International Journal of Health, Economics, and Social Sciences (IJHESS)
Vol. 7, No. 4, October 2025, pp. 1702~1710
DOI: 10.56338/ijhess.v7i4.8677
Website: https://jurnal.unismuhpalu.ac.id/index.php/IJHESS

# The Relationship Between Physical Environmental Factors in the Home and the Incidence of Respiratory Infections in Children in Pasar Simundol Village

**Indah Rahayu Ritonga[1]*, Yulia Khairina Ashar[2], Syafran Arrazy[3], Rapotan Hasibuan[4], Jufri Naldo[5]**
[1,2,3,4,5] Universitas Islam Negeri Sumatera Utara, Indonesia

**Article Info**

***Article history:***

Received 17 Jul, 2025
Revised 15 Sep, 2025
Accepted 09 Oct, 2025

***Keywords:***

Toddlers, Acute Respiratory Infection, Physical Housing Conditions, Environment

**ABSTRACT**

Acute respiratory infections (ARI) in toddlers remain an urgent health issue in Indonesia because toddlers are susceptible to infection due to their immature immune systems. The physical environment of the home plays a major role as a risk factor, especially in homes with poor ventilation, minimal lighting, high humidity, and inadequate sanitation. The objective of this study is to determine the relationship between housing density, the presence of ventilation, the presence of windows, lighting, and temperature with the incidence of ISPA in infants in Pasar Simundol Village. The research method used is quantitative with a cross-sectional design. The sample size in this study is 55 infants, calculated using the Lameshow formula. Data analysis was performed using univariate and bivariate analysis with the chi-square test. The results of the study showed a relationship between the presence of windows (PR = 1.697; p = 0.019 < 0.05), the presence of ventilation (PR = 1.080; p = 0.030 < 0.05), lighting (PR = 1.753; 0.011 < 0.05), temperature (PR = 1.733; p = 0.012 < 0.05), and humidity (PR = 1.853; p = 0.026), while there was no association with housing density (PR = 1.175; p = 0.832 > 0.05). It is recommended that the community improve the physical conditions of their homes, such as adding ventilation, windows, and maintaining cleanliness and lighting to reduce the risk of respiratory infections in infants.

***Corresponding Author:***
Indah Rahayu Ritonga
Universitas Islam Negeri Sumatera Utara, Indonesia
*Corresponding Author: indahrahayu65416@gmail.com

## INTRODUCTION

Health problems that often arise in toddlers are acute respiratory infections (ARI). According to the Ministry of Health (2023), ARI is an acute infectious disease that attacks one or more parts of the respiratory tract, from the nose (upper tract) to the alveoli (lower tract), including adjacent tissues such as the sinuses, middle ear cavity, and pleura. ARI is the leading cause of death among toddlers and often ranks first in terms of morbidity among toddlers (profil kesehatan indonesia, 2018),

Early treatment of respiratory tract infections has been proven to reduce mortality. One cause of death from respiratory tract infections is pneumonia, which is caused by infection with Streptococcus pneumoniae or Haemophilus influenzae. Many deaths from pneumonia occur at home, including after several days of illness (Rahmadanti & Darmawansyah Alnur, 2023).

ARI is the leading cause of morbidity and mortality from infectious diseases worldwide. Nearly four million people die from ARI each year, 98% of which are caused by lower respiratory tract infections. Mortality rates are particularly high among infants, children, and the elderly, especially in low- and middle-income countries. ARI is one of the leading causes of consultation or hospitalization in health care facilities, especially in pediatric wards (Garmini & Purwana, 2020).

The World Health Organization (WHO) reports that the incidence of infant mortality due to acute respiratory infections (ARI) in developing countries is 15-20% per year in the under-5 age group (Daka,

Aryastuti, Dwi Nuryani, et al., 2024). The WHO estimates that approximately 13 million children worldwide die each year from ARI, with the majority of these deaths occurring in developing countries (Daka, Aryastuti, Nuryani, et al., 2024). The incidence of ARI in developing countries is 2-10 times higher than in developed countries. This difference is related to etiology and risk factors (Khoiriyah & Ismarwati, 2023).

Indonesia ranks second in the world for the number of respiratory tract infections in toddlers after India (Rane et al., 2024). The number of acute respiratory infection (ARI) cases in Indonesia in 2023 reached 877,531 cases. In Indonesia, ARI occurs throughout the year, but at the beginning, middle, and end of the year, there is usually an increase due to the rainy season and seasonal changes. Based on the 2024 routine ARI report in Indonesia, the ARI trend does not show a significant increase in cases.

