PUBLIC HEALTH RESEARCH

The Effect of Healthy House Indicators on the Incidence of Acute Respiratory Infection in Tangerang Regency, Banten Province

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ABSTRACT

Introduction	A healthy home is a physical building that meets health criteria. The surrounding environment benefits physical and mental health and provides an appropriate social environment for family and individual health. Acute Respiratory Infection (ARI) is one of the effects of diseases caused by houses that do not meet healthy housing standards. ARI incidence was ranked 5th in Banten Province, with a prevalence of 17.7%. This study aims to determine whether healthy home indicators affect the incidence of ARI in assisted families in Tangerang Regency, Banten Province.
Methods	This analytic study with a cross-sectional approach was conducted on 115 residents in Kresek Village and Kemiri Village, who were taken using a quota sampling technique. Methods of data analysis using univariate, bivariate, and multivariate analysis using software IBM-SPSS version 29.0 and Microsoft Excel.
Results	ARI was found in 50.4% of people in the past three months. There was a significant effect (P<0.05) between the incidence of ARI and indicators of a healthy home, specifically the area of ventilation in the house (P=0.002, OR:3.5, 95% CI 2.1 - 28.4) and opening the windows in the family room (P=0.030, OR:3.5, 95% CI 1.3 - 10.78).
Conclusions	The indicator that most dominantly influenced the incidence of ARI in this study was the ventilation indicator. Thus, a strategy is needed to increase the use of ventilation by the people of Tangerang Regency.
Keywords	Healthy Homes; Acute Respiratory Infections (ARI); Ventilation; Indicators

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INTRODUCTION

A healthy and comfortable home is a source of inspiration for its residents to work to increase individual productivity. According to the World Health Organization,[1] a healthy house is a physical structure for shelter with health requirements, where the environment is helpful for physical and mental health as well as social conditions for family and individual health.[1] In addition to meeting physiological and psychological needs, healthy house help prevent diseases such as Acute Respiratory Infection (ARI), Tuberculosis (TB), diarrhea, DHF, Filariasis, and other diseases.[2] As indicated in Sustainable Development Goals (SDGs) 3 relating to good health and well-being, especially target 3.3 namely combating communicable disease and target 3.9 about environmental health.

The criteria for a healthy house are based on technical guidelines arranged by the Directorate General of Disease Control and Environmental Health, Ministry of Health, Republic of Indonesia, in 2007. The assessment of a healthy house includes the physical components of the house, sanitation facilities, and occupant behaviour.[3] Home and environmental sanitation are closely related to the incidence of infectious diseases, such as ARI.[4]

ARI is an infectious upper or lower respiratory tract disease that can cause various illnesses ranging from asymptomatic or moderate infection to severe or deadly, depending on the causative pathogen, environmental factors, and host factors (WHO, 2007).[5] With a rate of 25% - 30% and 10% - 25%, respectively, ARI is more frequent in underdeveloped nations than in industrialized countries.[6] This creates an additional financial strain on the healthcare system while also increasing mortality and morbidity.[7]

Based on Indonesia's health profile data for 2018, Banten Province is ranked 5th, with a prevalence of 17.7% of ARI from 34 provinces in Indonesia. According to the Kresek Health Center report in April 2022,[8] ARI is the second most common disease, with 203 out of 1440 cases (14.09%). In addition, as stated in data at the Kemiri Health Center in 2021,[9] there were 972 cases of ARI.

ARI can cause decreased lung function especially in children under 3 years old[10] and reduced productivity in family members. Thus to reduce mortality and morbidity from the incidence of ARI, it is necessary to carry out comprehensive prevention in the environment in Tangerang Regency. Based on the problems above, this study aimed to determine the effect of healthy home indicators on the incidence of ARI among residents in Kresek and Kemiri Villages, Tangerang Regency, Banten Province.

