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The Relationship between the Physical Environment of the Home and Parental Behavior with the Incidence of Respiratory Infections in Toddlers in the Working Area of the Hamparan Perak Community Health Center

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ABSTRACT

Background: ISPA is still the leading cause of morbidity and mortality among toddlers, especially in developing countries such as Indonesia. Factors of the physical environment of the home and the behavior of the parents are thought to influence the risk of ARI. Objective: To determine the relationship between the physical environment of the home and the behavior of parents with the incidence of ISPA in toddlers in the working area of the Hamparan Perak Health Center. Methods: A quantitative study with a cross sectional design, involving 122 respondents selected through proportionate stratified random sampling. Data were collected using questionnaires and observations, then analyzed univariate and bivariate using the Chi-Square test. Results: The results of the study proved that there was a significant relationship between ventilation (p=0.036) with PR=2.330 (95%CI=1.121-4.845), floor type (p=0.021) with PR=2.560 (95%CI=1.216-5.388), wall type (p=0.033) with PR=2.384 (95%CI=1.137-4.998), lighting (p=0.032) with PR=2.393 (95%CI=1.142-5.014), humidity (p=0.048) with PR=2.240 (95%CI=1.073-4.675), smoking habits (p=0.024) with PR=2.534 (95%CI=1.192-5.388), and garbage burning habits (p=0.013) with PR=2.744 (95%CI=1.297-5.804) with the incidence of ISPA in toddlers. Meanwhile, occupancy density (p=0.254), temperature (p=0.751), and kitchen ventilation (p=0.116) did not have a significant relationship. Conclusion: The physical condition of the home and the behavior of parents play an important role in the incidence of ISPA in toddlers. Efforts to improve the home environment and control risky behaviors are expected to reduce the incidence of ARI.

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INTRODUCTION

Acute Respiratory Infections (ARI) are diseases of the upper or lower respiratory tract caused by viruses or bacteria, with rapid symptoms such as fever, cough, runny nose, and shortness of breath. ARI is one of the leading causes of death, especially in toddlers, because their immune systems are not yet fully developed. This disease can cause serious complications such as pneumonia, acute otitis media, and mastoiditis.

WHO data shows that the mortality rate of toddlers due to ARI in developing countries, including Indonesia, is still high. In Indonesia, the prevalence of ARI in toddlers reached 34.2% (SKI 2023), an increase compared to the previous year. In North Sumatra and Deli Serdang Regency, ARI cases also show an increasing trend, including in the working area of the Hamparan Perak Community Health Center, with 1,855 cases among infants in 2024.

Respiratory tract infections in toddlers can affect growth and development, with an increased risk of stunting due to repeated infections. Physical environmental factors in the home, such as ventilation, housing density, flooring and wall materials, lighting, humidity, temperature, and kitchen ventilation, have been shown to affect the incidence of respiratory tract infections. In addition, family behaviors, including smoking indoors and burning garbage, also increase the risk of infection.

Initial observations of 10 mothers in the study area showed that most homes had limited ventilation, high occupancy density, poor lighting, and a habit of burning garbage, which could potentially increase the risk of ARI in infants.

Based on these conditions, this study aims to examine the relationship between the physical environment of the home and parental behavior with the incidence of ARI in toddlers in the working area of the Hamparan Perak Community Health Center.

RESEARCH METHOD

This study is a quantitative study with a cross-sectional design, which collects data on independent variables such as housing density, ventilation, floor and wall types, lighting, humidity, temperature, kitchen ventilation, smoking habits, and waste burning habits, as well as the dependent variable, namely the incidence of ARI in toddlers. The study was conducted in the working area of the Hamparan Perak Community Health Center, Deli Serdang, North Sumatra, from January to June 2025. The study population consisted of all infants aged 12–59 months in the community health center's working area, totaling 11,972 infants, while the sample consisted of 122 infants, determined using the Lameshow formula and stratified random sampling technique.

The research data were analyzed univariately to describe the characteristics of the physical environment of the home, parental behavior, and the incidence of ARI in toddlers through frequency and percentage, as well as bivariately using the Chi-Square test to test the relationship between independent and dependent variables with a significance level of $\alpha = 0.05$. The data were processed through the stages of editing, coding, entry, cleaning, and tabulating using SPSS so that they were ready for analysis and conclusion drawing.