Previous research conducted by (Giroth et al., 2022) showed a value of $p=0.003 < \alpha=0.05$, which means that there is a relationship between nutritional status and the incidence of ARI in toddlers at the Tompaso Community Health Center in Minahasa Regency (Giroth et al., 2022). Another study conducted by (Fahrial, 2018) found a p-value of $0.001 < \alpha=0.05$, meaning that there is a relationship between nutritional status and the incidence of ARI in toddlers. Research conducted by (Yusridawati & Tanjung, 2021) showed a p-value of $0.03 < 0.05$, indicating a relationship between nutritional status and the incidence of acute respiratory infections (ARI) in toddlers at the Batang Kuis Community Health Center in Deli Serdang Regency in 2020. Based on the researchers' analysis, poor nutritional status and infectious diseases are closely related (Daka, Aryastuti, Nuryani, et al., 2024). Nutrition is very important for growth, development, and maintenance of bodily functions. Without adequate nutrition, the body will be susceptible to diseases, one of which is respiratory tract infection.

Based on data obtained from the North Sumatra Provincial Statistics Agency (BPS), in 2022, there are an estimated 25,983 cases of ARI in toddlers in North Sumatra. This figure reflects the high burden of ARI among infants in various districts and cities in North Sumatra, which can be influenced by various factors, including air quality, population density, and access to health services. ARI itself is a significant public health problem, especially in areas with high levels of air pollution and environmental conditions that are not conducive to respiratory health.

The physical environment of the home is one of the factors associated with ARI. A physical environment that does not meet health standards can be a risk factor for the transmission of environment-based diseases. This has an impact on the health of toddlers who are vulnerable to disease. In rural areas, this can also contribute to the incidence of ARI. This is because in villages, many houses still have dirt floors, inadequate ventilation, wooden walls, and lack of smoke vents in the kitchen.

Based on data from the Pasar Simundol Community Health Center, cases of acute respiratory infections (ARI) in the last five years have fluctuated significantly, from 209 cases in 2019 to 280 cases in 2020 due to factors such as air quality, lifestyle, and the impact of COVID-19. then decreased to 215 cases in 2021 and 99 cases in 2022 thanks to the implementation of health protocols, increased public awareness, access to health services, environmental improvements, and vaccination. However, in 2024, cases rose again to 279 due to unsuitable physical conditions in homes, such as lighting, temperature, humidity, ventilation, and windows, with 130 of these cases originating from Pasar Simundol Village. These fluctuations in ARI cases highlight the importance of continuous efforts in the prevention and treatment of infectious diseases, especially in areas with high levels of pollution exposure. More intensive health interventions are needed, including public education on ARI risk factors, improved access to health services, and strengthened environmental health programs to reduce the incidence of ARI in the future.

Based on the above description, the author is interested in conducting research in the form of a thesis entitled: “Factors related to the incidence of respiratory tract infections in the Pasar Simundol Village area.”

## RESEARCH METHOD

This study used a quantitative method with a cross-sectional approach conducted in the Pasar Simundol Village area, located in North Padang Lawas Regency. The population of this study included all mothers with toddlers, with a total of 165 toddlers spread across the Pasar Simundol Village area, North Padang Lawas Regency. Sampling was conducted using the Lameshow formula, resulting in 55 toddlers being sampled in this study. The sampling technique used was simple random sampling. The variables in this study were independent variables (housing density, presence of ventilation, presence of windows, lighting, temperature, and humidity) and dependent variables (incidence of ARI).

This research instrument uses a questionnaire and then uses a lux meter to measure lighting, a thermohygrometer to measure temperature and humidity, and a meter to measure ventilation and occupancy density. Data collection uses primary data obtained directly from the first source through research methods such as observation, interviews, and questionnaires, then secondary data obtained from existing sources. Data analysis uses univariate and bivariate analysis with the chi-square test.

## RESULT

### Characteristics of Respondents: Mothers of Toddlers

**Table 1.** Characteristics of Respondents: Mothers of Toddlers

| Characteristics of Respondents | Frequency (f) | Percentage (%) |
|---|---|---|
| Usia | | |
| 21 – 30 Tahun | 26 | 47,3 |
| 31 – 40 Tahun | 20 | 36,4 |
| 41 – 50 Tahun | 9 | 16,4 |
| Highest Level of Education | | |
| Unfinished | 6 | 10,9 |
| Elementary School | 4 | 7,3 |
| Junior High School | 15 | 27,3 |
| High School | 17 | 30,9 |
| Higher education institution | 13 | 23,6 |
| Mother Empleyment Status | | |
| Housewife | 28 | 50,9 |
| Merchant | 9 | 16,4 |
| Entrepreneur | 3 | 5,5 |
| Civil Servant | 10 | 18,2 |
| Pharmacist | 5 | 9,1 |
| Total | 55 | 100,0 |

