

ARTICLE INFORMATION

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Association between Indoor PM10 exposure and acute respiratory infection among children under five

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Abstract

Background: Acute Respiratory Tract Infection (ARI) is a major health problem in toddlers and remains a cause of high morbidity and mortality in Indonesia, including Jambi City. The incidence of ARI in toddlers is influenced by various risk factors, one of which is environmental factors, particularly indoor air quality. One such indoor air pollutant is PM10. In addition to PM10, other factors can influence the incidence of ARI, such as nutritional status, exclusive breastfeeding, the presence of smokers in the home, adequate ventilation, and the use of mosquito coils.

Purpose: To analyze the association between indoor PM10 exposure and acute respiratory infection among children under five.

Method: This study used an observational analytical design with a cross-sectional approach. The sample consisted of 90 respondents aged 6-59 months in the Putri Ayu Community Health Center working area in Jambi City, selected using a purposive sampling technique. Data were collected through PM10 levels measurements using a DAZ-400 Particle Counter and interviews using a questionnaire. Data analysis was performed using univariate, bivariate, and stratified methods using R software.

Results: Results showed that children living in homes with PM10 levels that did not meet the criteria were at risk of developing ARI (PR = 1.63; 95% CI: 1.19-2.23; P = 0.027). After stratification, PM10 remained a risk factor in each stratum, but with ventilation as an effect modifier.

Conclusion: Indoor PM10 exposure was significantly associated with ARI among children under five. Improving indoor air quality, reducing indoor pollutant sources, and strengthening household ventilation are recommended to reduce ARI-related risks.

Keywords: Acute Respiratory Infection; Children Under Five; Indoor Air Quality; PM10; Ventilation.

INTRODUCTION

Acute Respiratory Tract Infection (ARI) is one of the respiratory diseases frequently found in Indonesia and is a significant public health problem (Ministry of Health of the Republic of Indonesia, 2023). ARI refers to a disease caused by bacterial or viral infections and various environmental factors that can attack the upper and lower respiratory tract and last for 14 days (Ibrahim, Boekoesoe, & Lalu, 2022). Globally, ARI remains a major cause of morbidity and mortality in children. The World Health Organization (WHO) reports that the incidence of ARI in developing

countries reaches 15-20% per year, with a prevalence of 42.91% in 2020 (World Health Organization, 2020). UNICEF also states that ARI, including pneumonia, is one of the main causes of death in children under five, with an incidence of more than 1,400 cases per 100,000 children per year (UNICEF, 2024). The prevalence of ARI in Indonesia shows a fluctuating trend, decreasing from 25% in 2013 to 9.3% in 2018, then increasing again to 23.5% in 2023, particularly among toddlers aged 6-59 months (Ministry of Health of the Republic of Indonesia, 2013; Ministry of Health

of the Republic of Indonesia, 2018; Ministry of Health of the Republic of Indonesia, 2023).

This phenomenon at the national level also reflects the prevalence of ARI at the regional level, including in Jambi Province, which fluctuated from 17% in 2013 to 7.3% in 2018, and then increased again to 18.8% in 2023 (Ministry of Health of the Republic of Indonesia, 2023). According to data from the Jambi Provincial Health Office, ARI is the most common of the ten diseases in Jambi Province. Meanwhile, in Jambi City, data from the Health Office shows that the prevalence of acute respiratory infections (ARI) has experienced a dynamic trend in recent years. It reached 24.66% in 2020, then decreased to 16.68% in 2021, remained relatively stable at 16.63% in 2022, then increased again to 32.20% in 2023, and then decreased slightly to 29.06% in 2024. This indicates that ARI remains a health problem that requires attention.

This disease pattern indicates that acute respiratory infections (ARI) remain a health problem that requires attention, especially in toddlers. ARI can impact the growth and development of toddlers and can lead to serious complications and even death if not properly managed. Based on John Gordon's epidemiological triad theory, disease incidence is influenced by the interaction between agent, host, and environmental factors (Susilawaty, Sudaryanto, Aulia, Aulia, Fitria, Prisusanti, & Aini, 2022). In the context of ARTI, environmental factors such as indoor air quality play a crucial role. Exposure to particles such as Particulate Matter (PM10), an environmental factor, can increase the incidence of ARTI because these particles can linger in the air and are easily inhaled into the respiratory tract, especially in toddlers with underdeveloped immune systems (Farhan & Islam, 2025).