METHODS

This type of research is analytical research with a cross-sectional design. Data were collected on 2 February 2023 using checklist about healthy house based on 2007 criteria by Indonesian Ministry of Health. We observed the house, and interviewed the family member regarding health behaviour and symptoms of ARI. The Healthy House checklist used was standard from the Indonesian Ministry of Health so we did not conduct validity tests.

The inclusion criteria in the study were residents of Kresek and Kemiri Village who were willing to be respondents, have a kitchen within the house, and respondents who lived at home. At the same time, the exclusion criteria in this study was the subject that the house being renovated.

The population was residents in Kresek Village and Kemiri Village, Tangerang Regency, Banten Province. The sampling technique used was quota sampling (the number of samples according to the quota given by the community health center that fosters the area).

The calculation of the minimum sample size used the following formula.[11]

The characteristics of the respondents are divided based on age, last education, occupation, and income per month. Variables can be categorized as healthy and unhealthy house criteria based on the Ministry of Health 2007,[3] which is provided in Table 1. Furthermore, the ARI variable was categorized into ARI and not ARI based on the ARI symptom score ≥ 3 in the last three months because identifying the type of illness, the intensity and duration of the symptoms are crucial factors as healthcare professionals to look at the patient's symptoms and medical history. Monto et al[12] found that there were 3-4 cases of ARI per year in the family, so we asked about the incidence of ARI in the last 3 months.

$$n = \frac{Z^2 P(1 - P)}{d^2}$$

P (expected prevalence) = 14.09%
Z (statistic corresponding to 95% level of confidence) = 1.96
d (precision) = 0.1
n (minimum sample size) = 47 samples

Table 1 Operational definition

Name of Variables	Definition	Measurement of Process	Category	Information
Ventilation area	A good ventilation area has of at least >10% total floor area in each room inside the house.	Checklist and observation by researcher	1 = qualified	ventilation area >10% total floor area
			2 = unqualified	ventilation area <10% total floor area
Living room window	The window area in the living room meets the requirements at least > 5 % floor area of the room family.		1 = qualified	living room window >5% total floor area
			2 = unqualified	living room window <5% total floor area
Bedroom window	The window area in the bedroom is at least > 5% of the floor area of the bedroom		1 = qualified	bedroom window >5% total bedroom floor area
			2 = unqualified	bedroom window <5% total bedroom floor area
Kitchen chimney	The smoke hole that meets the requirements of the smoke hole in the kitchen is at least > 10% of the kitchen floor area, with smoke coming out perfectly		1 = qualified	kitchen chimney >10% total kitchen floor area
			2 = unqualified	kitchen chimney <10% total kitchen floor area
Opening living room window behavior	Opening the window meets the good criteria if the occupant has a habit of frequently opening the window.	Interview with family member	1 = good	frequently opening the window
			2 = bad	never or rarely opening the window
Opening bedroom window behavior	Opening the window meets the inadequate criteria if the occupant has a habit of never and rarely opening the window.		1 = good	frequently opening the window
			2 = bad	never or rarely opening the window

Data were processed using a version of the IBM-SPSS Data Analysis Program 29.0. The frequency distribution was used to describe independent and dependent variables, along with the characteristics description of the respondents, by univariate analysis. For bivariate analysis, a non-parametric test chi-square was performed with a significant degree of $p<0.05$ to determine the relationship between the independent variables and the dependent variable. The multivariate test uses logistic regression by analyzing variables with a p-value <0.25 from the results of the bivariate test.

RESULTS

A total number of 115 respondents are eligible for this study. The following tables show the results of univariate, bivariate, and multivariate analyze.

In the gender variable, it was found that most were women (51.3%) compared to men. As many as 28.7% of the subjects came from the adults (> 46 years). As many as 41.7% of respondents had the last education at the elementary school level. One hundred thirteen subjects (98.3%) had income below the regional minimum wage for Tangerang Regency.

Table 3 presents the results of houses divided based on the 2007 Healthy House criteria, it was found that 100% houses were unhealthy.

Table 4 shows that of the 115 respondents, 50.4% experienced ARI in the last 3 months with more than three symptoms.