Based on the characteristics of the respondents, it was found that the majority of respondents were aged 21–30 years old, totaling 26 people (47.3%), followed by those aged 31–40 years old, totaling 20 people (36.4%), and those aged 41–50 years old, totaling 9 people (16.4%). Based on their highest level of education, most respondents had a high school education, numbering 17 people (30.9%), followed by junior high school education, numbering 15 people (27.3%), while the rest had a vocational high school education, numbering 13 people (23.6%), did not complete school, numbering 6 people (10.9%), and had an elementary school education, numbering 4 people (7.3%). Meanwhile, based on employment status, the majority of respondents were housewives, totaling 28 people (50.9%), followed by civil servants, totaling 10 people (18.2%), traders, totaling 9 people (16.4%), pharmacists, totaling 5 people (9.1%), and entrepreneurs, totaling 3 people (5.5%).

### Characteristics of Toddler Respondents

Table 2. Characteristics of Toddler Respondents

| Characteristics of Toddler Respondents | Frekuency (f) | Percentage (%) |
|---|---|---|
| Gender | | |
| Man | 31 | 56,4 |
| Woman | 24 | 43,6 |
| Age | | |
| 1 – 3 Years | 37 | 56,4 |
| 4 – 5 Years | 18 | 43,6 |
| Total | 55 | 100,0 |

Based on the characteristics of toddlers, it is known that the majority of toddlers are male, numbering 31 (56.4%), while female toddlers number 24 (43.6%). Based on age group, most of the toddlers were aged 1–3 years, numbering 37 (56.4%), while toddlers aged 4–5 years numbered 18 (43.6%). This data shows that the toddler respondents were dominated by males and the 1–3 age group.

### Univariate Analysis

**Table 3.** Univariate Analysis, Frequency Distribution of ARI Incidence in Toddlers and the Physical Environment of the Home

| Variable | Frekuency (f) | Percentage (%) |
|---|---|---|
| Incidence of acute respiratory infections | | |
| Yes | **36** | **65,6** |
| Not | **19** | **34,5** |
| Housing Density | | |

| | | |
|---|---|---|
| Not Eligible | 8 | 14,5 |
| Eligible | 47 | 85,5 |
| The Existence of Windows | | |
| Not Eligible | 15 | 27,3 |
| Eligible | 40 | 72,7 |
| The Existence of Ventilation | | |
| Not Eligible | 27 | 49,1 |
| Eligible | 28 | 50,9 |
| Lighting | | |
| Not Eligible | 26 | 47,3 |
| Eligible | 29 | 52,7 |
| Temperature | | |
| Not Eligible | 33 | 60,0 |
| Eligble | 22 | 40,0 |
| Humidity | | |
| Not Eligible | 38 | 69,1 |
| Eligible | 17 | 30,9 |
| Total | 55 | 100,0 |

Based on the results of the study, it was found that most toddlers experienced ARI, namely 36 children (65.6%), while 19 children (34.5%) did not experience ARI. The condition of the respondents' homes showed that the majority of them met the housing density requirements, namely 47 homes (85.5%), while only 8 homes (14.5%) did not meet the requirements. The presence of windows in the respondents' homes generally met the requirements in 40 houses (72.7%), while 15 houses (27.3%) did not meet the requirements. For ventilation, 28 houses (50.9%) met the requirements and 27 houses (49.1%) did not meet the requirements. Lighting conditions mostly met the requirements in 29 houses (52.7%) and did not meet the requirements in 26 houses (47.3%). The temperature of the respondents' homes was mostly not eligible, with 33 homes (60.0%) not meeting the criteria, while 22 homes (40.0%) met the criteria. Humidity was also mostly not eligible, with 38 homes (69.1%) not meeting the criteria, and 17 homes (30.9%) meeting the criteria.

**Bivariate Analysis**

**Table 4.** Bivariate Analysis, Relationship between Physical Environmental Conditions of the Home and Incidence of Respiratory Infections in Toddlers