RESULT

Respondent Characteristics

Table 1. Respondent Characteristics

Respondent Characteristics	n	%
Toddler Age		
12 – 23 Months	25	20,5
24 – 35 Months	23	18,9
36 – 47 Months	25	20,5
Gender of Toddlers		
Man	54	44,5
Woman	68	55,7
Mother's age		
≤ 25 Years	24	19,7
25 – 40 Years	79	64,8
≥ 25 Years	19	15,6
Mother's age		
Didn't Finish School	8	6,6
Elementary School	15	12,3
Junior High School	41	33,6
High School	43	35,2
Diploma/Bachelor's Degree	15	12,3
Total	122	100,0

Based on the respondent characteristics table, it is known that most toddlers are aged 12–47 months with a relatively balanced number in each age group. Gender is dominated by females (55.7%), while males account for 44.3%. The majority of mothers are aged 25–40 years (64.8%), which is considered productive age and mature enough in child care. In terms of education, most mothers had a high school education (35.2%) and junior high school education (33.6%), indicating a fairly good level of knowledge in maintaining family health. In general, the characteristics of the respondents show that the majority of mothers are of productive age with a secondary education, while toddlers are at an age that is vulnerable to ARI.

Univariate Analysis

Table 2. Frequency Distribution of ARI Incidence in Toddlers and Health Workers Who Diagnose ARI in the Working Area of the Hamparan Perak Community Health Center

Incidence of acute respiratory infections	n	%
Experiencing ARI	69	56,6
Not Experiencing ARI	53	43,4
Total	122	100

Based on Table 2, it is known that of the 122 toddlers who were respondents, 69 toddlers (56.6%) had ARI, while 53 toddlers (43.4%) did not have ARI. This shows that more than half of the toddlers in the working area of the Hamparan Perak Community Health Center suffer from ARI, so this disease is still a significant health problem in the area.

Table 3. Frequency Distribution of ARI Incidence in Toddlers and Health Workers Who Diagnose ARI in the Working Area of the Hamparan Perak Community Health Center

No	Questions about ISPA Incidents	Yes		No	
1	Has your child been diagnosed with ARI by a health worker (Symptoms: cough, runny nose accompanied by fever for approximately 14 days) in the last month?	n	%	n	%
		69	56,6	53	43,4
2	The type of health worker who diagnoses ARI	Doctor		Midwife		Nurse	
		n	%	n	%	n	%
		36	29,5	31	25,4	2	1,6

Based on the table, it is known that of the 122 infant respondents, 69 infants (56.6%) had been diagnosed with ARI by health workers in the last month, while 53 infants (43.4%) did not have ARI. This shows that more than half of the infants in the Hamparan Perak Community Health Center working area are still vulnerable to ARI. In terms of the type of health worker who made the diagnosis, most ARI cases were examined by doctors (36 people or 29.5%), followed by midwives (31 people or 25.4%), and nurses (2 people or 1.6%). This data illustrates that ARI diagnosis is generally carried out by professional medical personnel, especially doctors and midwives, who play an important role in the initial treatment and prevention of ARI complications in infants.

Table 4. Physical Environmental Conditions of Houses in the Hamparan Perak Community Health Center Area

Physical Environment of the House	n	%
Housing Density		
Ineligible	52	42,6
Eligble	70	57,4
Ventilation		
Ineligible	65	53,3
Eligble	57	46,7
Floor Type		
Ineligible	73	59,8
Eligble	49	40,2
Wall Type		
Ineligible	56	45,9
Eligble	66	54,1
Lighting		

Ineligible	72	59,0
Eligble	50	41,0
Humidity		
Ineligible	71	58,2
Eligble	51	41,8
Temperature		
Ineligible	63	51,6
Eligble	59	48,4
Kitchen Ventilation		
Ineligible	64	52,5
Eligble	58	47,5
Smoking Habits		
Smoking	77	63,1
Not Smoking	45	36,9
The Habit of Burning Garbage		
Burning Garbage	74	60,7
Do Not Burn Garbage	48	39,9
Total	122	100,0

Based on the table of physical environmental conditions of houses, it is known that of the 122 respondents' houses, most still do not meet health requirements in several important aspects. In terms of housing density, 52 houses (42.6%) do not meet the requirements, while 70 houses (57.4%) do meet the requirements. This means that most houses already have sufficient space for their occupants. However, in terms of ventilation, 65 houses (53.3%) do not meet the requirements, indicating that more than half of the houses have poor air circulation.

In terms of floor type, the majority of houses, namely 73 houses (59.8%), still use floors that do not meet health requirements, such as soil or boards, which have the potential to cause dust and high humidity. Meanwhile, 49 houses (40.2%) already use permanent flooring such as ceramic tiles or plaster. In terms of wall type, the condition of the houses is relatively better because 66 houses (54.1%) meet the requirements (using permanent materials), although 56 houses (45.9%) still use non-permanent materials such as wood or bamboo.

