Smoke Exposure at Home to the Incidence of Pneumonia in Children Under 5 Years Old

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Abstract

Increased levels of pollutants in the room, apart from the penetration of outdoor pollutants, can also come from indoor pollutant sources such as cigarette smoke, smoke from using firewood, and the use of mosquito coils. Pneumonia is the ultimate overlooked child killer (*major "forgotten killer of children"*). In Klaten District, pneumonia cases in the last 3 years have increased, 1,068, 1,244, and 1,705. This study was to determine the relationship between the incidence of pneumonia and exposure to smoke at home in children under 5 years of age in Klaten Regency, Central Java Province. This type of research is observational analytic with case-control studies. The total sample of 278 (139 cases and 139 controls) children under 5 years of age resided in Klaten Regency and were recorded as pneumonia cases in the public health care register in 2012 that met the inclusion and exclusion criteria. The research instrument consisted of a structured questionnaire. The results of data analysis showed that the relationship with the incidence of pneumonia in children under five was the variable exposure to cigarette smoke (OR=2,053; *p*=0,017 and 95% CI=1,137-3,705) and exposure to kitchen smoke (OR=2,664; *p*=0,003 and 95% CI=1,4002-5,0680). Factors associated with the incidence of pneumonia in children under 5 years of age in Klaten Regency, Central Java Province are exposure to cigarette smoke and exposure to kitchen smoke.

Keywords: *Risk factors, pneumonia, toddler*

Introduction

The goal of health development that has been listed in the National Health System is an effort to implement health by the Indonesian nation to obtain the ability to live a healthy life for every community to achieve an optimal health degree, which is said to indicate that the increase in the degree of public health is influenced by several factors, namely the environment, health services, actions and congenital (congenital)[1].

Environmental conditions can affect public health conditions. Many aspects of human well-being are influenced by the environment, and many diseases can be initiated, supported, sustained, or stimulated by environmental factors. This means that the interaction between humans and their environment is an important component of health because humans need the carrying capacity of environmental elements for their survival, for example, air, water, food, clothing, and all human needs must be taken from their environment. Human health can only be affected by environmental conditions if the human is exposed to environmental factors at a level that cannot be tolerated[2,3].

The house plays a very important role in human life, where the values of a family take place, it becomes a human space to express how to live, communicate, interact with the people closest to them. The housing and settlement problems in Indonesia are rooted in the shift

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in population concentration from rural to urban areas. The growth of the urban population in Indonesia is quite high, around 4% per year, higher than the national growth, and tends to continue to increase[4,5].

Indoor air pollution can be very dangerous because the source is in direct proximity to humans. In developing countries, an important problem of indoor air pollution is pollution in the house due to cooking or burning wood for heating without adequate chimneys. Other pollutants that hurt health are O3, ionizing radiation, and cigarette smoke. WHO estimates that every year there are about three million cases due to indoor air pollution and 0.2 million due to outdoor pollution[6].

Based on research from the American College of Allergies, about 50% of diseases are caused by indoor air pollution. The United States Environmental Protection Agency (US EPA) states that indoor air pollution is two to ten times more dangerous than outdoor air. Scientific America reports that a baby crawling on the floor inhales carpet dust, mold, mildew, mites, etc. the equivalent of smoking four cigarettes a day. More than 90% of people spend their time indoors so indoor air pollution has more dangerous health impacts than outdoor air pollution[7].

Increased levels of pollutants in the room, apart from the penetration of outdoor pollutants, can also come from indoor pollutant sources such as cigarette smoke, smoke from using firewood, and the use of mosquito coils. Pneumonia is one of the causes of high morbidity and mortality in children under five years of age (toddlers) in developing countries. Nineteen percent of deaths of children under five are caused by pneumonia. Three-quarters of pneumonia cases in the world are found in 15 countries and Indonesia is in the sixth rank[5,8].

According to WHO and UNICEF, pneumonia is the major "forgotten killer of children". Pneumonia is a higher cause of death when compared to the total deaths due to AIDS, malaria, and measles. Every year, more than 2 million children die from pneumonia, meaning 1 in 5 children under five dies in the world. Pneumonia is the most common cause of death, especially in countries with high mortality rates. Almost all deaths from pneumonia (99.9%), occur in developing and less developed countries (*least developed*)[9,10].

Indonesia is one of the 15 countries and occupies the 6th place with 6 million cases. The Household Health Survey (SKRT) from the Ministry of Health in 1992, 1995, and 2001 showed that pneumonia had a major contribution to infant and child mortality. Whereas in the basic health research (Riskesdas) in 2007, pneumonia was in 2nd place as the cause of death for infants and toddlers after diarrhea and was in 3rd place as the cause of death in neonates[11].

