Analysis of Physical Housing Environmental Factors on the Incidence of Acute Respiratory Infection (ARI) in the Working Area of Public Health Centers in Sarolangun Regency

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Abstract
Introduction: *The physical condition of the home environment is one of the factors that can influence the health of household occupants, particularly the occurrence of Acute Respiratory Infection (ARI). Ventilation, lighting, humidity, and indoor temperature that do not meet health standards can increase the risk of respiratory disorders.* ***Objective:*** *This study aims to analyze the relationship between physical housing environmental factors and the incidence of ARI in the working area of Public Health Centers in Sarolangun Regency.* ***Method:*** *This study used a quantitative approach with an observational cross-sectional design. The study population consisted of all ARI patients recorded in four Public Health Center working areas in Sarolangun Regency totaling 7,251 cases. The sample consisted of 379 respondents determined using the Slovin formula with a cluster sampling technique. Data were collected through observation of the physical condition of houses and environmental measurements using a lux meter, measuring tape, and a digital thermometer equipped with a hygrometer. Data analysis was conducted through univariate analysis, bivariate analysis using the Chi-Square test, and multivariate analysis using logistic regression.* ***Results and Discussion:*** *The results showed that bedroom ventilation, house lighting, humidity, and indoor temperature had a significant relationship with the incidence of ARI (p-value < 0.05). Multivariate analysis showed that humidity was the most dominant factor influencing the incidence of ARI with an odds ratio value of 7.107.* ***Conclusion:*** *Physical housing environmental factors are associated with the incidence of ARI in the working area of Public Health Centers in Sarolangun Regency, with household humidity as the most dominant factor influencing the incidence of ARI.*

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Introduction

Acute Respiratory Infection (ARI) is one of the public health problems that remains a major concern in many countries, especially in developing countries (Embisa & Ukratalo, 2025). ARI is an acute infection that affects both the upper and lower respiratory tracts and can be caused by various microorganisms such as viruses, bacteria, and fungi (Liu, Yanuarsyah, & Fatimah, 2025); (Dorawati, Herawati, & Fauziah, 2021); (Putri, Mulyanti, & Umayah, 2022). This disease can affect all age groups; however, vulnerable groups such as infants and toddlers have a higher risk because their immune systems have not yet developed optimally (Amalia et al., 2024). ARI remains one of the leading causes of morbidity and mortality due to infectious diseases. This disease is also a major cause of outpatient visits and hospitalizations in health service facilities, particularly among children under five years old (toddlers) (Afriani, 2020); (Suhada, Novianus, & Wilti, 2023). The high incidence of ARI indicates that this disease is still a serious challenge for public health systems in many countries.

ARI in Indonesia is also still one of the diseases with a high prevalence. Several reports indicate that ARI is a major cause of mortality among toddlers and is one of the most frequently found diseases in health service facilities. The high incidence of ARI is influenced by various factors, including environmental conditions, individual health status, and community behavior. Jambi Province is one of the regions in Indonesia that still faces a high number of ARI cases. Data show that ARI consistently ranks first among the ten most common diseases recorded in health service facilities. A similar condition also occurs in Sarolangun Regency, where ARI cases have continuously ranked first among the ten most common diseases during the period from 2020 to 2024. This indicates that ARI remains an important health problem that needs to be addressed in the region.

One of the factors contributing to the occurrence of ARI is the physical condition of the home environment (Jeni, Syamsul, & Wijaya, 2022). A home environment that does not meet health standards can increase the risk of environmentally based diseases, including respiratory infections. Several home environmental conditions that may influence the occurrence of ARI include inadequate ventilation, insufficient natural lighting, inappropriate indoor temperature, and high levels of air humidity (Rafaditya, Saptanto, & Ratnaningrum, 2022); (Reja, Nababan, Silitonga, & Manurung, 2022). These conditions can affect indoor air quality and create an environment that supports the growth of pathogenic microorganisms. Several previous studies have shown a relationship between the physical condition of the home environment and the occurrence of ARI. Inadequate ventilation can hinder air circulation, thereby increasing the concentration of microorganisms indoors. Poor lighting and high air humidity can create environmental conditions that support the growth of microorganisms causing respiratory diseases (Ernawati, Dwimawati, & Parinduri, 2022); (Wardani & Astuti, 2022)

Although various studies have examined the relationship between home environmental conditions and the occurrence of ARI, research specifically investigating physical housing environmental factors in Sarolangun Regency is still limited. Considering the high incidence of ARI in this region, a more in-depth study is needed to identify the home environmental factors that contribute to the occurrence of ARI in the community. This study aims to analyze the relationship between physical housing environmental factors including ventilation, lighting, humidity, and indoor temperature and the incidence of Acute Respiratory Infection (ARI) in the working area of Public Health Centers in Sarolangun Regency. The results of this study are expected to provide

useful scientific information for ARI prevention efforts and support the improvement of healthier home environmental conditions for the community.