| **Physical Environment of the Home** | **Incidence ARI** | | | | **Total** | | ***P-Value*** | **PR (95%CI)** |
|---|---|---|---|---|---|---|---|---|
| | Yes | | Not | | | | | |
| | n | % | n | % | N | % | | |
| **Housing Density** | | | | | | | | |
| Not Eligible | 6 | 75,0 | 2 | 25,0 | 8 | 100,0 | 0,832 | 1,175 (0,746 – 1,851) |
| Eligible | 30 | 63,8 | 17 | 36,2 | 47 | 100,0 | | |
| **The Existence of Windows** | | | | | | | | |
| Not Eligible | 14 | 93,3 | 1 | 6,7 | 15 | 100,0 | 0,019 | 1,697 (1,243 – 2,317) |
| Eligible | 22 | 18 | 18 | 45,0 | 40 | 100,0 | | |
| **The Existence of Ventilation** | | | | | | | | |
| Not Eligible | 22 | 81,5 | 5 | 18,5 | 27 | 100,0 | 0,030 | 1,630 (1,080 – 2,460) |
| Eligible | 13 | 50,0 | 14 | 50,0 | 28 | 100,0 | | |
| **Lighting** | | | | | | | | |
| Not Eligible | 22 | 84,6 | 4 | 15,4 | 26 | 100,0 | 0,011 | 1,753 (1,162 – 2,643) |
| Eligible | 14 | 48,3 | 15 | 51,7 | 29 | 100,0 | | |
| **Temperature** | | | | | | | | |
| Not Eligible | 26 | 78,8 | 7 | 21,2 | 33 | 100,0 | 0,024 | 1,733 (1,061 – 2,834) |
| Eligible | 10 | 45,5 | 12 | 54,5 | 22 | 100,0 | | |
| **Humidity** | | | | | | | | |
| Eligible | 29 | 76,3 | 9 | 23,7 | 26 | 100,0 | 0,026 | 1,853 (1,022 – 3,361) |
| Not Eligible | 7 | 41,2 | 10 | 58,8 | 29 | 100,0 | | |
| Total | 36 | 65,5 | 19 | 34,5 | 55 | 100,0 | | |

Based on the analysis, housing density did not show a significant association with the incidence of ARI in this sample (p = 0.832; PR = 1.175; 95% CI 0.746–1.851), meaning that there was no evidence that the prevalence of ARI differed between houses with qualifying and non-qualifying densities. In contrast, several physical aspects of the home showed a significant relationship with the prevalence of ARI: homes that did not meet the requirement for windows had an ARI prevalence approximately 1.70 times higher than those that met the requirement (p = 0.019; PR = 1.697; 95% CI 1.243–2.317); inadequate ventilation was associated with a prevalence approximately 1.63 times higher (p = 0.030; PR = 1.630; 95% CI 1.080–2.460); inadequate lighting was associated with a prevalence approximately 1.75 times higher (p = 0.011; PR = 1.753; 95% CI 1.162–2.643); inappropriate temperature was associated with a prevalence approximately 1.73 times higher (p = 0.024; PR = 1.733; 95% CI 1.061–2.834); and inadequate humidity was associated with a prevalence approximately 1.85 times higher (p = 0.026; PR = 1.853; 95% CI 1.022–3.361).

## DISCUSSION

### The Relationship between Housing Density and the Incidence of Respiratory Infections in Toddlers

Based on the results of the study, it was found that 6 toddlers (75%) living in substandard housing density had experienced ARI and 2 toddlers (25%) had never experienced ARI, while 30 toddlers (63.8%) living in housing density that met the requirements had experienced ISPA and 17 toddlers (36.2%) had never experienced ISPA. Although the statistical test showed P = 0.832 (> 0.05), which means that the relationship between housing density and ARI is not statistically significant, the PR value = 1.175 (95% CI: 0.746–1.851) indicates that, practically speaking, toddlers in homes with substandard housing density are 1.175 times more likely to experience ARI than those in standard housing. This is in line with the findings of Zolanda et al. (2021), whose meta-analysis showed that housing density is one of the dominant environmental factors that increase the risk of ARI in toddlers (Zolanda et al., 2021).

National data and local studies in the last five years have reinforced the finding that housing density contributes to the incidence of ARI in toddlers. For example, research conducted by Suswani and Aszrul (2018) found that infants living in highly densely populated homes were 8.254 times more likely to experience ARI than those living in less densely populated homes, with a p-value of 0.001 indicating that the relationship was statistically significant (Arihta Tarigan & Heryanti, 2021).

Furthermore, a study conducted in Padang City by Hidayanti et al. (2021) also showed similar results, where an odds ratio (OR) of 21.99 with p = 0.001 was obtained. This means that housing density is a significant risk factor for ARI in toddlers in that area (Hidayati & Hasibuan, 2022).

Meanwhile, research in Bengkulu in 2021 showed that the variable of housing density was significantly associated with the incidence of ARI, with a p-value of 0.013. This confirms the importance of paying attention to housing conditions as part of the prevention of respiratory tract infections (Hidayanti et al., 2019).

Based on field observations, researchers identified several triggering factors that may contribute to ARI cases in toddlers, especially in densely populated dwellings. First, cramped rooms and poor ventilation result in suboptimal air circulation, thereby increasing exposure to microorganisms that cause infection. Second, cooking with solid fuels such as wood or charcoal indoors produces smoke that can irritate children's respiratory tracts. Third, exposure to secondhand smoke is also a risk factor, especially in enclosed and cramped spaces, although some local studies show that the relationship is not always significant.

