Relationship Of Exposure Of Air Pollution In House With Occurrence Of Acute Respiratory Infections In Children Under Five At Puskesmas Malimongan Baru in 2016

NUR INDAHSARI
Faculty of Public Health, Hasanuddin University,
Jl. Perintis Kemerdekaan Km. 10, Tamalanrea Indah, Tamalanrea, Tamalanrea Indah, Tamalanrea, Kota Makassar, Sulawesi Selatan 90245, Indonesia
indahsariyu@gmail.com

Nur Nasry Noor
Faculty of Public Health, Hasanuddin University,
Jl. Perintis Kemerdekaan Km. 10, Tamalanrea Indah, Tamalanrea, Tamalanrea Indah, Tamalanrea, Kota Makassar, Sulawesi Selatan 90245, Indonesia
nasrynoor@hotmail.com

Dian Sidik Arsyad
Faculty of Public Health, Hasanuddin University,
Jl. Perintis Kemerdekaan Km. 10, Tamalanrea Indah, Tamalanrea, Tamalanrea Indah, Tamalanrea, Kota Makassar, Sulawesi Selatan 90245, Indonesia
dian_sidiq@yahoo.com

ABSTRACT

Acute Respiratory Infections (ARI) is a major killer of children <5 years old in developing countries and has been estimated to be responsible for> 2 million deaths per year. World Health Organization (WHO) in 2013 stated that the incidence of Acute Respiratory Infections (ARI) in children under five in the world over 40 per 1,000 live births. This study aims to determine the relationship exposure indoor air pollution with ARI of toddlers in Puskesmas Malimongan Baru 2016. Design of study was observational analytic with cross sectional study, conducted in February-March 2016 Puskesmas Malimongan Baru. The population in this study were all toddlers recorded in the medical record as many as 2,500 health centers. Sampling using simple random sampling with a sample of 156 people. The results showed that there is a relationship between exposure to secondhand smoke, relationship is weak (p = 0.026, φ = 0178), exposure to household fuel, relationship is weak (p = 0048, φ=0149) exposure to mosquito coils, relationship is weak (p= 0.000, φ= 0.290) with ARI. Conclusions of research there is a relationship between exposure to air pollution in homes with ARI in infants in Puskesmas Malimongan Baru 2016.

CCS Concepts

- **Social and professional topics → User characteristics**

Keywords

ARI; air pollution; under five children

1. INTRODUCTION

Acute Respiratory Infection (ARI) is an acute infection involving upper respiratory tract and lower respiratory tract caused by viruses, fungi and bacteria. ARI will attack the host if the immune system (immunology) [1].

Toddler age is the group most susceptible to respiratory tract infections. The fact that morbidity and mortality rates from ARI are still high in infants and toddlers in developing countries, because this group is one of the groups that have immune systems that are still vulnerable to various diseases [2]. Research on the health effects that should be strengthened, especially in relation to infants, Tuberculosis and Acute Respiratory Infections [3].

Until now ARI is still a global health problem. ARI is the leading killer of children <5 years in developing countries, and has been estimated to be responsible for> 2 million deaths per year. Globally, Acute Respiratory Infections have killed 2.8 million children under the age of <5 years in 2010 [4].

Based on World Health Organization (WHO) data in 2013 reported that the incidence of Acute Respiratory Infection (ARI) in infants in the world above 40 per 1000 live births with the proportion of child mortality by 15-20%. An estimated 945,000 infant deaths were attributed to pneumonia or about 15% of 6.3 million deaths among under-fives. Then from 6.3 million underfives, 53% of them are from Africa and Southeast Asia [5].

Indonesia is one of the countries in Southeast Asia that has the highest case of ARI. It is known that toddlers are taken to health facilities and diagnosed with ISPA of 66% with the number of deaths from ARI by 17%. Acute Respiratory Infection (ARI) ranks first in illness in infants and toddlers in Indonesia [6].

Period prevalence of ARI is calculated in the past 1 month. Six provinces with the highest ISPA were East Nusa Tenggara (41.7%), Papua (33.1%), Aceh (30.0%), West Nusa Tenggara (28.9%), East Java (28.3%) and South Sulawesi (24.9%). At Riskesdas 2007, East Nusa Tenggara is also the highest province with ARI. Period prevalence of ISPA Indonesia according to Riskesdas 2013 (25.0%) is not much different from 2007 (25.5%). Characteristics of the population with the highest respiratory infection occurred in the age group 1-4 years (25.8%) [7].