Method

This study used a quantitative approach supported by qualitative data to analyze the relationship between physical housing environmental factors and the incidence of Acute Respiratory Infection (ARI). The research design used was observational with a cross-sectional approach, where the collection of independent and dependent variable data was conducted at the same time. The study was conducted in four Public Health Center working areas in Sarolangun Regency that had the highest number of ARI cases, namely Cermin Nan Gedang Public Health Center, Pulau Pandan Public Health Center, Pelawan Public Health Center, and Singkut V Public Health Center.

The study population consisted of all ARI patients recorded in the four Public Health Center working areas, totaling 7,251 cases. The sample size was determined using the Slovin formula with a 5% margin of error, resulting in 379 respondents. The sampling technique used cluster sampling based on the Public Health Center working areas. The independent variables in this study included bedroom ventilation, lighting, air humidity, and indoor temperature, while the dependent variable was the incidence of ARI. Primary data were obtained through observation of the physical condition of houses and environmental measurements using measuring tape, a lux meter, and a digital thermometer equipped with a hygrometer. Secondary data were obtained from medical record data of ARI cases at the Public Health Centers. Data analysis was conducted through univariate, bivariate, and multivariate analyses. Univariate analysis was used to describe the distribution of research variables. Bivariate analysis was conducted using the Chi-Square test with a significance level of $p \leq 0.05$ to determine the relationship between variables. Multivariate analysis used logistic regression to determine the most dominant factor influencing the incidence of ARI.

Result and Discussion
1. Result
Distribution of Respondents Based on Research Variables

The distribution of respondents based on the physical condition of the home environment provides an initial overview of the environmental conditions of the residential areas where the study was conducted. Housing environmental conditions including ventilation, lighting, humidity, and indoor temperature can affect indoor air quality and potentially influence the health of the occupants. Therefore, it is important to understand the distribution of the physical housing environmental conditions of respondents in this study. The distribution of respondents based on research variables can be seen in Table 1 below

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Table 1
Distribution of Respondents Based on Research Variables

Variable	Category	ARI	Non-ARI	Total	%
Bedroom Ventilation	Not eligible	111	82	193	50.9
	Eligible	61	125	186	49.1
Lighting	Not eligible	112	71	183	48.3
	Eligible	60	136	196	51.7
Humidity	Not eligible	136	83	219	57.8
	Eligible	36	124	160	42.2
Indoor Temperature	Not eligible	90	86	176	46.4
	Eligible	82	121	203	53.6

Source: Primary data processed, 2026

Based on Table 1, it can be seen that out of a total of 379 respondents, 172 respondents (45.4%) experienced ARI and 207 respondents (54.6%) did not experience ARI. In the bedroom ventilation variable, most respondents' houses had ventilation that did not meet the requirements, totaling 193 houses (50.9%), while those that met the requirements were 186 houses (49.1%). In the lighting variable, most respondents' houses had lighting that met the requirements, totaling 196 houses (51.7%), while those that did not meet the requirements were 183 houses (48.3%). In the humidity variable, most respondents' houses had humidity levels that did not meet the requirements, totaling 219 houses (57.8%). In the indoor temperature variable, most respondents' houses had temperature conditions that met the requirements, totaling 203 houses (53.6%), while those that did not meet the requirements were 176 houses (46.4%).