As many as 91.4% ARI were founded in subjects from the unqualified ventilation area group compared with 8.6% ARI in qualified ventilation area group ($P<0.001$). There was a significant relationship ($P<0.001$) between windows in living rooms that did not meet the requirements and the incidence of ARI at the respondent's house, notably 49 respondents (84.4%) in the last 3 months. Table 4 also shows that 54 respondents (45.9%) experienced ARI on the bedroom window who did not meet requirements compared to those who met the requirements. No significant relationship ($P > 0.05$) between the kitchen chimney in the subject's house and the incidence of ARI in the last three months.

Table 6 is the result of an analysis of the relationship between window-opening behavior and the incidence of ARI. It shows that most respondents who did not suffer from ARI have a good habit of opening windows in their living rooms, as much as 40.4% ($P <0.001$) in Kresek Village and Kemiri Village. However, the bad habit of opening the bedroom window did not have a significant relationship with the incidence of ARI (77.6%).

Table 2 Characteristic of residents in Kresek dan Kemiri Villages, Tangerang Regency

Variables	Category	Frequency (n)	Percentage (%)
Gender	Female	59	51.3
	Male	56	48.7
Age	Toddler (0-5 years old)	7	6.1
	Children (5-11 years old)	13	11.3
	Early Teens (12-16 years old)	7	6.1
	Late Teens (17-26 years old)	18	15.7
	Early Adulthood (26-35 years old)	28	24.3
	Late Adulthood (36-45 years old)	9	7.8
	Adults (>46 years old)	33	28.7
Last education	No School	21	18.3
	Elementary	48	41.7
	Junior High	20	17.4
	Senior High	26	22.6
	Undergraduate	0	0
Income	Low (< Rp4.285.798, 90)	113	98.3
	High (≥ Rp4.285.798, 90)	2	1.7

Table 3 Healthy house distribution among residents in Kresek dan Kemiri Villages, Tangerang Regency

Healthy house	Frequency	Percentage (%)
Healthy	0	0
Unhealthy	115	100

Table 4 ARI incidence distribution among residents in Kresek dan Kemiri Villages, Tangerang Regency

ARI incidence	Frequency	Percentage (%)
Non-ARI	57	49.6
ARI	58	50.4
Total	115	100

Table 5 The correlation between ventilation and ARI incidence

Variables		Frequency (n)	%	ARI		Non-ARI		P-*value*
				n	%	n	%	
Ventilation Area	Qualified	30	26.1	5	8.6	25	43.9	<0.001
	Unqualified	85	73.9	53	91.4	32	56.1	
Living Room Window	Qualified	36	31.3	9	18.2	27	47.4	<0.001
	Unqualified	79	68.7	49	84.5	30	52.6	
Bedroom Window	Qualified	24	20.9	4	20.9	20	35.1	<0.001
	Unqualified	91	79.1	54	45.9	37	64.9	
Kitchen Chimney	Qualified	13	11.3	4	6.9	9	15.8	0.132
	Unqualified	102	88.7	54	93.1	48	84.2	

Table 6 The correlation between opening window behavior and ARI incidence

Variabel		Total (n)	ARI		No ARI		P-*value*
			No.	%	No.	%	
Opening Living Room Window	Good	30	7	12.1	23	40.4	<0.001
	Bad	85	51	87.9	34	59.6	
Opening Bedroom Window	Good	33	13	22.4	20	35.1	0.133
	Bad	82	45	77.6	37	64.9	

Table 7 Multivariate logistic regression analysis

Variables	B	Std. error	Wald	Sig.	Exp (B)	95% CI
Ventilation area inside the house	2.047	0.663	9.523	0.002	7.742	2.11 - 28.41
Living room window	0.053	0.624	0.007	0.933	1.054	0.31 - 3.58
Bedroom window	1.089	0.759	2.059	0.151	2.970	0.67 - 13.14
Kitchen chimney	0.978	0.761	1.652	0.199	2.659	0.60 - 11.80
Opening living room window	1.251	0.575	4.729	0.030	3.493	1.13 - 10.78

Table 7 is the result of an analysis of healthy home indicators that have a significant effect on the incidence of ARI, which shows that ventilation (OR: 7.7, 95% CI: 2.1 - 28.4) and opening the family room window (OR: 3.50, 95% CI: 1.1 - 10.8) gave significant results to the incidence of ARI in Kresek Village and Kemiri Village.