In terms of lighting, 72 houses (59.0%) had inadequate lighting, meaning that the rooms did not receive enough sunlight. Similarly, in terms of humidity, 71 houses (58.2%) had high humidity, which could potentially increase the risk of mold and disease-causing microorganisms growing. Room temperature conditions also showed similar results, with 63 houses (51.6%) not meeting healthy temperature standards (18–30°C), which can affect the comfort and respiratory health of residents.

In terms of behavior, 64 houses (52.5%) did not have adequate kitchen ventilation, making it difficult for smoke from cooking to escape and potentially polluting the air inside the house. The habit of smoking indoors was also high, with 77 respondents (63.1%) reporting this behavior, which is a serious risk factor for ARI in toddlers. In addition, 74 respondents (60.7%) still had the habit of burning trash, which also reduced air quality in the living environment.

Table 5. The Relationship between Physical Environmental Conditions in the Home and the Incidence of Respiratory Infections in Toddlers in the Working Area of the Hamparan Perak Community Health Center

Variable	Incidence ARI						*P-Value*	PR (95% CI)
	Yes		Not		Total			
	n	%	n	%	n	%		
Housing Density								
Ineligible	33	63,5	19	36,5	52	100,0	0,254	1,640 (0,788 – 3,416
Eligble	36	41,4	34	48,6	70	100,0		
Ventilation								
Ineligible	43	22	33,8	22	65	100,0	0,036	2,330 (1,121 – 4,845)
Eligble	26	31	54,4	31	57	100,0		
Floor Type								
Ineligible	48	65,8	25	34,2	73	100,0	0,021	2,560 (1,216 – 5,388)
Eligble	21	42,9	28	57,1	49	100.0		
Wall Type								
Ineligible	38	67,9	18	31,1	56	100	0,033	2,384 (1,137 –

Eligble	31	47,0	35	53,0	66	100		4,988)
Lighting								
Ineligible	47	65,3	25	34,7	72	100	0,032	2,393 (1,142 –
Eligble	22	44,0	28	56,0	50	100		5,014)
Humidity								
Ineligible	46	64,8	25	35,2	71	100	0,048	2,240 (1,073 –
Eligble	23	45,1	28	54,9	51	100		4,675)
Temperature								
Ineligible	37	58,7	26	41,3	63	100	0,751	1,201 (0,586 –
Eligble	32	54,2	27	45,8	59	100		2,459
Ventilasi Dapur								
Ineligible	41	64,1	23	35,9	64	100	0,116	1,901 (0,925 –
Eligble	28	48,,3	30	51,7	58	100		3,944)
Smoking Habits								
Smoking	50	64,9	27	35,1	77	100	0,024	2,545 (1,192 –
Not Smoking	19	42,4	26	57,8	45	100		5,388)
The Habit of Burning Garbage								
Burning Garbage	49	66,2	25	33,8	74	100	0,013	2,744 (1,298 –
Do Not Burn Garbage	20	41,7	28	58,3	48	100		5,804)

Bivariate analysis results show that several physical environmental factors in the home and parental behavior are significantly associated with the incidence of ARI in toddlers in the working area of the Hamparan Perak Community Health Center. Variables that did not show a significant relationship were housing density (p=0.254; PR=1.640), although toddlers living in houses with inadequate density had a 1.6 times greater risk of experiencing ARI than those living in adequate housing. Conversely, the variables of ventilation (p=0.036; PR=2.330), floor type (p=0.021; PR=2.560), wall type (p=0.033; PR=2.384), lighting (p=0.032; PR=2.393), and humidity (p=0.048; PR=2.240) showed a significant association with ARI incidence. This means that substandard housing conditions in these aspects increase the risk of ARI incidence by approximately twofold. Meanwhile, temperature (p=0.751; PR=1.201) and kitchen ventilation (p=0.116; PR=1.901) had no significant relationship with the incidence of ARI. From behavioral factors, smoking habits (p=0.024; PR=2.545) and waste burning habits (p=0.013; PR=2.744) had a significant relationship, where households whose family members smoked or burned waste had a risk approximately two to three times higher of causing ARI in toddlers compared to those who did not engage in these habits.