PM10 is a fine particle originating from air pollution and measuring $<10 \mu\text{m}$ (Rahim & Camin, 2021). Indoor pollution sources that can produce PM10 include cigarette smoke, cooking activities, the use of mosquito coils, building materials, and household products. It can also originate from outdoors, such as road dust entering the home. According to the WHO, exposure to PM10 can cause health effects both in the long term and short term. One of the risks of short-term exposure is the emergence of Acute Respiratory Tract Infections (ARI) (Anggraeni, Darundiati, & Joko, 2021). Findings in Terate found a significant

correlation between increased exposure to PM10 in the home environment and the incidence of ARI in toddlers in Terate, with an Odds Ratio (OR) value of 3.348 and a $p < 0.025$, which means that children in Terate who live indoors with PM10 concentrations that meet the requirements according to the established quality standards ($\text{PM}_{10} > 70 \mu\text{g}/\text{m}^3$) have a 3.348 times risk of experiencing ARI compared to toddlers who live in rooms with PM10 concentrations that meet the requirements (Hayati & Iriani, 2018).

Based on this, it is necessary to pay attention to indoor air quality. In addition to PM10, other factors such as ventilation area, residential density, the presence of smokers in the home, nutritional status, and exclusive breastfeeding also contribute to the incidence of ARI (Haris, 2021). Previous research also showed a relationship between indoor smoking behavior and the incidence of ARI in toddlers (Putri, Anggraini, & Rodhiyah, 2022).

RESEARCH METHOD

This study is a quantitative, observational, and analytical study using a cross-sectional approach. The independent and dependent variables were measured simultaneously to determine the relationship between PM10 exposure and the incidence of acute respiratory infections (ARI) in toddlers. The study was conducted in the Putri Ayu Community Health Center (Puskesmas) area in Jambi City from January 2026 until completion. The population comprised all children aged 6–59 months in the study area, with a sample size of 90 respondents. The sampling technique used purposive sampling, which selects the sample based on specific criteria.

Respondents were selected purposively, considering that they were toddlers aged 6–59 months living in homes near high-traffic roads. This selection was based on the consideration that these locations have a higher potential for exposure to air pollution, particularly PM10, and are therefore relevant to the research objectives. The dependent variables of this study were the incidence of ARI as assessed based on a diagnosis by a health worker in the past month, diagnosed with pneumonia in the past month, having experienced symptoms of fever, cough for ≤ 2 weeks, runny nose/stuffy nose, sore throat, or shortness of breath in the past month. The

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independent variable in this study was PM10 which was measured directly in the respondents' homes using a DAZ-400 type Particle Counter. Measurements were carried out at one point in the house at a height of $\pm 1-1.5$ meters from the floor or equivalent to the height of a toddler. The measurement duration was approximately 2 minutes until the device displayed the results in $\mu\text{g}/\text{m}^3$.

The measurement results were then recorded on an observation sheet. PM10 levels were then categorized into two, namely meeting the requirements if $\leq 70 \mu\text{g}/\text{m}^3$ and not meeting the requirements if $> 70 \mu\text{g}/\text{m}^3$, referring to applicable indoor air quality standards. Furthermore, covariate variables were also measured, namely nutritional status, exclusive breastfeeding, the presence of smokers in the house, residential density, ventilation area, and the use of mosquito coils. The research

instruments included a questionnaire, a DAZ-400 Particle Counter to measure PM10 concentration (range 0–500 $\mu\text{g}/\text{m}^3$ with a laser scattering sensor), a scale to measure children's weight, and a roll meter to measure the ventilation area of the house.

Data analysis was performed univariately to describe the distribution of variables, bivariate analysis using the Chi-square test with a significance level of $p < 0.05$ and the association measure used was the Prevalence Ratio (PR) with 95% CI to assess the risk factors of variables with the incidence of ARI, as well as stratification analysis using the Mantel-Haenszel method to see the modification effect and calculate the adjusted prevalence ratio. Data processing used R Studio software with the packages used were haven, dplyr, janitor, readxl, misty, epitools, and epiR.