DISCUSSION

This study found that the most prominent sex group was women, with as many as 59 respondents (51.3%). Riskesdas[13] shows that the prevalence of ARI in Indonesia is 9.3%, of which 4.3% are male and 4.4% are female. This result was also influenced by the number of female respondents who were more than male because, at the time of data collection, the male respondents were working and were not at the data collection location. In the age variable, the largest age group was the adults (> 46 years), with 33 respondents (28.7%).

In the education variable, it was found that the last education of most respondents was elementary education, with 48 respondents (41.7%). According to the Ministry of Education and Culture's Data and Information Center for 2021, the Ministry of Education and Culture's Data and Information Center (Pusdatin) noted that Tangerang Regency occupies the first position in the number of out-of-school children in Banten Province with 16,656 children. Education is related to an increased risk of disease, including ARI. Several factors related to ARI that occur in the community include public education about hygiene and health, community knowledge about maintaining health and the environment, and information from health educators about the disease and the causes of the disease, especially ARI.[14]

In this study, 58 respondents (50.4%) suffered from ARI, while 57 respondents (49.6%) did not suffer from ARI. The determination of the incidence of ARI in this study was based on the ARI symptom score ≥ 3 within the last 3 months.[15] This result follows the Kresek Health Center data profile in April 2022,[8] where ARI is the second most common disease, namely, 203 cases out of 1440 cases (14.09%).

The bivariate analysis results in this study showed a relationship between ventilation and the incidence of ARI. Of 30 respondents who met ventilation requirements, 5 respondents (8.6%) suffered from ARI, while for 85 respondents who did not meet ventilation requirements, 53 respondents (91.4%) had ARI. With a 95% CI and statistical test results with a chi-square P-value=0.001 (P significant <0.05), it can be concluded that there is a relationship between ventilation and the incidence of ARI. This result is in line with Janati's study,[16] which stated that there was a relationship between ventilation and the incidence of ARI, i.e., that ventilation areas that did not meet the requirements increased the incidence of ARI. The study by Hassen et al[17] in Ethiopia also showed the same results, revealing a link between ventilation scarcity and ARI incidence. Similar to studies conducted by Sikolia et al[18] in Kenya and in India by Mir et al,[19] Goel et al. ,[20] and Kumaresan Kuppusamy.[21] Since ventilation supplies fresh air and removes dirty air from a naturally or mechanically closed room.[22]

Multiple logistic regression analysis results show that ventilation is the most significant healthy house indicator (P=0.002, OR: 7.7, 95% CI: 2.1 - 28.4) in Tangerang Regency. It can be concluded that respondents with poor ventilation have the possibility of experiencing ARI events 7 times more often than respondents with good ventilation. Because ventilation is a place for air exchange in the house with fresh air coming from outside in the amount needed. According to Permenkes Number: 1077 of 2011 concerning Guidelines for Indoor Air Conditioning at home, the minimum ventilation requirement is 10% of the floor area, and improper air exchange causes an increase in the growth of microorganisms that cause disease. This specification is important because ventilation maintains airflow in the room so that the O_2 balance is maintained. Lack of ventilation can cause a lack of O_2, and high CO_2, which are toxic to the body, and ventilation can maintain a balance of indoor air humidity which is a medium for the development of microorganisms that cause ARI.[22]