Based on data of finding of ARI cases in 2013 in South Sulawesi Province, it was found that the highest incidence rate was in Makassar with 9,587 cases and lowest in Maros City with 305 cases (Health Profile prov.sulsel, 2014). Based on data obtained from the Health Service Division of Makassar City Health Office for infants (1-4) years known in 2013-2014, the number of ARI

ICHSM 2018, June 8–10, 2018, Tsukuba, Japan

ACM ISBN 978-1-4503-6435-5/18/06...$15.00
DOI: https://doi.org/10.1145/3242789.3242825

cases in under-five children increased from the number of cases 26,978 to 30,781 cases [8].

Puskesmas Malimongan Baru is one of 46 puskesmas located in Makassar City l in Bontoala Subdistrict. New Malimongan Community Health Center is included in 3 major puskesmas that have the highest ARI cases. In the year 2012 there are cases of ARI of 2777, then increased in 2013 to 2818 cases. In 2014, the number of ARI cases was 1080 cases. By 2015 there are 1008 Cases. It is known that although the prevalence of ARI from 2013-2015 has decreased, the number of ARI cases in Malimongan remains high. In fact, ARI disease is always the first rank every year in outpatient registration at Malimongan Baru Puskesmas [9]

ARI can be caused by three factors namely agent factor, individual child and environmental factors. Agent factors include viral infections, bacteria and fungi. Individual child factors include: child's age, birth weight, nutritional status, vitamin A and immunization status. Environmental factors include: indoor air pollution (cigarette smoke and fumes burning fuel for high concentration cooking), home ventilation and occupancy density [10]. One of the factors that can cause the occurrence of ARI disease is environmental factors that include air pollution in space that comes from burning fuel used for cooking, the use of mosquito repellent and cigarette smoke [2].

Air pollution in the home is responsible for 1.6 million human deaths each year and in 59% of all deaths from indoor air pollution experienced by women and children as a result of traditional fuel consumption [11]. The presence of air pollution in the home environment will damage the mechanism of defense of the lungs, thereby facilitating the occurrence of interference in the respiratory tract

Cigarette smoke and fumes burning fuel for cooking with high concentrations can damage the defense mechanisms in the lungs, thus facilitating ARIs. The results of the International Energy Agency study, states that there are 155 million people in Indonesia in 2000 still use charcoal fuel and firewood for cooking and warms. It is not surprising that currently acute respiratory tract infections account for the highest number of urban and rural health centers in Indonesia [12]. The Global Burden of Disease Study 2010, published in 2012 estimates that air pollution caused by the use of solid fuels for cooking and heating in households causes 4 million premature deaths each year [13].

Smoking habits of parents in the home make toddlers as passive smokers are always exposed to cigarette smoke. Homes whose parents have a smoking habit have a chance of increasing the incidence of ISPA by 7.83 times compared with toddlers whose parents do not smoke in the house. Meanwhile, the number of smokers in a family is quite high [14].

Associated with the description of the background, the authors are interested to conduct research To determine the relationship of exposure to air pollution in the home with the incidence of ARI in infants at the working area of the new Puskesmas Malimongan 2016.

2. METHODOLOGY

2.1 Research Type

This type of research is an observational analytic research with cross sectional study approach.

2.2 Location and Time of Study

Data collection was conducted from April to June 2015 at 3 (three) health centers in Keerom Regency of Papua Province, namely , Puskesmas Arso III representing rural area , Puskesmas Waris represent remote area and Puskesmas Ubrub represent very remote area.

2.3 Population and Sample

The population in this research is all the children under five years old, which are aged 1- <5 years registered in health record of health center. Based on the large calculation of samples conducted based on the sample formula [15] obtained the number of samples were 156 toddlers.

2.4 Data Collection

Primary data were collected by questionnaire on the respondent (parent / caregiver of the toddler) in the form of a list of closed questions, whether about exposure to cigarette smoke, exposure to household fuels and exposure to mosquito repellent. Secondary data was obtained from recording and reporting at Malimongan Baru Public Health Center in 2016, Makassar City Health Office, Department of Health, South Sulawesi Provincial Health Office and other related institutions

2.5 Data Analysis

Data processing and analysis was done using SPSS 22 application. Bivariate analysis was done. Bivariate analysis is an analysis performed on two variables that correlate or correlate by using Chi square test. In this case, if the sample is large enough, then the calculation can be done with Chi square formula commonly used in contingency table 2 x 2 in general can be described (Budiarto, 2001). Bivariate analysis see the value of Pvalue, If the value of p <0.05 then null hypothesis rejected and alternative hypothesis accepted, whereas if the value p> 0.05 then the value of null hypothesis accepted means alternative hypothesis is rejected.