Material and Method

This type of research is an observational analytic study with case-control study design. The population in this study were all children under 5 years of age suffering from pneumonia in 3 sub-districts in rural areas and 2 sub-districts in urban areas and visited each Public health center.

The research locations were in 5 sub-districts, namely Pedan (Pedan Public health center), Tulung (Tulung and Majegan Public health center), gantiwarno (Switchwarno Public health center), Klaten Selatan (Klaten Selatan Public health center), and Kalikotes (Kalikotes Public health center). The population in this study were 139 cases and 139 controls. Data analysis of the research results was carried out in 3 stages, a namely univariate analysis which aims to describe the phenomena found, both in the form of risk factors and effects or results, bivariate analysis to determine the relationship of research variables to the incidence of pneumonia used the Mc Nemar test and multivariate analysis was carried out. with the conditional logistic regression multiple tests to find evidence that the independent variables are related to the dependent variable which is measured together.

Findings

Table 1. Description of Respondents According to Smoke Exposure at Home in Klaten Regency

Variable	Case		Control		Total		p
	n	%	n	%	n	%	
Cigarette smoke exposure							
Yes	84	60,4	62	44,6	146	52,5	0,008
No	55	39,6	77	55,4	132	47,5	
Total	139	100	139	100	278	100	
Mosquito coils exposure							
Yes	83	59,7	69	49,6	152	54,7	0,092
No	56	40,3	70	50,3	126	45,3	
Total	139	100	139	100	278	100	
Kitchen smoke exposure							
Yes	49	35,3	24	17,3	73	26,3	0,001
No	90	64,7	115	82,7	205	73,7	
Total	139	100	139	100	278	100	

Table 2. Relationship Between The Incidence of Pneumonia and Smoke Exposure at Home in Children Under 5 Years Old in Klaten District

Case	Control		Total	OR	95% CI	p
	FR (+)	FR (-)				
Cigarette smoke exposure						
Yes (FR +)	45	39	84	2,3	1,267-4,325	0,0046
No (FR -)	17	38	55			
Total	62	77	139			
Mosquito coils exposure						
Yes (FR +)	46	37	83	1,6	0,931-2,836	0,0925
No (FR -)	23	33	56			
Total	69	70	139			
Kitchen smoke exposure						
Yes (FR +)	11	38	49	2,9	1,523-5,980	0,0006
No (FR -)	13	77	90			
Total	24	115	139			

Table 3. Multivariate Analysis (Multiple Conditional Logistic Regression) Relationship Between Pneumonia Incidence and Smoke Exposure at Home in Children Under 5 Years Old in Klaten Regency

Variable	OR	SE	Z	p-value	95% CI	Pseudo R2	LR	Prob>Chi2
Model 1						0,1042	20,08	0,0002
Cigarette smoke exposure	2,04	0,617	2,35	0,019	1,127-3,689			
Mosquito coils exposure	1,372	0,39	1,11	0,266	0,786-2,394			
Kitchen smoke xposure	2,51	0,84	2,77	0,006	1,308-4,821			
Log-likelihood	-86,304995							
Model 2						0,0977	18,84	0,0001
Cigarette smoke exposure	2,053	0,619	2,39	0,017	1,137-3,705			
Kitchen smoke xposure	2,664	0,87	2,99	0,003	1,400-5,068			
Log-likelihood	-86,929877							

Discussion

Cigarette Smoke Exposure

Cigarette smoke is categorized as the most dominant cause of indoor air pollution. In a closed room, smoke collects with a concentration that varies according to the number of smokers in the room, the type of cigarette, the number of cigarettes smoked, and the characteristics of the room such as size, ventilation, temperature, and humidity. Smoking is not only dangerous for the health of the smoker but also dangerous for those around him who are accidentally exposed to the smoke (passive smoking), especially children who still have low immunity. Besides being carcinogenic, cigarette smoke can also cause airway irritation by sulfur dioxide, ammonia, and formaldehyde[12,13].

Based on research in Klaten Regency, the results of the bivariate analysis showed that there was a significant biological and statistical relationship between cigarette smoke exposure and the incidence of pneumonia with p = 0.0046 at α = 5% (0.05); OR = 2; and 95% CI = 1.267-4.325, so that continued with multivariate analysis obtained p-value = 0.017; OR = 2.053; and 95% CI = 1.137-3.705, which means that there is a significant relationship between exposure to cigarette smoke and the incidence of pneumonia. The magnitude of the risk can be seen from the OR = 2.053 value, which means that children exposed to cigarette smoke will have an increased risk of developing pneumonia by 2.053 times greater than children who are not exposed to cigarette smoke.