The relationship between the family room window and the incidence of ARI was analyzed from 36 respondents who met the criteria for the family window. There were 9 respondents (18.2%) who suffered from ARI, while 79 respondents did not meet the requirements for the family window; there were 49 respondents (84.5%) suffering from ARI. With a 95% confidence level and statistical test results with a chi-square P-value= 0.001 (P is significant <0.05), it can be concluded that there is a relationship between ventilation and the incidence of ARI. This outcome is related to ventilation, which plays a vital role in preventing the transmission of ARI. ARI is generally caused by bacteria and viruses, where the transmission process is through the air. Respiratory infection is a complication in the breathing system involving the throat, sinuses, lungs, and airways. With good ventilation, air contaminated with microorganisms will quickly be replaced with fresh air.[7,23]

In this study, the results of the analysis of the relationship between the bedroom window and the incidence of ARI were obtained from 24 respondents who met the bedroom window requirements; 4 respondents (4.9%) suffered from ARI, while 91 respondents who did not meet the bedroom window requirements, there were 54 respondents (45.9%) suffering from ARI. With a 95% confidence level and statistical test results with a chi-square P-value obtained value=0.001 (P is significant <0.05), it can be concluded that there is a relationship between ventilation and the incidence of ARI.

The relationship between the kitchen chimney and the incidence of ARI was obtained from 13 respondents who met the chimney requirements, and 4 respondents (6.9%) suffered from ARI. In comparison, 102 respondents did not meet the requirements for bedroom windows, were 54 respondents (93.1%) suffered from ARI. With a 95% confidence level and statistical test results with a chi-square p-value obtained value= 0.132 (p is significant <0.05), it can be concluded that there is no relationship between the kitchen chimney and the incidence of ARI. These results align with Aprinda's research,[24] which stated that there was no relationship between kitchen chimneys and the

incidence of ARI in toddlers. In Husna's research,[25] it was found that there was a significant relationship between kitchen smoke pits and the incidence of ARI in children under five in the Pasar Panas Health Center working area. Kitchen smoke exhaust holes are essential because smoke can impact health, especially for residents in the house.[25] A kitchen without a relative smoke vent will introduce a lot of smoke pollution into the house. The pollution produced by fuel-using wood is much higher than fuel using gas. The results of the use of biomass fuels produce, among others, CO, NO_x, SO_2, ammonia, HCl, and hydrocarbons, including formaldehyde, Suspended Particulate Matter. Hydrocarbons and CO are produced in high concentrations. Substances from using biomass fuels are harmful to health and can lead to the risk of persistent diseases such as ARI.[26] Johri's[27] experiment stated that a kitchen vent 12 feet from the seating area could function as an exhaust system, resulting in air exchange and reducing indoor aerosol counts more efficiently in an indoor setting with no additional ventilation or open windows.

Based on the results of this study, the percentage of ARI symptoms with a bad habit of opening the family room windows was 87.9% (P=0.03; OR 1.05; 95% CI 1.1 - 10.7). The p value <0.05 can be statistically interpreted as having a relationship with the incidence of ARI in the last 3 months. Based on the odds ratio, it was found that respondents with a bad habit of opening the family room window increased the occurrence of ARI 3 times greater. The effect of opening windows on the incidence of ARI follows Yuslinda's research,[28] a house that has no windows or has windows but does not open windows according to health requirements can cause the air to be polluted and unable to get out. Air pollution that occurs a lot is carbon monoxide; if in large quantities, it can cause interference with the respiratory tract. Budiman[26] said that healthy humidity is around 40-70%, so humidity that exceeds 70% will affect the health of the occupants of the house.

The habit of opening windows needs to be improved, and the owned ventilation needs to meet the criteria for a healthy home. Therefore, the lighting in the house becomes less, especially sunlight which is essential for killing pathogenic bacteria. In addition, lighting provides light for dark spaces to prevent the growth of bacteria or viruses that cause ARI.[29] Although the data obtained differs on the relationship between terrible bedroom window habits and the incidence of ARI with 45 respondents (P=0.133) in Tangerang Regency. However, according to Darmawati et al[30] stated that if a bedroom had a window but never opened, it would make the bedroom stuffy and damp, allowing bacteria to grow and develop in the room, which is not in line with the results of this study.