Relationship Between Bedroom Ventilation and the Incidence of ARI
Table 2
Relationship Between Bedroom Ventilation and the Incidence of ARI

Bedroom Ventilation	ARI Incidence				Total		P-Value	OR (95%C)
	ARI		Non-ARI					
	N	%	n	%	N	%		
Not eligible	111	57.5	82	42.5	193	100		2.774
Eligible	61	32.8	125	67.2	186	100	0.000	(1.825-
Total	**172**	**45.4**	**207**	**54.6**	**72**	**100**		4.216)

Source: Primary data processed, 2026

Based on Table 2, it can be seen that out of 193 houses with ventilation that did not meet the requirements, 111 respondents (57.5%) experienced ARI and 82 respondents (42.5%) did not experience ARI. Meanwhile, among the 186 houses with ventilation that met the requirements, 61 respondents (32.8%) experienced ARI and 125 respondents (67.2%) did not experience ARI. The results of the statistical test using the Chi-Square test showed a p-value of 0.000 (p < 0.05), indicating a significant relationship between bedroom ventilation and the incidence of ARI. The Odds Ratio (OR) value of 2.774 indicates that respondents living in houses with ventilation that did not meet the requirements had a 2.7 times higher risk of experiencing ARI compared to respondents living in houses with ventilation that met the requirements.

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Relationship Between House Lighting and the Incidence of ARI

Table 3

Relationship Between House Lighting and the Incidence of ARI

Lighting	ARI Incidence				Total		P-Value	OR (95%C)
	ARI		Non-ARI					
	N	%	n	%	n	%		
Not eligible	112	61.2	71	38.8	183	100		3.576
Eligible	60	30.6	136	69.4	196	100	0.000	(2.337-
Total	172	45.4	207	54.6	379	100		5.469

Source: Primary data processed, 2026

Based on Table 3, it can be seen that out of 183 houses with lighting that did not meet the requirements, 112 respondents (61.2%) experienced ARI and 71 respondents (38.8%) did not experience ARI. Meanwhile, among the 196 houses with lighting that met the requirements, 60 respondents (30.6%) experienced ARI and 136 respondents (69.4%) did not experience ARI. The results of the statistical test using the Chi-Square test showed a p-value of 0.000 ($p < 0.05$), indicating a significant relationship between house lighting and the incidence of ARI. The Odds Ratio (OR) value of 3.576 indicates that respondents living in houses with lighting that did not meet the requirements had a 3.5 times higher risk of experiencing ARI compared to respondents living in houses with lighting that met the requirements.

Relationship Between House Humidity and the Incidence of ARI

Table 4

Relationship Between House Humidity and the Incidence of ARI

Humidity	ARI Incidence				Total		P-Value	OR (95%C)
	ARI		Non-ARI					
	N	%	n	%	n	%		
Not eligible	136	62.1	83	37.9	219	100		5.644
Eligible	36	22.5	124	77.5	160	100	0.000	(3.561-
Total	172	45.4	207	54.6	379	100		8.946)

Source: Primary data processed, 2026

Based on Table 4, it can be seen that out of 219 houses with humidity levels that did not meet the requirements, 136 respondents (62.1%) experienced ARI and 83 respondents (37.9%) did not experience ARI. Meanwhile, among the 160 houses with humidity levels that met the requirements, 36 respondents (22.5%) experienced ARI and 124 respondents (77.5%) did not experience ARI. The results of the statistical test using the Chi-Square test showed a p-value of 0.000 ($p < 0.05$), indicating a significant relationship between house humidity and the incidence of ARI. The Odds Ratio (OR) value of 5.644 indicates that respondents living in houses with humidity levels that did not meet the requirements had a 5.6 times higher risk of experiencing ARI compared to respondents living in houses with humidity levels that met the requirements

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Relationship Between Indoor Temperature and the Incidence of ARI
Table 5
Relationship Between Indoor Temperature and the Incidence of ARI

Temperature	ARI Incidence				Total		P-Value	OR (95%C)
	ARI		Non-ARI					
	N	%	N	%	n	%		
Not eligible	90	51.1	86	48.9	176	100		1.544
Eligible	82	40.4	121	59.6	203	100	0.046	(1.028-
Total	172	45.4	207	54.6	379	100		2.321)

Source: Primary data processed, 2026

Based on Table 5, it can be seen that out of 176 houses with indoor temperature that did not meet the requirements, 90 respondents (51.1%) experienced ARI and 86 respondents (48.9%) did not experience ARI. Meanwhile, among the 203 houses with indoor temperature that met the requirements, 82 respondents (40.4%) experienced ARI and 121 respondents (59.6%) did not experience ARI. The results of the statistical test using the Chi-Square test showed a p-value of 0.046 ($p < 0.05$), indicating a significant relationship between indoor temperature and the incidence of ARI. The Odds Ratio (OR) value of 1.544 indicates that respondents living in houses with indoor temperature that did not meet the requirements had a 1.5 times higher risk of experiencing ARI compared to respondents living in houses with indoor temperature that met the requirements.