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RESEARCH RESULTS

Table 1. Respondent of Characteristics (N=90)

Variable	Result	PR (95%CI)	Adjusted PR (95% CI)	Δ PR (%)	P-value
ARI (n/%)					
Yes	51/56.7				
No	39/43.3				
PM10 (n/%)		1.63 (1.19-2.23)			0.027
Not eligible	13/14.4				
Qualify	77/85.6				
Gender (n/%)					
Male	46/51.0				
Female	44/49.0				
Age (n/%)					
0-23 Months	26/29.0				
24-59 Months	64/71.0				
Nutritional Status (n/%)		1.32 (0.90-1.92)	1.57 (1.15-2.14)	3.68	0.198
At Risk	17/19.0				
Not at Risk	73/81.0				
Exclusive Breastfeeding (n/%)		1.76 (1.12-2.75)	1.54 (1.14-2.08)	5.52	0.005
Not Exclusively Breastfeeding	54/60.0				
Exclusively Breastfeeding	36/40.0				
Presence of Smokers in the Home (n/%)		1.94 (1.14-3.31)	1.53 (1.14-2.06)	6.13	0.003
Yes	61/68.0				
No	29/32.0				
Occupancy Density (n/%)		1.23 (0.83-1.81)	1.62 (1.18-2.21)	0.61	0.338
Does Not Meet Requirements	18/20.0				
Meets Requirements	72/80.0				
Ventilation Area (n/%)		1.62 (1.10-2.37)	1.38 (1.01-1.88)	15.33	0.009
Does Not Meet Requirements	44/49.0				
Meets Requirements	46/51.0				
Mosquito coil use (n/%)		1.50 (1.07-2.09)	1.66 (1.22-2.26)	1.84	0.034
Uses	24/27.0				
Does Not Use	66/73.0				

The frequency distribution of respondent characteristics can be seen in Table 1. The findings show that the prevalence of ARI is 56.67%. Most toddlers living in homes with PM10 meet the

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requirements at 85.56%. Based on toddler characteristics or host factors, the proportion of boys was found to be greater than girls at 51.11%. The majority of children were aged 24-59 months at 71.11%. Based on nutritional status, most toddlers were not at risk at 81.11%. Most toddlers were not exclusively breastfed at 60%. Viewed from physical environmental factors, those who did not use mosquito coils were greater than those who used them at 73.33%. The residential density variable shows that most houses with residential density met the requirements at 80%. Meanwhile, the proportion of ventilation area that met the requirements was found at 51.11%. Based on social environmental factors, the presence of smokers in the home was found to be high at 67.78%.

The results of the chi-square analysis obtained a p-value of 0.027, indicating a significant relationship between PM10 and the incidence of ARI in toddlers in the work area of the Putri Ayu Community Health Center in Jambi City. The PR value obtained was 1.63 (95% CI: 1.19-2.23), which means that toddlers living in homes with PM10 levels that do not meet the requirements are 1.63 times more likely to experience ARI compared to children living in homes with PM10 levels that meet the requirements.

Based on statistical analysis, the covariate variables associated with the incidence of ARI were exclusive breastfeeding (p-value = 0.005, PR = 1.76, 95% CI: 1.12 – 2.75), the presence of smokers in the house (p-value = 0.003, PR = 1.94, 95% CI: 1.14 – 3.31), ventilation area (p-value = 0.009, PR = 1.62, 95% CI: 1.10 – 2.37) and the use of mosquito coils (p-value = 0.034, PR = 1.50, 95% CI: 1.07 – 2.09). Meanwhile, covariate variables that were not related to ARI were nutritional status (p-value = 0.198, PR = 1.32, 95% CI: 0.90 – 1.92) and residential density (p-value = 0.3338, PR = 1.23, 95% CI: 0.83 – 1.81).

The results of the stratification analysis showed that exposure to PM10 that did not meet the requirements consistently increased the risk of ARI incidence in toddlers across almost all covariate variable strata. For the variables of nutritional status, exclusive breastfeeding, presence of smokers in the home, residential density, and use of mosquito coils, no significant differences in the strength of the association were found between strata ($p > 0.05$), so these variables did not act as a modifying or confounding effect in the relationship between PM10

and ARI incidence. In contrast, ventilation area showed a difference in the modifying effect ($p < 0.05$) with a ΔPR value $\geq 10\%$, so it can be identified as a variable that acts as a modifying and confounding effect. This indicates that the effect of PM10 exposure on ARI incidence is influenced by home ventilation conditions.