### The Relationship Between the Presence of Windows and the Incidence of Respiratory Tract Infections

Based on the results of the study, it was found that 14 respondents (93.3%) of toddlers living in homes with windows that did not meet the requirements had experienced ARI, while 1 respondent (6.7%) had never experienced ARI. while 22 respondents (55%) of toddlers living in houses with windows that met the requirements had experienced ISPA and 18 respondents (45%) had never experienced ISPA. Statistical tests showed a P value of 0.019 (<0.05) and a Prevalence Ratio (PR) of 1.697 (95% CI: 1.243–2.317), which means that toddlers living in homes with non-compliant windows are 1.697 times more likely to experience ARI than those living in homes with compliant windows. This difference is statistically significant.

These findings are consistent with various studies conducted over the past five years. Research in Purwokerto (2021) shows that ventilation and lighting, including window quality, are significantly associated with ARI in toddlers (p = 0.019) (Rafaditya et al., 2022). A meta-analysis of 22 journals also stated that ventilation size, including windows, plays an important role in the incidence of ARI. In addition, an ecology-based study using Riskesdas (2018) found that the habit of regularly opening windows reduced the incidence of ARI (p = 0.003; r = –0.493) (Riset Kesehatan Dasar (Riskesdas), 2018).

Biologically, windows serve as one of the main ventilation routes in a home. If windows are inadequate because they are too small, closed, or cannot be opened, air exchange is hampered. As a result, the concentration of pathogens in the indoor air increases, especially when toddlers are in the room. This directly increases the risk of transmission of droplets or aerosols of diseases such as ARI. In addition, suboptimal lighting conditions, which are also related to window quality, can prolong room humidity,

creating an ideal environment for respiratory viruses and bacteria to thrive (Cholifah et al., 2020).

**The Relationship Between Ventilation and the Incidence of Respiratory Tract Infecti**

Based on the results of the study, it was found that 22 toddlers (81.5%) living in homes without proper ventilation had experienced ARI, while 5 toddlers (18.5%) had never experienced ARI. while 14 toddlers (50%) living in homes with adequate ventilation had experienced ARI and 14 toddlers (50%) had never experienced ARI. Statistical testing yielded a P-value of 0.030 (<0.05) and a Prevalence Ratio (PR) = 1.630 (95% CI: 1.080–2.460), indicating that toddlers in dwellings with inadequate ventilation have a 1.63 times greater risk of experiencing ARI than toddlers in dwellings with good ventilation. This difference is statistically significant.

This finding is reinforced by a number of studies in the last five years that show a significant relationship between home ventilation conditions and the incidence of ARI in toddlers. A study in Klapanunggal (2020) found that poor ventilation increases the risk of ARI with an odds ratio (OR) of 2.625 and a p-value of 0.003, indicating a statistically significant relationship (Arihta Tarigan & Heryanti, 2021). Meanwhile, a study in Purwokerto (2021) showed that houses with ventilation area less than 10% of the floor area had a much higher risk of ARI, with a multivariate OR of 5.594 (p = 0.015) (Rafaditya et al., 2022). Furthermore, a national meta-analysis of various studies on ARI risk factors in Indonesia (2023) also identified home ventilation as one of the dominant factors affecting ARI incidence. This was reinforced by research in Aceh Singkil (2021) which found that toddlers living in homes with poor ventilation were 13.7 times more likely to experience ARI than those living in homes with good ventilation (OR = 13.7; p = 0.001).

Ventilation serves as an important mechanism for air exchange, reducing the concentration of pathogens and humidity in a room. When ventilation is inadequate, for example in rooms without windows or with insufficient ventilation, stagnant air can trigger the accumulation of respiratory microorganisms and increase the risk of respiratory tract infections in toddlers (Astorina, 2011). Therefore, the statistically significant findings (p = 0.030) are consistent with this biological mechanism and are reinforced by empirical evidence from various studies. Implementing ventilation improvements in households with toddlers is an important strategic step in preventing ARI.

**The Relationship Between Lighting and the Incidence of Respiratory Tract Infections**

Based on the results of the study, it was found that 22 respondents (84.6%) of toddlers living in inadequate lighting conditions had experienced ARI, while 4 toddlers (15.4%) had never experienced ARI. while 14 toddlers (48.3%) living in adequate lighting conditions had experienced ISPA and 15 toddlers (51.7%) had never experienced ISPA. Statistical testing showed a P-value of 0.011 (<0.05) and a Prevalence Ratio (PR) = 1.753 (95% CI: 1.162–2.643), indicating that toddlers in homes with inadequate lighting have a 1.75 times higher risk of experiencing ARI compared to toddlers with adequate lighting.