Analysis of the Dominant Factors Influencing the Incidence of ARI
Table 6
Multivariate Analysis of Physical Housing Environmental Factors on the Incidence of ARI

Relationship of Variables with ARI	P-value	PR	Description
Humidity	0.000	7.107	Significant relationship
Lighting	0.000	5.313	Significant relationship
Ventilation	0.000	3.917	Significant relationship
Temperature	0.046	1.734	Significant relationship

Source: Primary data processed, 2026

Based on Table 6, it can be seen that all physical housing environmental variables studied have a significant relationship with the incidence of ARI. This is indicated by the p-value < 0.05 for each variable, namely humidity (0.000), lighting (0.000), ventilation (0.000), and temperature (0.046). From the analysis results, humidity is the most dominant factor influencing the incidence of ARI, with a PR value of 7.107, followed by lighting (PR = 5.313), ventilation (PR = 3.917), and temperature (PR = 1.734).

2. Discussion
Distribution of Respondents Based on Research Variables

The distribution of respondents based on physical housing environmental conditions shows that a substantial proportion of homes still do not meet health standards in terms of ventilation and humidity. This condition reflects the general housing situation in developing areas where infrastructure improvements are ongoing yet uneven. Although improvements to the physical housing environment — such as through community infrastructure programs — are assumed to have a positive impact on residents' health, the

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environmental indicators used in this study (ventilation area ratio, lux levels for lighting, percentage relative humidity, and thermometer-based indoor temperature) may not fully capture the subjective or behavioral dimensions of the home environment experienced by occupants. This limitation is important to acknowledge when interpreting the distribution findings. The high proportion of non-compliant humidity (57.8%) and ventilation (50.9%) reflects structural housing challenges commonly found in tropical regions. Houses with good ventilation, adequate lighting, and appropriate humidity and temperature levels can help maintain indoor air quality and reduce the risk of respiratory infections. A healthy home environment can also inhibit the growth of disease-causing microorganisms and support the creation of healthier living conditions for the community.

Relationship Between Bedroom Ventilation and the Incidence of ARI

Proper ventilation functions to maintain indoor air quality through the exchange of air between indoor air and outdoor air. Inadequate ventilation can cause indoor air to become stuffy and increase the concentration of air pollutants and disease-causing microorganisms. These conditions can increase the risk of respiratory infections among household occupants (Ministry of Health of the Republic of Indonesia, 2021). This finding is consistent with the opinion of Sari and Rahmawati (2021), who stated that house ventilation has a significant relationship with the incidence of ARI in the community. The study showed that houses with ventilation that do not meet health standards have a higher risk of respiratory diseases. Inadequate ventilation can cause poor air circulation inside the house, which facilitates the accumulation of disease-causing microorganisms.

Relationship Between House Lighting and the Incidence of ARI

Natural lighting from sunlight plays an important role in maintaining the health of the home environment. Sunlight can help kill various pathogenic microorganisms such as bacteria and viruses that can cause disease. Houses with adequate lighting can also reduce air humidity so that the environmental conditions become healthier for the occupants (Ministry of Health of the Republic of Indonesia, 2021). This finding is consistent with the opinion of Widianti (2020), who stated that house lighting conditions have a significant relationship with the incidence of respiratory infections. Houses with inadequate lighting tend to have more humid room conditions, which facilitate the growth of disease-causing microorganisms.

Relationship Between House Humidity and the Incidence of ARI

Indoor air humidity has a significant influence on the quality of the residential environment. High humidity levels can increase the survival of various pathogenic microorganisms and accelerate the growth of fungi indoors. These conditions can increase the risk of respiratory health problems among house occupants. This finding is consistent with the opinion of Lasari et al. (2020), who stated that house humidity has a significant relationship with the incidence of acute respiratory infections. Houses with high humidity levels can create environmental conditions that support the growth of disease-causing microorganisms, thereby increasing the risk of health problems among occupants.

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Relationship Between Indoor Temperature and the Incidence of ARI

Indoor temperature has an influence on the quality of the home environment. Inappropriate temperature can affect air humidity and the comfort of the occupants. Temperature conditions that are too high or too low can also influence the survival of pathogenic microorganisms that may trigger respiratory infections. According to Hartono (2023), indoor temperature has a relationship with the incidence of respiratory diseases in the community. Home environments with inappropriate temperature conditions can affect indoor air quality and increase the risk of respiratory health problems.