Mosquito Coils Exposure

Most of the Indonesian people still use mosquito coils to repel mosquitoes because the price of mosquito coils is relatively cheaper. Mosquito repellent is very dangerous for our body, especially mosquito coils. Mosquito repellent includes drugs that contain toxic chemicals and are very harmful to the body when the

smoke is inhaled. Mosquito repellent is dangerous for humans because of the active ingredients belonging to the organophosphate group such as Dichlorovynil dimethyl phosphate (DDVP), Propoxur (Carbamate), and Diethyltoluamide, which are a type of insecticide that kill insects that are carcinogenic[14,15].

The toxic content of mosquito repellents depends on the concentration of the poison and the amount of use and the effect on the body depends on the type, amount, age of use, and the ingredients of the mixture. Children are vulnerable to mosquito repellents because their organs are not yet perfect and their immune systems are not yet good. The active ingredients of the mosquito repellent will enter the body through the breath and the skin and then circulate in the blood and then spread to the body's cells such as respiration, brain (through the central nervous system), and others. The greatest effect will be experienced by sensitive organs. Because, mosquito repellent is more about inhaled, so what is usually affected is breathing. Meanwhile, the side effects on the skin depend on the sensitivity of the skin. Disturbances in human organs will occur if the use of insect repellent is not controlled or the dosage is excessive. People who have allergies will react more quickly. The most common allergies usually affect the airways, causing a cough[16,17].

The human airway is equipped with an epithelium or airway lining which has cilia like vibrating hairs that function to expel something. Cilia will react to secretions (mucus fluid) and foreign objects in the airway that will be expelled upward, however, the chemicals in mosquito repellents consist of active, irritating substances so that the epithelial cells and cilia are more easily damaged. If the epithelium and cilia are damaged, foreign objects cannot be removed. Besides, the cells under the epithelium will also be affected as a result, mucus will be released. Furthermore, the airway becomes contracted because the nerves are disturbed, resulting in coughing and difficulty breathing[16,18].

Based on research in Klaten Regency, the results of the bivariate analysis showed that there was no significant biological or statistical relationship between exposure to mosquito coil smoke and the incidence of pneumonia with p = 0.0925 at α = 5% (0.05); OR = 1.6; and 95% CI = 0.931-2.836 because the p-value <0.25, then continued with multivariate analysis, the results obtained were p = 0.266 OR = 1.37 and 95% CI = 0.786-2.394 which means that there is no significant relationship between exposures. mosquito coils with incidence of pneumonia. The magnitude of the risk can be seen from the OR = 1.37, which means that children exposed to mosquito coil smoke will increase the risk of developing pneumonia by 1.37 times greater than children who are not exposed to mosquito coil smoke.

Kitchen Smoke Xposure

Based on research in Klaten Regency, the results of the bivariate analysis showed that there was a significant biological and statistical relationship between exposure to kitchen smoke and the incidence of pneumonia with a value of p = 0.0006 at α = 5% (0.05); OR = 2.9; and 95% CI = 1,523-5,980, so that continued with multivariate analysis obtained p-value = 0.003, OR = 2,664 and 95% CI = 1,400-5,068, which means that there is a significant relationship between exposure to kitchen smoke and the incidence of pneumonia. The magnitude of the risk can be seen from the OR = 2,664, which means that children who are exposed to kitchen smoke will have an increased risk of developing pneumonia by 2.664 times greater than children who are not exposed to kitchen smoke. This study was different from Salam (2006), which showed that there was no significant relationship between exposure to kitchen smoke and the incidence of pneumonia with p = 0.157; OR = 3.328, and 95% CI = 0.630-17.596.

Air pollution from burning traditional kitchen biomass (wood, charcoal, straw, former harvest) is a public health risk. Smoke pollutants produced from combustion are very dangerous to health and will cause various kinds of diseases, especially if the ventilation does not meet health requirements. Diseases that can be caused include ARI, asthma, lung cancer, cataracts, and tuberculosis. The smoke and soot when inhaled enter the respiratory tract to the lining of the lungs (mesothelium) so that the respiratory system will shrink (spasm), as a result, the elasticity of the lungs will decrease and the vascular pressure will increase. Biomass stoves produce pollutants, including carbon monoxide. Carbon monoxide is poison gas. The concentration of CO in the kitchen using biomass can reach 100 ppm per hour, far above the threshold set by the World Health Organization

(WHO) of 25 ppm.[19–21]

Conclusion

Based on the results and discussion of research, the relationship between the incidence of pneumonia and exposure to smoke in the home in children under 5 years of age in Klaten Regency can be concluded as follows: The research variable that was not statistically significant for the incidence of pneumonia in Klaten was exposure to mosquito coil smoke.

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Ethical Clearance: The study was approved by the institutional Ethical Board of Ibn Khaldun University.

All subjects were fully informed about the procedures and objectives of this study each subject before the study signed an informed consent form.

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