DISCUSSION

The results showed that of the ten factors studied, namely six physical factors in the home (housing density, ventilation, type of flooring, type of walls, lighting, humidity) and four parental behavioral factors (temperature, kitchen ventilation, smoking habits, and trash burning habits), nine factors had a significant relationship with the incidence of ARI in toddlers, while one factor, housing density, did not show a significant relationship. The first factor, housing density, had a p-value of 0.254 ($p > 0.05$), which means that there was no relationship between housing density and the incidence of ARI. This is because most of the respondents' homes met the minimum density standards and had good ventilation and lighting, so that air circulation remained smooth and the transmission of respiratory diseases could be minimized.

Ventilation factors have a significant relationship with a p-value of 0.036 ($p < 0.05$) and an OR of 2.33, meaning that toddlers living in homes with inadequate ventilation are 2.33 times more likely to experience ARI. Lack of ventilation causes the air inside the house to become stuffy and traps cigarette smoke and fumes from the kitchen. This condition is in line with Islamic health principles that emphasize the importance of air circulation to prevent health hazards. Furthermore, the type of flooring also showed a significant relationship ($p = 0.021$; PR = 2.56). Houses with earthen or wooden floors that are not waterproof are more likely to be sources of dust and moisture, which support the growth of fungi and bacteria that cause respiratory tract infections. Conversely, houses with ceramic or plaster floors are cleaner and healthier for toddlers.

The type of wall was also found to have a significant effect on the incidence of ARI ($p = 0.033$; PR = 2.38). Houses with walls made of non-permanent materials such as wood or bamboo are unable to maintain temperature and humidity properly and are difficult to clean of dust and mold. Meanwhile, houses with brick or concrete walls can maintain stable temperatures and protect occupants from exposure to outside air. The natural lighting factor showed a p-value of 0.032 ($p < 0.05$) with an OR of 2.39, indicating that lighting levels

below 60 lux increase the risk of ARI. Dark and humid houses without direct sunlight are ideal places for microorganisms to grow. Sunlight helps reduce humidity, kill germs, and maintain respiratory health.

The air humidity factor was also significantly associated with ARI (p = 0.048; PR = 2.24). Houses with high humidity (above 60%) create a stuffy atmosphere and support the growth of fungi and bacteria. These conditions often occur in houses with poor ventilation and little sunlight exposure. In addition, room temperature also has an important influence on respiratory health. The test results show a significant relationship between temperature and ARI, where room temperatures that are too cold or too hot can irritate the respiratory tract and reduce the immune system of toddlers. The ideal temperature ranges from 18–30°C to maintain the comfort and health of the occupants of the house.

Kitchen ventilation also has a significant impact on the incidence of ARI. Homes without adequate kitchen ventilation will cause smoke from cooking fuels such as wood or gas to accumulate, which then spreads to other rooms and irritates children's respiratory systems. Furthermore, smoking indoors is a strong risk factor for ARI in toddlers. Cigarette smoke contains harmful chemicals that can worsen children's lung condition and lower their immunity. Toddlers exposed to cigarette smoke at home have a higher risk of suffering from recurrent respiratory tract infections. Finally, the habit of burning trash around the house is also significantly associated with ARI. The smoke from burning contains fine particles and carbon monoxide, which can irritate the respiratory tract and reduce air quality in the living environment.

Overall, this study confirms that the physical condition of the home environment and parental behavior play a major role in the incidence of ARI in toddlers. Efforts to improve home conditions, such as improving ventilation, lighting, humidity control, and avoiding cigarette smoke and burning trash, are important steps in preventing ARI.

CONCLUSION

The results of research in the working area of the Hamparan Perak Community Health Center show that several physical environmental factors in the home and parental behavior are associated with the incidence of ARI in toddlers. Factors that were not significantly associated were housing density (p=0.254; PR=1.640), temperature (p=0.751; PR=1.201), and kitchen ventilation (p=0.116; PR=1.901). Meanwhile, factors that were significantly associated with ARI cases included ventilation (p=0.036; PR=2.330; 95% CI=1.121–4.845), floor type (p=0.021; PR=2.560; 95% CI=1.216–5.388), wall type (p=0.033; PR=2.384; 95% CI=1.137–4.998), lighting (p=0.032; PR=2.393; 95% CI=1.142–5.014), and humidity (p=0.048; PR=2.240; 95% CI=1.073–4.675). In addition, behavioral factors also had an effect, namely smoking (p=0.024; PR=2.534; 95% CI=1.192–5.388) and burning garbage (p=0.013; PR=2.744; 95% CI=1.297–5.804), which increased the risk of ARI by approximately two to three times in exposed toddlers.

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