However, it is noteworthy that among the four physical housing environmental factors examined, indoor temperature showed the weakest association with the incidence of ARI, as reflected by the lowest OR value (1.544) in the bivariate analysis and the lowest PR value (1.734) in the multivariate analysis. There are at least two possible explanations for this relatively modest effect. First, the indicator used to measure indoor temperature — a standard thermometer reading — may be less sensitive to the dynamic fluctuations in temperature that residents actually experience throughout the day and night. The measurement may not adequately reflect exposure duration or the interaction between temperature and other environmental factors such as humidity. Second, it is also possible that indoor temperature, while statistically significant, represents a less modifiable or less perceived risk factor in the daily lives of community members compared to conditions such as humidity and lighting, which are more visibly associated with dampness and poor air quality in residential environments in tropical climates.

Analysis of the Dominant Factors Influencing the Incidence of ARI

The multivariate analysis confirmed that humidity is the most dominant physical housing environmental factor associated with the incidence of ARI (PR = 7.107), followed by lighting (PR = 5.313), ventilation (PR = 3.917), and indoor temperature (PR = 1.734). High indoor humidity can increase the survival of various pathogenic microorganisms such as bacteria, viruses, and fungi. Damp environmental conditions can also cause poor indoor air quality, thereby increasing the risk of respiratory health problems among household occupants. According to Lasari et al. (2020), house humidity has a significant relationship with the incidence of acute respiratory infections. Damp home environmental conditions can increase exposure to microorganisms indoors and affect indoor air quality. Controlling house humidity through proper ventilation, adequate lighting, and improvement of housing conditions is an important step in preventing ARI in the community.

The dominance of humidity and lighting over temperature in the multivariate model may partly be explained by the nature of the indicators used. While ventilation, lighting, and humidity are each measured using parameters that directly reflect conditions known to support microbial growth — such as air exchange rates, lux levels, and relative humidity percentages — the indoor temperature indicator captures only a single-point thermometer reading. This measurement approach may not be sensitive enough to detect the nuanced contribution of temperature to respiratory infection risk, particularly in a tropical climate where temperature variation between houses is relatively small compared to variation in humidity. Additionally, it should be considered whether the physical environmental indicators employed in this study comprehensively represent the full range of housing conditions that contribute to ARI. Future studies may benefit from incorporating subjective indicators — such as residents' perceptions of indoor air quality,

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thermal comfort, and dampness — alongside objective physical measurements. Such an approach would provide a more complete understanding of the pathways through which housing conditions influence respiratory health, particularly in communities where infrastructure improvements are underway but residents' behavioral and socioeconomic circumstances also play a significant role

Conclusion

Based on the results of the study regarding the analysis of physical housing environmental factors on the incidence of Acute Respiratory Infection (ARI) in the working area of Public Health Centers in Sarolangun Regency, it can be concluded that many respondents' home environmental conditions still do not meet health requirements. Physical housing environmental factors that did not meet the requirements include bedroom ventilation at 50.9%, lighting at 48.3%, humidity at 57.8%, and indoor temperature at 46.4%. Meanwhile, physical housing environmental conditions that met the requirements were bedroom ventilation at 49.1%, lighting at 51.7%, humidity at 42.2%, and indoor temperature at 53.6%. The results of statistical analysis showed that all physical housing environmental variables studied had a significant relationship with the incidence of ARI in the working area of Public Health Centers in Sarolangun Regency. The bedroom ventilation variable had a p-value of 0.000 ($p < 0.05$), lighting had a p-value of 0.000 ($p < 0.05$), humidity had a p-value of 0.000 ($p < 0.05$), and indoor temperature had a p-value of 0.046 ($p < 0.05$). This indicates that ventilation, lighting, humidity, and indoor temperature conditions in the house influence the incidence of ARI in the community.

Based on the results of the multivariate analysis, it was found that humidity is the most dominant factor influencing the incidence of ARI in the working area of Public Health Centers in Sarolangun Regency with an odds ratio value of 7.107. This indicates that houses with humidity conditions that do not meet the requirements have approximately seven times greater risk of experiencing ARI compared to houses with humidity conditions that meet health standards.

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