This finding is reinforced by various studies in the last five years that show that home lighting plays an important role in the incidence of ARI in toddlers. A cross-sectional study in Purwokerto (2021) reported a significant association between home lighting and ARI incidence, with a p-value of 0.049, indicating that infants living in homes with poor lighting are at greater risk of developing ARI (Falah et al., 2023). In addition, a national study on ARI risk factors in Indonesia (2023) also confirmed that lighting is one of the main environmental determinants that influence the incidence of ARI. This is reinforced by a field survey in Tasikmalaya (2021), which found that 93.8% of homes inhabited by toddlers with ARI had inadequate lighting in the main room, making it clear that inadequate lighting can contribute significantly to an increased risk of ARI (Falah et al., 2023).

Poor natural lighting causes high humidity and poor air circulation. Damp conditions and lack of sunlight create an ideal environment for bacteria and viruses to grow on interior surfaces, as well as reducing indoor air quality (Ningrum & Ardillah, 2021). Minimal exposure to sunlight also reduces the sterilizing effect of natural UV rays, allowing pathogenic droplets or aerosols to survive longer. This biological mechanism explains why inadequate lighting can significantly increase the risk of ARI, as shown by statistical test results (P = 0.011).

Therefore, improving home lighting by installing additional windows or skylights, and maintaining cleanliness and interior design that maximizes natural light are important strategies in preventing ARI in toddlers.

**Hubungan The Relationship Between Temperature and the Incidence of Respiratory Tract Infections in Toddlers**

Based on the results of the study, it was found that 26 toddlers living in unsuitable temperatures had experienced ARI and 7 toddlers (21.2%) had never experienced ARI, while 10 toddlers (45.5%) living in suitable temperatures had experienced ARI and 12 toddlers (54.5%) had never experienced ARI. Statistical

testing yielded a P-value = 0.024 (< 0.05) and PR = 1.733 (95% CI: 1.061–2.834), indicating that toddlers living in homes with non-ideal temperatures have a 1.73 times higher risk of experiencing ARI compared to those living in homes with temperatures that meet the standard; this difference is significant.

This finding is reinforced by several previous studies. Research conducted by Nabiha PZ et al. (2023) shows that inadequate home temperatures increase the risk of ARI in toddlers by up to 2.829 times (Nabiha et al., 2023). A national meta-analysis (2022) also confirmed that temperature is a physical environmental factor consistently associated with ARI (Anggraeni, 2017). In addition, research in Pontianak (2018) found that suboptimal home temperatures significantly increased the incidence of upper respiratory tract infections in infants (Raden Hastryadi Kurniansyah & Khayan, 2020)

Indoor temperature plays a crucial role in the microclimate balance of a room. Temperatures that are too low (<18°C) can cause contraction of the respiratory tract and reduce the defense function of respiratory epithelial cells. Conversely, temperatures that are too high (>30°C) can increase humidity, creating an ideal environment for pathogens such as viruses and bacteria to survive and spread through droplets. The combination of extreme temperatures and poor ventilation worsens indoor air quality and facilitates the transmission of ARI. Thus, the significant results (P = 0.024 and PR = 1.733) can be explained by these biological mechanisms and are supported by empirical evidence from national and local studies. Therefore, any home health intervention should include temperature regulation through good building design, the use of appropriate building materials, and the adoption of passive strategies such as cross ventilation to prevent ARI in toddlers.

**The Relationship Between Humidity and the Incidence of Respiratory Tract Infections in Toddlers**

Based on the results of the study, it appears that 78.8% of toddlers living in homes with inadequate humidity experienced ARI, compared to 45.5% in the group with adequate humidity. Statistical tests show a P-value = 0.026 (<0.05) and a Prevalence Ratio (PR) = 1.853 (95% CI: 1.022–3.361), which means that toddlers living in homes with inadequate humidity are 1.85 times more likely to experience ARI than those living in homes with adequate humidity indicating a statistically significant relationship.

These findings are reinforced by a number of previous studies showing that household humidity plays a significant role in the incidence of ARI in toddlers. A study published in Health Sciences (2021) reported that substandard household humidity significantly increases the risk of ARI, with OR = 3.010 and p = 0.018. A similar study in Bengkulu (2021) also found a significant association between indoor air humidity and ARI incidence, with a p-value of 0.007. Additionally, an environmental analysis in Wirobrajan, Lampung (2024) identified humidity as one of the main physical environmental factors contributing to the increase in ARI cases among infants (Fakhrurrozi, 2013). These findings reinforce that controlling humidity inside the home is an important step in preventing ARI.