3. Result and Discussion

3.1 Exposure Relationship of Cigarette Smoke with ARI Occurrence

Exposure to cigarette smoke in this study is the presence of cigarette smoke coming from household members, meaning that if there are household members who smoke in the home then it can be exposed to infants exposed, as well as vice versa. Infants exposed and unexposed if associated with ARD events in infants, can be seen on the table 1. Results showed that of the 122 infants suffering from ARI most exposed to tobacco smoke as many as 115 people (80.4%) while those who were not exposed only 7 people (53.8%). As of 34 infants who are not ARI exposed to cigarette smoke as much as 28 people (19.6%) while those who are not exposed to cigarette smoke as much as 6 people (46.2%). The result of chi-square test analysis obtained p value = 0.026 (<0.05) so it can be concluded that there is correlation between exposure of cigarette smoke with the incidence of ARI in infants at working area of Puskesmas Malimongan Baru 2016. Then known value of ϕ (Phi) equal to 0.178 this means strong relationship between exposure variables of cigarette smoke with the incidence of weak ARI. Can be known there is a contribution of 17.8% of cigarette smoke can increase the incidence of ARI in infants.

Table 1. Exposure Relationship of Cigarette Smoke with ARI Occurrence in Infants

Exposure to Cigarette smoke	ARI Occurrence							
	Yes		No		Total		P value	φ
	n	%	n	%	n	%		
Exposed	115	80.4	28	19.6	143	100		
Not Exposed	7	53.8	6	46.2	13	100	0.026	0.178
Total	122	78.2	34	21.8	156			

3.2 Exposure Relationship of Cooking Fuel Households with ARI Occurrences

Exposure to household cooking fuel is exposure to fumes resulting from burning household fuels, said to be exposed if respondents use biomass fuel, such as charcoal, wood, and kerosene. While those not exposed if respondents do not use biomass fuel. When associated with ARD of infants, it can be seen in the Table 2. Result showed that out of 122 children under five suffering from ARI were not exposed to household biomass cooking of 104 people (75.9%) while those exposed to biomass fuel were only 18 (94.7%). As for 34 under-five children who do not have the most respiratory diseases that are not exposed to household biomass fuel as much as 33 people (24.1%) while those exposed only 1 person (5.3%). Fisher's exact test results obtained p value = 0.048 (<0.05) so it can be concluded that there is a relationship between exposure to household fuels with the incidence of ARI in infants at the working area Puskesmas Malimongan Baru 2016.Then it is known that the value of ϕ (Phi) of 0.149 this means strong relationship between variable use of biomass fuel with the incidence of weak ARI. It can be seen that a contribution of 14.9% of the use of biomass fuel can increase the incidence of ARI in infants

Table 2. Exposure Relationship of Cooking Fuel Households with ARI Occurrences in Infants

Exposure to Cooking Fuel	ARI Occurrence							
	Yes		No		Total		P value	φ
	n	%	n	%	n	%		
Exposed	18	94.7	1	5.3	19	100		
Not Exposed	104	75.9	33	24.1	137	100	0.048	0.149
Total	122	78.2	34	21.8	156			

3.3 Exposure Relationship of Mosquito Drugs with ARI Occurrences

Exposure to mosquito repellent is exposure to smoke from the burning of mosquito repellent by respondents. It is said to be exposed if respondents use mosquito coils and spray while those who are not exposed if respondents do not use mosquito repellent, or respondents use mosquito repellent but in the form of lotion and electric. If related to ARI occurrence in toddler, can be seen in table 3. Result showed that out of the 122 infants suffering from ARI most are exposed to mosquito repellent as much 96 people (85.7%) while those who are not exposed to mosquito coil only 26 people (59.1%). As for 34 under-five children who are not at most ARI are not exposed to mosquito repellent as much as 18 people (40.9%) while those exposed to mosquito repellent are only 16 people (14.3%). Chisquare test results obtained p = 0.000 (<0.05) so that it can be concluded that there is a relationship between the exposure of mosquito repellent with the incidence of ARI in infants at the working area of area Puskesmas Malimongan Baru 2016.Then it is known value of ϕ (Phi) of 0.290 this means strong relationship between variables use of mosquito coils and spray with the incidence of mild respiratory infection. So it can be seen there is a contribution of 29.0% of mosquito coils and spray can increase the incidence of ARI in infants.