DISCUSSION

Dust particles measuring $\leq 10 \mu\text{m}$ (PM10) are a hazardous air pollutant, particularly for vulnerable groups such as toddlers, as they can penetrate the lower respiratory tract, triggering irritation and increasing susceptibility to infection. Research conducted in the Putri Ayu Community Health Center in Jambi City showed that toddlers living in homes with substandard PM10 levels had a 1.63-fold higher risk of developing acute respiratory infections (ARI) compared to those living in homes with adequate PM10 levels, confirming that PM10 exposure is a significant risk factor. This condition can be influenced by household activities and the surrounding environment, particularly in respondents living on roadsides, where outdoor pollution, such as vehicle emissions, contributes to increased PM10 concentrations indoors. Although measurements were conducted intermittently, the results still demonstrate the potential for exposure relevant to the risk of acute respiratory infections (ARI).

The results of this study are consistent with research conducted in Central Kenya, which indicated a significant relationship between exposure to particulate matter (PM10) in the home and the incidence of ARI in toddlers ($p = 0.000$) and an RR value of 1.57 (95% CI, 1.19-1.27) which means that children who live in homes with high PM10 levels have a 1.57 times risk of experiencing ARI compared to children who live in homes with low PM10 levels (Ali & Febriyana, 2022). This finding is also supported by research conducted in Pekalongan City, which found that ARI incidents mostly occurred in toddlers who live in homes with unsafe particulate levels. The findings showed a significant relationship with a p-value of 0.034 and OR = 2.17 (95% CI: 1.70 – 2.78), meaning that toddlers with poor particulate dust levels in the home had a 2.17 times greater risk of suffering from ARI compared to toddlers with safe particulate dust levels in the home (Maulana, Nida, Pangestu, & Akbar, 2024). This confirms that indoor air quality is

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an important determinant of children's respiratory health.

PM10 particles generally originate from sources such as wind-borne dust from erosion, agricultural land, highways, and mining activities. Furthermore, PM10 can also be produced by various human activities such as fuel combustion or cooking, motor vehicle emissions, industrial processes, power plants, construction activities, waste incineration, and forest and land fires. Therefore, dust particles are often used as a primary indicator in assessing the health impacts of air pollution exposure (Ministry of Health of the Republic of Indonesia, 2025). Biologically, PM10 can cause inflammation in the airways, reduce mucociliary defense function, and increase oxidative stress, leading to a weakened immune system. Furthermore, these particles can act as a carrier for pathogenic microorganisms, increasing the likelihood of respiratory tract infections.

Stratification analysis results show that the relationship between PM10 and the incidence of acute respiratory infections is consistent across various strata, such as nutritional status, exclusive breastfeeding, presence of smokers, ventilation area, and use of mosquito coils. This indicates that PM10 remains a major risk factor without being significantly influenced by these covariate variables.

Overall, high indoor PM10 levels reflect the still-poor quality of the home environment, particularly related to ventilation and pollution source control. Therefore, efforts to prevent ARI in toddlers should not only focus on curative aspects but also focus on controlling indoor air quality through improved ventilation, reducing pollutant sources, and increasing public awareness. These findings underscore the importance of promotive and preventive approaches in reducing the risk of ARI through sustainable, environmentally-based interventions.

Exclusive breastfeeding has been shown to be associated with the incidence of ARI in toddlers (p -value = 0.005), where toddlers who are not exclusively breastfed have a higher risk of ARI with a PR value of 1.76 (95% CI: 1.12 – 2.75). This study is consistent with previous research that also showed a significant association between exclusive breastfeeding and ARI in toddlers with a p -value of 0.001 and a PR of 0.31 (95% CI: 0.17–0.54), indicating that exclusive breastfeeding is a protective factor against ARI because the PR <1, thus exclusive

breastfeeding is associated with a reduced risk of ARI (Qarimah, Priono, Surasmaji, & Ariyanto, 2025).

Exclusive breastfeeding is the provision of only breast milk without additional food or fluids for the first 6 months of a baby's life. Breast milk also contains immunoglobulins that function to help mature the baby's still-immature immune system, thus providing protection against pathogens (Aithal, Sachdeva, & Kurmi, 2023). Therefore, increasing the coverage of exclusive breastfeeding is an important strategy in reducing the incidence of ARI in toddlers.