High humidity indoors can facilitate the growth of microorganisms such as viruses and fungi that cause respiratory infections, as well as increase the level of aerosol particles that carry pathogens. A humid environment also reduces the function of the respiratory defense system, inhibiting cleansing and increasing mucosal susceptibility to infection (Haryani & Misniarti, 2021). This explains why inappropriate humidity conditions can pose a higher risk and why the statistical test results show significance (P = 0.026). Therefore, interventions that target humidity improvement, such as the use of dehumidifiers after rain, cross ventilation design, and maintaining room conditions so that they are not humid, are important strategies in the prevention of ARI in toddlers.

## CONCLUSION

Based on the results of the study, it can be concluded that housing density is not associated with the incidence of ARI in toddlers (p-value 0.832; PR 1.175; 95% CI: 0.746–1.851). However, several household environmental factors show a significant association with the incidence of ARI. The presence of windows is associated with ARI cases (p-value 0.019; PR 1.697; 95% CI: 1.243–2.317), as is the presence of ventilation (p-value 0.030; PR 1.630; 95% CI: 1.080–2.460), lighting (p-value 0.011; PR 1.753; 95% CI: 1.162–2.643), temperature (p-value 0.024; PR 1.733; 95% CI: 1.061–2.834), and humidity (p-value 0.026; PR 1.853; 95% CI: 1.022–3.361). These results indicate that substandard physical conditions in the home, such as poor windows, ventilation, lighting, temperature, and humidity, increase the risk of ARI in toddlers compared to standard conditions.

## REFERENCES

Anggraeni, S. N. (2017). HUBUNGAN KUALITAS UDARA DALAM RUMAH DENGAN KELUHAN GEJALA INFEKSI SALURAN NAPAS AKUT PADA ANAK BAWAH LIMA TAHUN DI RUMAH SUSUN MARUNDA JAKARTA UTARA. 11(1), 92–105.

Arihta Tarigan, D., & Heryanti, E. (2021). Perbedaan Kelembaban, Kepadatan Hunian, Ventilasi Rumah terhadap Kejadian Infeksi Saluran Pernafasan Akut pada Balita. Jurnal Health Sains, 2(7), 871–876.

https://doi.org/10.46799/jhs.v2i7.218

Astorina, N. (2011). Kesehatan Lingkungan. In Media Kesehatan Masyarakat Indonesia (Vol. 10, Issue 2). https://doi.org/10.14710/mkmi.10.2.1-10

Cholifah, C., Nisak, U. K., & PK, A. (2020). Buku Ajar Ilmu Kesehatan Masyarakat. FiKes Univetsitas Muhammadiyah Sidoarjo, August, 138. https://books.google.com/books?hl=en%5C&lr=%5C&id=lqzuDwAAQBAJ%5C&oi=fnd%5C&pg=PA1%5C&dq=pelayanan+dalam+bidang+farmasi%5C&ots=jODNSz6HY4%5C&sig=3ESmAvtmtgyO2c2eiOcn-tAx5_U

Daka, R., Aryastuti, N., Dwi Nuryani, D., & Aryawati, W. (2024). Jurnal Abdi Masyarakat Vokasi (Amarasi) Hubungan Pengetahuan Ibu_Dengan Kejadian Ispa Pada Balita Di Wilayah Kerja Puskesmas Kaliasin. Jurnal Abdi Masyarakat Vokasi (Amarasi), 1(2), 177–183.

Daka, R., Aryastuti, N., Nuryani, D. D., & Aryawati, W. (2024). JURNAL ABDI MASYARAKAT VOKASI HUBUNGAN STATUS GIZI _ DENGAN KEJADIAN ISPA PADA BALITA DI Amarasi , Vol 1 No 2 , Juli 2024-Sekolah Vokasi Unhan RI JURNAL ABDI MASYARAKAT VOKASI Amarasi , Vol 1 No 2 , Juli 2024-Sekolah Vokasi Unhan RI. 1(2), 184–190.

Fakhrurrozi, M. A. (2013). Relation between Indoor Air Pollution with Acute Respiratory Infections in Children Aged Under 5 in Puskesmas Wirobrajan. 26(4), 1–37.

