2025)

From an inflammatory perspective, particles and chemicals in cigarette smoke trigger oxidative stress in the respiratory tract epithelium, activating inflammatory mediators (cytokines/chemokines) and increasing permeability and epithelial damage. This irritated epithelium becomes more “leaky” and reactive, making symptoms (coughing, mucus production) more likely to appear and infections more likely to develop. In toddlers, this effect is greater because the diameter of the airways is smaller, so even a slight edema/inflammation significantly increases breathing resistance, and the immune system is still developing (Merera, 2021).

In families with smokers, toddlers are statistically twice as likely to develop ARI compared to toddlers from families without smokers. Other studies have also found that the risk of ARI in toddlers doubles if the parents smoke (Tasimalaya et al., 2020). Research conducted at the Puuwatu Community Health Center BLUD UPTD reinforced these findings. Of the 42 toddler respondents, 27 children suffered from ARI and 15 did not. The results of the analysis showed that 22 toddlers (54.2%) lived with families who smoked, while 5 toddlers (11.9%) lived in families without smokers. The results of the Chi-Square test showed a p-value = 0.015 < 0.05, so H_0 was rejected and H_1 was accepted. Thus, there is a significant relationship between the presence of family members who smoke and the incidence of ARI in toddlers.

These results are in line with research (Kusumawardani et al., 2020) which states that the presence of smokers in the home increases the risk of pneumonia in toddlers. Another study (Suryani et al., 2024) also shows that family members' smoking habits are closely related to the incidence of ARI. The more family members who smoke at home, the higher the risk of toddlers developing ARI.

This study has several limitations, one of which is the cross-sectional design used, which only provides a snapshot of conditions at a single point in time without being able to identify causal relationships. Therefore, although there is a significant association between factors such as exclusive breastfeeding, complete immunization, and cigarette smoke exposure and the incidence of ARI, this design cannot confirm whether these factors actually cause ARI in toddlers. To gain a deeper understanding of causality, future longitudinal studies or intervention experiments are highly recommended. Longitudinal studies will allow researchers to demonstrate the development of ARI incidence over time and highlight the impact of interventions or behavioral modifications, such as increasing exclusive breastfeeding or reducing exposure to cigarette smoke at home. Therefore, further research with more robust designs will provide more robust evidence regarding the influence of these factors on toddler respiratory health and support the development of more effective prevention programs.

CONCLUSION

There was no significant association between basic immunization status and the incidence of ARI among toddlers in the working area of the Puuwatu Community Health Center BLUD UPTD. However, toddlers who were not exclusively breastfed and who lived with family members who smoked had a higher risk of developing ARI. Therefore, exclusive breastfeeding and the presence of family members who smoke are the most influential factors affecting the incidence of ARI among toddlers in this study area.

Health workers are advised to increase education about the importance of exclusive breastfeeding and the dangers of exposure to cigarette smoke, and parents are advised to provide exclusive breastfeeding and keep toddlers away from smokers, as well as completing basic immunizations for toddlers as a preventive measure against other infectious diseases that can worsen children's health conditions.

ACKNOWLEDGEMENT

The researchers would like to express their deepest gratitude to the head of BLUD UPTD Puskesmas Puuwatu and all staff who have provided permission, support, and facilities in conducting this research. The researchers would also like to thank those who have participated in assisting the research, both directly and indirectly. All forms of assistance and support provided were very meaningful so that this research could be completed successfully. This research did not receive funding from any party, it only relied on the researcher's personal funds.

FUNDING

The author(s) reported there is no funding associated with the work featured in this article.

AUTHORS' CONTRIBUTIONS

La Ode Liaumin Azim conceptualized the study, designed the methodology, and led the manuscript drafting and critical revision. As the corresponding author, he also coordinated the research activities and finalized the submission. La Ode Ahmad Saktiansyah contributed to data analysis and interpretation and assisted in reviewing and refining the manuscript. Agnes Mersatika Hartoyo supported data collection and literature review and contributed to manuscript editing. All authors read and approved the final version of the manuscript.

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COMPETING INTERESTS

The authors affirm that there are no conflicts of interest related to the research, writing, or publication of this article.

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