The test has certain limitations, particularly the insensitivity of the grouping of respondents into the ARI category because it only depends on an interview due to limited tools and costs for support diagnosis. Researchers also still need help in conducting interviews and observations as a way of measuring in determining the value of several variables, which can lead to measurement bias in research decisions.

CONCLUSION

Based on the results of this study, it can be concluded that there is an influence between healthy home indicators, namely ventilation and the incidence of ARI in residents of Tangerang Regency.

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REFERENCES

1. WHO. *Definition of Healthy House*. World Health Organization; 2001.
2. Riviwanto. *Residential Health*. Gosyen Publishing; 2011.
3. Health Department of Republic of Indonesia. *Decree of The Minister of Health of Republic of Indonesia No: 900/MENKES/VII/2007*. Health Department of Republic of Indonesia; 2007.
4. Juniartha SK, Hadi C & Notes N. Relationship between area and position of house ventilation with the incidence of ARI occupants of the house in North Bangli health center in 2012. Jurnal Kesehatan Lingkungan. 2014; 4(2): 169–174.
5. WHO. *Infection Prevention and Control of Epidemics and Pandemics in Health Care*. WHO Interim Guidelines; 2007.
6. Taarelluan KT, Ottay RI & Pangemanan JM. Relationship between knowledge and attitude of the community towards prevention of acute respiratory infection (ARI) in Tataaram 1 Village, South Tondano Sub-district, Minahasa District. Jurnal Kedokteran Komunitas Dan Tropik. 2016; 4(1): 31–38.
7. Zhao Lin, Wu LiPing, Xu Wenda, Wei Jing, Niu Xiaorong, Liu GuoYin, Yu Li, Wu Ying, Zhou Qiang, Liu Lu. Diagnostic techniques for critical respiratory infections: Update on current methods. *Heliyon*. 2023; 9(8): e18957.
8. *Kresek Health Center*. Kresek Health Center Profile; 2022.