The presence of smokers showed a significant association with the incidence of ARI in toddlers (p -value = 0.003). The PR obtained was 1.94 (95% CI: 1.14-3.31), meaning toddlers living with smokers at home had a 1.94-fold greater risk of experiencing ARI compared to those not living with smokers at home. This study also aligns with previous research that found that smoking behavior in the home can increase the risk of ARI four-fold higher in toddlers with a p -value of 0.000 and an OR of 4.04 (95% CI: 1.87-8.72) (Ridha et al., 2025). Biologically, cigarette smoke contains various dangerous compounds, such as tar, nicotine, carbon monoxide (CO), and fine particles that can reach the lung alveoli. Exposure to cigarettes can damage the lung's defense mechanisms, including disruption of the mucociliary system, thus facilitating the entry of infection-causing microorganisms (Susanti, Puspita, & Sari, 2025). Thus, implementing a smoke-free home is an important preventive measure. The extent of house ventilation shows a significant relationship with the incidence of ARI in toddlers with a p -value = 0.009 and a prevalence ratio of 1.62 times (95% CI: 1.10-2.37). Inadequate ventilation can cause suboptimal air circulation, resulting in the accumulation of pollutants and microorganisms in the room. This finding is supported by research (Syafitri, 2025) which shows the same thing, where toddlers who live in homes with poor ventilation have a 3.87 times higher risk of experiencing ARI compared to toddlers who live with good ventilation (p -value = 0.012).

Inadequate ventilation, i.e., less than 10% of the floor area or rarely opened, can cause rooms to become damp, stuffy, produce unpleasant odors, and allow microorganisms to survive longer due to suboptimal air circulation. These conditions can increase the risk of respiratory infections in toddlers. Conversely, adequate ventilation of more than 10%

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allows for optimal air circulation, allowing fresh air to enter and contaminated air to exit, thereby reducing the concentration of disease-causing agents in the room.

The use of mosquito coils is associated with an increased incidence of respiratory infections (ARI) in toddlers (p-value = 0.034) and a PR value of 1.50 (95% CI: 1.07-2.09), indicating that mosquito coil use is a risk factor for increased incidence of respiratory infections in toddlers. The results of this study are in line with previous research that showed a significant correlation between mosquito coils and the incidence of ARI with a p-value of 0.000 and an OR of 6.34 (95% CI: 2.80-14.39), meaning that toddlers who live with mosquito coils at home are at 6.34 times greater risk of contracting ARI than toddlers who do not use mosquito coils at home (Ridha, Naser, Timantha, Sudarmaji, Indawati, & Silalahi, 2025). The smoke produced from burning mosquito coils contains fine particles and chemical compounds that can irritate the respiratory tract and trigger inflammation. Continuous exposure, especially in rooms with poor ventilation, can increase the risk of respiratory disorders in children (Fadila & Siyam, 2022).

CONCLUSION

Indoor PM10 exposure was significantly associated with ARI among children under five in the Putri Ayu Community Health Center working area, Jambi City. Exclusive breastfeeding, the presence of smokers in the home, ventilation area, and mosquito coil use were also associated with ARI. Ventilation appeared to modify the association between PM10 exposure and ARI. Efforts to improve household ventilation, reduce indoor pollutant sources, implement smoke-free homes, and promote exclusive breastfeeding are recommended.

REFERENCES

Aithal, S. S., Sachdeva, I., & Kurmi, O. P. (2023). Air quality and respiratory health in children. *Breathe*, 19(2).

Ali, L., & Febriyana, Y. (2022). Analisis Faktor Risiko Kejadian ARI pada Balita di Wilayah Kerja Puskesmas Liwuto Kota Baubau An Analysis of Risk Factor for ARI Incidence in Toddlers in the Working Area of the Liwuto Public Health Center

Baubau City.

Anggraeni, H. D. A., Darundiati, Y. H., & Joko, T. (2021). Analysis of PM10 concentrations measured by the Kemayoran BMKG station in Central Jakarta during the COVID-19 pandemic. *Media Kesehatan Masyarakat Indonesia*, 20(1), 63–69

Fadila, F. N., & Siyam, N. (2022). Faktor risiko infeksi saluran pernapasan akut (ARI) pada anak balita. *Higeia (Journal of Public Health Research and Development)*, 6(4), 320-331.

Farhan, M., & Islam, F. (2025). Pengukuran Kualitas Udara Particulate Matter (PM2, 5) Dalam Ruangan Di PT. Rekind Daya Mamuju. *Jurnal Kesehatan Lingkungan Mapaccing*, 3(1), 7-16.

Haris, N. (2021). Faktor Yang Berhubungan Dengan Kejadian Infeksi Saluran Pernapasan Akut (ARI) Pada Balita Di Wilayah Kerja Puskesmas Padongko Kabupaten Barru= Factors Related To The Incidence Of Acute Respiratory Infection (Ari) On Children Under Five Age In The Working Area Of Padongko Health Center Barru Regency (Doctoral dissertation, Universitas Hasanuddin).