Falah, M., Lismayanti, L., Sari, N. P., Handayani, H., & Fadhilah, N. (2023). Lingkungan Fisik Rumah Penderita Infeksi Saluran Pernafasan Akut (ISPA) di Kota Tasikmalaya. JI-KES (Jurnal Ilmu Kesehatan), 6(2), 122–128. https://doi.org/10.33006/jikes.v6i2.562

Garmini, R., & Purwana, R. (2020). Polusi Udara Dalam Rumah Terhadap Infeksi Saluran Pernafasan Akut pada Balita di TPA Sukawinatan Palembang. Jurnal Kesehatan Lingkungan Indonesia, 19(1), 1. https://doi.org/10.14710/jkli.19.1.1-6

Giroth, T. M., Manoppo, J. I. C., & Bidjuni, H. J. (2022). Hubungan Status Gizi Dengan Kejadian Ispa Pada Balita Di Puskesmas Tompaso Kabupaten Minahasa. Jurnal Keperawatan, 10(1), 79. https://doi.org/10.35790/jkp.v10i1.36338

Haryani, S., & Misniarti, M. (2021). Faktor Yang Mempengaruhi Kejadian Infeksi Saluran Pernafasan Akut (Ispa) Di Provinsi Bengkulu. Quality : Jurnal Kesehatan, 15(2), 95–104. https://doi.org/10.36082/qjk.v15i2.240

Hidayanti, R., Yetti, H., & Putra, A. E. (2019). Risk Factors for Acute Respiratory Infection in Children Under Five in Padang, Indonesia. Journal of Maternal and Child Health, 4(2), 62–69. https://doi.org/10.26911/thejmch.2019.04.02.01

Hidayati, R., & Hasibuan, R. (2022). Hubungan Tingkat Pengetahuan Ibu Terhadap Stunting Pada Balita Usia 2-4 Tahun. Jurnal Pendidikan, 6(2), 218–221. https://journal.umtas.ac.id/index.php/earlychildhood/article/view/2408

Khoiriyah, H., & Ismarwati, I. (2023). Faktor Kejadian Stunting Pada Balita : Systematic Review. Jurnal Ilmu Kesehatan Masyarakat, 12(01), 28–40. https://doi.org/10.33221/jikm.v12i01.1844

Nabiha, P. Z., Azizah, R., Zulkarnain, O. F., Rizaldi, M. A., Febriani, A. K., Nugraheni, W. P., & Mahmudah, M. (2023). Risk analysis of temperature, humidity, ventilation, use of mosquito repellent, and smoking behaviour on the incidence of acute respiratory infections (ARI) in Toddlers. Journal of Air Pollution and Health, 8(4), 501–516. https://doi.org/10.18502/japh.v8i4.14543

Ningrum, S. A., & Ardillah, Y. (2021). Prosiding Forum Ilmiah Berkala Kesehatan Masyarakat Determinan ISPA pada anak usia sekolah di Prabumulih.

profil kesehatan indonesia. (2018). Provil Kesehatan Indonesia 2018 (Vol. 1227, Issue July). https://doi.org/10.1002/qj

Raden Hastryadi Kurniansyah, & Khayan. (2020). The Relationship Between Physical Parameters of Quality in the Home and the Occurrence of Upper Respiratory Infection (URI) in Toddler in Pontianak, West Kalimantan. Jurnal Teknologi Kesehatan Borneo, 1(1), 9–17. https://doi.org/10.30602/jtkb.v1i1.2

Rafaditya, S. A., Saptanto, A., & Ratnaningrum, K. (2022). Ventilasi dan Pencahayaan Rumah Berhubungan dengan Infeksi Saluran Pernapasan Akut (ISPA) pada Balita: Analisis Faktor Lingkungan Fisik. Medica Arteriana (Med-Art), 3(2), 115. https://doi.org/10.26714/medart.3.2.2021.115-121

Rahmadanti, D., & Darmawansyah Alnur, R. (2023). Faktor-Faktor Yang Berhubungan Dengan Kejadian ISPA Pada Balita. Jurnal Sains Dan Kesehatan, 2(2), 20–28. https://doi.org/10.57151/jurnalsainsdankesehatan.v2i2.266

Rane, S., Asiani, G., Rahutami, S., Studi, P., Kesehatan, M., Bina, S., & Palembang, H. (2024). ANALISIS KEJADIAN ISPA PADA BALITA PENDAHULUAN Penyakit menular kini masih menjadi masalah kesehatan di masyarakat yang dapat mengakibatkan kematian , kesakitan , dan dilakukannya tindakan pencegahan melalui upaya secara pengendalian efektif dan Upaya Inf. 9.

Riset Kesehatan Dasar (Riskesdas). (2018). Laporan Riskesdas 2018 Nasional.pdf. In Lembaga Penerbit Balitbangkes (p. hal 156). https://repository.badankebijakan.kemkes.go.id/id/eprint/3514/1/Laporan Riskesdas 2018 Nasional.pdf

Zolanda, A., Raharjo, M., & Setiani, O. (2021). Faktor Risiko Kejadian Infeksi Saluran Pernafasan Akut Pada Balita Di Indonesia. Link, 17(1), 73–80. https://doi.org/10.31983/link.v17i1.6828