Table 3. Exposure Relationship of Mosquito Drugs with ARI Occurrences in Infants

Exposure to Mosquito Drugs	ARI Occurrence							
	Yes		No		Total		P value	φ
	n	%	n	%	n	%		
Exposed	96	85.7	16	14.3	112	100		
Not Exposed	26	59.1	18	40.9	44	100	0.000	0.290
Total	122	78.2	34	21.8	156			

3.4 Low Birth Weight Relationship with ARI Occurrence.

Birth Weight in this study was classified into 3 categories: Low Birth Weight (LBW), Normal weight, and obesity. Low Birth Weight is a toddler who has birth weight <2500 grams. The relationship between LBW and ARI of Infants at toddlers can be seen in the table 4. Based on Table 4, it shows that under five LBW are 15 people. It is known that most children suffering from ISPA are 11 0rang (73.3%) while those who do not have ARI are only 4 people (26.7%). Wilcoxon test analysis results obtained p = 0.000 (<0.05) so it can be concluded that there is a relationship between LBW and LBW incidence in toddlers in the working area of Puskesmas Malimongan Baru 2016. Then it is known value ϕ (Phi) of 0.057 this means strong relationship between variable use of LBW with the incidence of weak ARI. So it can be seen there is a contribution of 5.7% LBW can increase the incidence of ARI in infants.

Table 4. Low Birth Weight Relationship with ARI Occurrence in Infants

Low Birth Weight	ARI Occurrence							
	Yes		No		Total		P value	φ
	n	%	n	%	n	%		
Yes	11	73.3	4	26.7	15	100		
No	111	71.2	30	28.8	141	100	0.000	0.057
Total	122	78.2	34	21.8	156			

3.5 Overall Discussion

ARI (Acute Respiratory Tract Infection) is a major disease that can cause morbidity and mortality in children. ARI can be caused by 3 factors: agent factor, individual child and. Environmental Factor [10]. One factor of the three factors is Environmental Factor, which according to Kusnuputranto [2] that environmental factors that can cause ARI is Air Pollution in space that comes from burning household cooking fuel, The use of mosquito repellent and cigarette smoke. In some studies conducted found that ARI disease more attacking Toddler Age, namely: 1-5 years [7].

Cigarette smoke can damage the lining of the child's airway, so that its defense mechanism against infectious diseases is disrupted. In addition to infectious diseases due to infection, cigarette smoke can also lead to decreased lung function. According to the World Health Organization (WHO) cigarettes is an addictive substance that contains approximately 4000 elements, of which 200 elements in it are harmful to the health of the body adding that the main and harmful toxins in cigarettes include tar, nicotine and carbon monoxide. endanger the health of the smoker [6]

This is in line with research conducted by Thapa P, et al [16] In Toddlers in Nepal who stated that among 198 children 79 (39.9%) were passive smokers, in which family members smoked in the house. Of 79 under-fives, there are 60 (85,7%) infants suffering from ARI (Acute Respiratory Infection).

ARI is the most common disease in children. One of the causes of ARI is air quality pollution indoors such as burning fuel used for cooking that produces kitchen fumes. Fuel for cooking is the type of fuel used for cooking, consisting of gas stove / LPG, kerosene stove, and wood [2].

This is in line with research by K Ram, et.al [17] (study conducted in Bhaktapur, Nepal stating that the use of biomass cooking fuel is associated with ARI events. Use of kerosene stove (OR = 1.87, 95%) Use of wood, kerosene, or coal (OR = 1,45; 95%). Studies performed by Leonarte et al .[18] in Calcutta in children between 2-35 months of age showed a clear correlation between fuel use and ARI occurrence (OR = 3.97; 95% IC 2.00-7.88

Mosquito repellent is a tool to avoid mosquito bites. Mosquito repellent can be mosquito coil, spray, electric, and lotion. Continuous use of mosquito repellent can cause respiratory tract disorders because it produces smoke and unpleasant odors. The presence of air pollution in the home environment will damage the defense mechanism of the lungs, thus facilitating the occurrence of respiratory problems [19]

This is in line with the research conducted by Mairuhu, et al [20] showed that there is a relationship between the behavior of mosquito repellent with the incidence of ARI in toddlers that there are 51 (87.9%) of respondents using mosquito repellent have ISPA toddler, of 0.026, where ($p < 0.05$). This means there is a relationship between the use of mosquito repellent with the incidence of ARI in toddlers.

4. Conclusion

This study was done to analyze the relationship of exposure to air pollution in the home with the incidence of ARI in infants at the working area of Malimongan Baru Public Health Center in 2016. Based on the results of this study, it can be concluded that there is a relationship between exposure to cigarette smoke, exposure to household fuels and exposure to mosquito repellent with the incidence of ARI in infants at the Working Area of Malimongan Baru Puskesmas in 2016.