Hayati, R. Z., & Iriani, D. U. (2017). Relationship Between Particulate Matter (PM10) Concentration and House Environmental Factor with Symptoms of Acute Respiratory Infection (ARI) on Children Under Five in Rawa Terate Health Centre, Cakung Sub-district in 2017. In 2nd Public Health International Conference (Phico 2017) (pp. 48-54). Atlantis Press.

Ibrahim, Z., Boekoesoe, L., & Lalu, N. A. S. (2022). Identifikasi Kualitas Udara Ambien Disekitar Wilayah Kota Gorontalo. *Public Health and Surveillance Review*, 1(1), 24-33.

Maulana, J., Nida, S. C., Pangestu, M. L., & Akbar, H. (2024). Analisis Faktor Risiko Kejadian ARI pada Balita di Puskesmas Jenggöt Kota Pekalongan. *Graha Medika Public Health Journal*, 3(1), 41-48.

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- Ministry of Health of the Republic of Indonesia. (2013). Laporan Nasional Riskesdas 2013. Retrieved from: <https://www.badankebijakan.kemkes.go.id/repositori/id/eprint/4428/>
- Ministry of Health of the Republic of Indonesia. (2018). Laporan Nasional Riskesdas 2018. Retrieved from: <https://repository.kemkes.go.id/book/1323>
- Ministry of Health of the Republic of Indonesia. (2023). Survei Kesehatan Indonesia 2023. Retrieved from: <https://www.badankebijakan.kemkes.go.id/hasil-ski-2023/>
- Ministry of Health of the Republic of Indonesia. (2025). Pedoman Surveilans Kualitas Udara Dalam Ruang dan Dampak Kesehatan. Retrieved from: <https://kemkes.go.id/id/koleksi-pedoman-kementerian-kesehatan>
- Putri, T. M., Anggraini, F. J., & Rodhiyah, Z. (2022). Analisis Hubungan Sumber Pencemaran Udara Dalam Rumah Terhadap Penyakit ARI Pada Balita. Dampak, 19(1), 30-39.
- Qarimah, Y. A., Priono, R. I. P., Surasmaji, L. I., & Ariyanto, S. (2025). Hubungan Asi Eksklusif, Imunisasi Dasar, Orang Tua Perokok Dengan Infeksi Saluran Pernapasan Akut (ARI) Pada Bayi 0-24 Bulan di Puskesmas Bagu Tahun 2024. Bioscientist: Jurnal Ilmiah Biologi, 13(1), 374-381.
- Rahim, F., & Camin, Y. R. (2018). Kondisi kualitas udara (So2, No2, PM10 Dan Pm2, 5) di dalam Rumah di sekitar Cilegon dan gangguan pernapasan yang diakibatkannya. Al-Kauniyah: Jurnal Biologi, 11(2), 82-90.
- Ridha, Y. F., Naser, M. I., Timantha, L. E., Sudarmaji, S., Indawati, R., & Silalahi, L. L. B. (2025). Determinan Kejadian ARI Pada Balita di Wilayah Kerja Puskesmas Ofa Padang Mahondang Tahun 2024. Health Information: Jurnal Penelitian, 17(2), 207-219.
- Susanti, S., Puspita, Y., & Sari, W. I. P. E. (2025). Hubungan Perilaku Merokok Orang Tua Terhadap Kejadian ARI Pada Balita. Journal of Nursing and Public Health, 13(1), 51-58.
- Susilawaty, A., Sudaryanto, S., Aulia, S. S., Aulia, R., Fitria, R., Prisusanti, R. D., & Aini, S. (2022). Epidemiologi Lingkungan. Get Press.
- Syafitri, R. (2025). Hubungan Kondisi Fisik Lingkungan Rumah dengan Kejadian ARI pada Balita di Kelurahan Pijorkoling Kecamatan Padangsidempuan Tenggara Tahun 2024. Jurnal Kebidanan Darmas (Jkd), 3(1), 30-39.
- UNICEF. (2024). UNICEF Annual Report 2023 . Retrieved from: <https://www.unicef.org/reports/unicef-annual-report-2023>
- World Health Organization. (2020). Severe Acute Respiratory Infections Treatment Centre. Retrieved from: <https://iris.who.int/server/api/core/bitstreams/9270cf67-1805-4e29-a237-5a1c3e72d2d5/content>

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