9. *Kemiri Health Center*. Kemiri Health Center Profile; 2022.
10. Kumar P, Mukherjee A, Randev S, Medigeshi GR, Jat KR, Kapil A, Lodha R & Kabra SK. Effect of acute respiratory infections in infancy on pulmonary function test at 3 years of age: A prospective birth cohort study. *BMJ Open Respiratory Research*. 2020; 7(1): 1–10. doi:10.1136/bmjresp-2019-000436
11. Pourhoseingholi MA, Vahedi M & Rahimzadeh M. (2013). Sample size calculation in medical studies. *Gastroenterology and Hepatology from Bed to Bench*. 2013; 6(1): 14–17.
12. Monto AS, Malosh RE, Petrie JG, Thompson MG & Ohmit SE. (2014). Frequency of acute respiratory illnesses and circulation of respiratory viruses in households with children over 3 surveillance seasons. Journal of Infectious Diseases. 2014; 210(11): 1792–1799. doi:10.1093/infdis/jiu327
13. Ministry of Health of Republic Of Indonesia. *A Healthy Portrait Of Indonesia from The 2018 Basic Health Research*. Ministry of Health; 2018. Available from http://www.depkes.go.id/article/view/ 18110 200003/potret-sehat-indonesia-dari-riskesdas-2018.html.
14. Riyanto A, Listyarini AD. Relationship between Health House PHBS Behavior and the Incidence Of ARI In Toodlers in Tanjung Rejo Village, Jekulo Kudus District; 2018. Available from www.stikescendekiautamakudus.ac.id
15. Lestari ASI, Rahim R & Sakinah AI. (2022). Relationship between physical house sanitation and ARI insidence in TPA Tamangappa Antang Makassar in 2020. *Jurnal Ilmiah Multi Disiplin Indonesia*. 2022; 2(1): 133–140.
16. Janati JNA & Siwiendrayanti A. Relationship Between Physical House Environment Conditions And Parents' Habits With The Incidence Of ARI In Toddlers In Traji Health Center Work Area Temanggung Regency; 2017. Availble from http://jurnal.unikal.ac.id/index.php/medika
17. Hassen S, Getachew M, Eneyew B et al. Determinants of acute respiratory infection (ARI) among under-five children in rural areas of Legambo District, South Wollo Zone, Ethiopia: A matched case-control study. *Int. J. of Infect. Dis.* 2020; 96: 688–695. doi:10.1016/j.ijid.2020.05.012
18. Sikolia DN, Mwololo K, Cherop H et al. The prevalence of acute respiratory infections and the associated risk factors : A study of children under five years of age in Kibera Lindi Village, Nairobi, Kenya. *J Natl Inst Pubic Health*. 2012; 51(1): 67-62.
19. Mir AA, Imtiyaz A, Fazili A, Iqbal J, Jabeen R, Salathia A. Prevalence and risk factor analysis of acute respiratory tract infections in rural areas of Kashmir valley under 5 years of age. Int *J Med Public Health*. 2012; 2: 47–52. doi:10.5530/ijmedph.2.3.10
20. Goel K, Ahmad S, Agarwal G, Goel P, Kumar V. A cross sectional study on prevalence of acute respiratory infections (ARI) in under- five children of Meerut district, India. *J Community Med Health Educ.* 2012; 2:176. doi: 10.4172/2161-0711.1000176
21. Kumaresan K, Ashok B & Dhananjaya S. Prevalence of Acute Respiratory Infections (ARI) and their determinants in under five children in urban and rural areas of Kancheepuram District, South India. *Annals of Tropical Medicine and Public Health*. 2013; 6 (5): 513. doi: 10.4103/1755-6783.133700
22. Istihoroh YR, Rahayu U & Hermiyanti P. Relationship between physical house condition and incidence of acute respiratory infection (ARI) in work Area Kadur Health Center, Pamekasan Regency in 2007. *Gema Kesehatan Lingkungan*. 2018; 16(1): 9–13.
23. Sudirman, Nurul Hikma S & Akbar H. Relationship between home ventilation and types of cooking fuels with the incidence of ARI among toddlers in the Juntinyuat Health Center Work Area. MPPKI. 2020; 3(3): 187–191.
24. Aprinda DW & Soedjajadi K. Association between levels of healthy house to ARI in children under five years old. *Jurnal Kesehatan Lingkunga*. 2007; 3(2).
25. Husna, J., Mahfuz, A. S., & Hayati, R. (2015). The Relationship Between Healthy Homes and Parental Knowledge with the Incidence of ISPA in Infants in the Working Area Puskesmas Pasar Panas District East Bartito.
26. Sudirman et al. Relationship between home ventilation and types of cooking fuels with the incidence of ARI among toodlers in the Juntinyuat Health Center work area. *The Indonesian Journal of Health Promotion*. 2020; 3(3).
27. Johri A. The effect of increasing indoor ventilation on artificially generated aerosol particle counts. *PloS one*. 2021; *16*(10):

e0258382. doi: 10.1371/journal.pone.0258382

28. Yuslinda WO, Yasnani & Ardiansyah RT. (2017). The associated between the environmental conditions inside house with a cute respiratory infection (ARI) disease among community in villages of Ranomeeto subdistrct of Ranomeeto in 2017. *Jurnal Ilmiah Mahasiswa Kesehatan Masyarakat*. 2017; 2*(*6): 1–9.
29. Taha L & Ryzdayani. (2018). Physical conditions of houses with arrival disease events in the Moncobalang Puskesmas working area Barombong District, Gowa District. *Jurnal Sulolipu*. 2018; 18(1): 24-29. Available from https://journal.poltekkes-mks.ac.id/ojs2/index.php/Sulolipu/article/download/729/337
30. Darmawati AT, Elvi S & Trisnaini I. The relationship between physical factors at home and behavior with the incidence of pneumonia in children under five years old in the work area of Yosomulyo Health Center Metro City. *Jurnal Ilmu Kesehatan Masyarakat*. 2016; *7*(1): 6–13.