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5. REFERENCES

[1] Probowo, S. (2012). Penyakit yang Paling Umum pada Anak. Majalah Kesehatan,(Online) http://majalahkesehatan. com/penyakit-yang-paling-umum-pada-anakbag-1/Diakses, 27.

[2] Kusnoputranto, H. (2000). Kesehatan lingkungan. Fakultas Kesehatan Masyarakat Universitas Indonesia. Jakarta.

[3] Pérez-Padilla, R., Schilmann, A., & Riojas-Rodriguez, H. (2010). Respiratory health effects of indoor air pollution. *The International Journal of Tuberculosis and Lung Disease*, *14*(9), 1079-1086.

[4] Lozano, R., Naghavi, M., Foreman, K., Lim, S., Shibuya, K., Aboyans, V., ... & AlMazroa, M. A. (2012). Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *The lancet*, *380*(9859), 2095-2128.

[5] UNCs, F. (2014). Levels and trends in child mortality: Report 2014. *New York: United Nations Children's Fund*.

[6] World Health Organization. (2014). Children: reducing mortality= Enfants: réduire la mortalité. *Wkly Epidemiol Rec*, *89*(38), 418-420.

[7] Kesehatan, D., & RI, K. K. (2013). Riset kesehatan dasar. Jakarta: Badan Penelitian dan Pengembangan Kesehatan Departemen Kesehatan Republik Indonesia.

[8] Makassar, D. K. (2013). Laporan Tahunan Dinas Kesehatan Kota Makassar. *Makassar: Dinas Kesehatan Kota Makassar*.

[9] Choiriyah, S., & Anggraini, D. N. (2015). Evaluasi Input Sistem Surveilans Penemuan Penderita Pneumonia Balita Di Puskesmas. *Unnes Journal of Public Health*, *4*(4).

[10] Nazaroff, W. W. (2013). Exploring the consequences of climate change for indoor air quality. *Environmental Research Letters*, *8*(1), 015022.

[11] Dherani, M., Pope, D., Mascarenhas, M., Smith, K. R., Weber, M., & Bruce, N. (2008). Indoor air pollution from unprocessed solid fuel use and pneumonia risk in children aged under five years: a systematic review and meta-analysis. *Bulletin of the World Health Organization*, *86*(5), 390-398C.

[12] Kasnodihardjo, K., Prasodjo, R., & Musadad, D. A. (2009). Gambaran Perilaku Masyarakat Kaitannya Dengan Penularan Dan Upaya Pengendalian Penyakit Berbasis Lingkungan Di Kabupaten Sukabumi, Provinsi Jawa Barat. *Jurnal Ekologi Kesehatan*, *8*(4 Des).

[13] Zhang, J. J., & Smith, K. R. (2007). Household air pollution from coal and biomass fuels in China: measurements, health impacts, and interventions. *Environmental health* perspectives, 115(6), 848.

[14] Fillacano, R. (2013). Hubungan lingkungan dalam rumah terhadap ISPA pada BALITA di Kelurahan Ciputat Kota Tangerang Selatan Tahun 2013.

[15] Lemeshow, S., Hosmer, D. W., Klar, J., Lwanga, S. K., & World Health Organization. (1990). Adequacy of sample size in health studies.

[16] Thapa, P., Basel, P., Shrestha, I. B., Adhikari, N., Wagle, R. R., & Amatya, A. (2014). Household passive smoking and acute respiratory infection among under-five children attending Kanti Children's Hospital. *Journal of Nepal Health Research Council*.

[17] Bates, M. N., Chandyo, R. K., Valentiner-Branth, P., Pokhrel, A. K., Mathisen, M., Basnet, S., ... & Smith, K. R. (2013). Acute lower respiratory infection in childhood and household fuel use in Bhaktapur, Nepal. *Environmental health perspectives*, *121*(5), 637.

[18] Fuentes-Leonarte, V., Ballester, F., & Ten ás, J. M. (2009). Sources of indoor air pollution and respiratory health in preschool children. *Journal of environmental and public health*, *2009*.

[19] Rahajoe, N. N., Supriyatno, B., & Setyanto, D. B. (2008). Buku ajar respirologi anak. *Ed*, *1*, 350-365.

[20] Mairuhu, V. (2012). Faktor Yang Berhubungan Dengan Kejadian ISPA Pada Balita Di Pulau Barrang Lompo Kecamatan Ujung Tanah Kota Makassar. *Universitas Hasanuddin Makassar*.