

HOW CAN CHILD WITH ASTHMA EXACERBATIONS ATTACK IN HOME?

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Abstract

Household air pollution is strongly influenced by physical environmental characteristics of the house and its inhabitants' behaviour. Long-term exposure to air pollution has an effect on public health. The aims this study was to analyse the influence of household environment and exposure tobacco smoke on asthma exacerbation risk in child. This study used an observational cohort, children in Surakarta with asthma aged 12-18 years. The researchers used self-reported observation to find demography, activity or behaviours room cleanliness, enable ventilation and smoking behaviour. In addition, researchers used Asthma Control Test (ACT). Survival analysis was conducted by using Cox Proportional Hazard Model with 95%. The results showed that the respondent's an unhealthy house category 71 (62.3%), the habit of doing house cleaning 82 (71.9%) and functioning of ventilation 89 (78.1%) and family habits of smoking indoors (61.4%). During the study period, it was known that the attack status (event) was 57%, and the sensor was 43%. Children who live in unhealthy homes experience 48 children (73.85%) of exacerbation asthma attacks significant ($p=0.009$) and increase the risk of exacerbation of asthma (HR = 2.00, 95% CI= 1.148-3.483, $p = 0.014$), and tobacco smoke exposure increased the incidence of asthma exacerbation attack in children (HR= 2.85, 95% CI=1.691-4.809), $p=0.001$. Household physical environments and exposure to tobacco smoke increased the risk of asthma exacerbation attacks in children. Therefore, its necessary to be done is to maintain ventilation, temperature, humidity, room lighting according to quality standards and healthy occupant behaviour.

Keywords: Household Air Pollution, Child, Asthma Exacerbations

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INTRODUCTION

Air quality in households is influenced by several family activities, for example, using cooking fuel, keeping pets and smoking. These activities produce pollutants such as particulate matter smaller than 2.5 μm (PM_{2.5}), carbon monoxide (CO), carbon dioxide (CO₂), nitrogen dioxide (NO₂) and endotoxin [1]. Recent research on deaths and disability-adjusted life years (DALYs) showed that 3,478,773 deaths were caused by household air pollution, 3,223,540 deaths were caused by ambient particulate matter pollution, and 773,030 deaths were caused by other environmental risks [2]. More than 75-90% of children spend their time indoors. Therefore, it is possible that they inhale these pollutants [1], [3]-[7].

The health effects that will occur after an exposure to these pollutants are irritation of the eyes, nose, throat; headache; dizziness; and fatigue. Such direct effects are usually short-term and treatable. Sometimes, the treatment is only done by removing exposure from sources of pollution. However, if exposure to pollutants occurs continuously and in the long run, it will have an impact in the form of several diseases, for example, respiratory disease, heart disease, and cancer. In addition, it will worsen or trigger an asthma attack. Various allergens, air irritants, and infections in the room trigger asthma exacerbation [7]-[9]. The Committee on the Assessment of Asthma and Indoor Air of the Institute of Medicine (IOM), reviews and summarizes scientific evidence that there is sufficient evidence of the relationship between indoor air exposure and the development of asthma exacerbation [4].

Pollutants in the household environment often occur in solid or particle forms, houses using peat fuel for cooking have PM_{2.5} concentration about twice that of ambient air, while smokers have PM_{2.5} concentration about more than ten times of ambient air [10]. Exposure to Environment Tobacco Smoke (ETS) in households can increase asthma attacks in children and adults. From 2005 to 2010, 53.2% of US children and adolescents with asthma were exposed to environmental tobacco smoke. Mothers

who smoke have 4 times increase in response to histamine, and 13% decrease in pulmonary function, the effect is even greater for children who are suffering from asthma with high cotinine urine values, who have 1.8 times increase in the risk of acute asthma exacerbation. There is sufficient evidence of a relationship between ETS exposure with asthma exacerbation in pre-schoolers [4], [11]-[13].

This study examines new evidence regarding the characteristics of household environments and exposure to environmental tobacco smoke to the severity of asthmatics, especially children, through survival analysis. We hypothesize that asthmatics living in unhealthy houses and living with smokers in their houses will have low survival rate so that they tend to experience asthma exacerbation faster.

METHOD

This research was used observational research with a cohort design for 3 months in 114 asthmatic children aged 12-18 years based on medical records in three pulmonary referral hospitals in the Surakarta area, namely Dr. Moewardi Surakarta Hospital, Community Lung Health Centre (BBKPM) of Surakarta, and Community Health Centre (Balkemas) of Klaten. Demographic data on activities in using cooking fuel, keeping pets, and smoking behaviour at house were collected based on the reported questionnaire. In addition, an examination on the physical environment of the house such as lighting, temperature, humidity and ventilation is carried out. To get clinical data on an exacerbation asthma attack, the researchers used the Asthma Control Test (ACT). Kaplan-Meier method was used to find out the probability and survival analysis graph of the independent variables for the dependent variable. Multivariate analysis was a using cox regression with 95% of confidence interval with [14].

RESULTS AND DISCUSSION

Based on the medical record from three hospitals namely Dr. Moewardi Surakarta Hospital, Community Lung Health Centre (BBKPM) of Surakarta, and Community Health Centre

(Balkesmas) of Klaten from January 2016 to March 2017, asthma patients were found in 726 children. The research samples were used according to criteria for 114 children. The detailed

description of demographic, socioeconomic, house environment and smoking behaviour characteristics was shown in table 1.

Table 1. Demographic characteristics of the study population

Variables		Event		Sensor		X ²	Log Rank (p-value)
		n	%	n	%		
Age							
	12-15	30	46.15	32	65.31	3.350	0.067
	16-18	35	53.85	17	34.69		
Sex							
	Woman	40	61.54	20	40.82	3.407	0.065
	Man	25	38.46	29	59.18		
Education							
	Elementary	32	49.23	33	67.35	5.351	0.069
	High School	29	44.62	15	30.61		
	Higher Education	4	6.15	1	2.04		
Income							
	< Rp1,418,000	41	63.08	24	48.98	2.361	0.124
	≥ Rp1,418,000	24	36.92	25	51.02		
Parents' Occupation							
	Civil Servant (PNS)/Indonesian Armed Forces (TNI)	6	9.23	7	14.29	0.604	0.437
	Private sector employee	21	32.31	17	34.69		
	Farmer	11	16.92	6	12.24		
	Labourer	27	41.54	19	38.78		
Ventilation							
	Exist, > 10%	52	80.00	45	91.84	2.900	0.089
	Exist, < 10%	13	20.00	4	8.16		
Keeping pet							
	Yes	33	50.77	20	40.82	0.681	0.409
	No	32	49.23	29	59.18		
Physical Environment of the House							
	Not Healthy	48	73.85	23	46.94	6.765	0.009
	Healthy	17	26.15	26	53.06		
ETS							
	House with smoke	44	67.69	13	26.53	18.283	0.001
	House without smoke	21	32.31	36	73.47		

Table 2. Hazard Ratio (HR) and 95% Confidence Interval (CI) for Asthma Exacerbation

No	Variables	Cox Regression		
		HR	p - value	95% CI
1	ETS of the house	2.852	0.001	1.691 - 4.809
2	Healthy House	2.001	0.014	1.148 - 3.483

HR: hazard ratio, CI: confidence interval

The median survival during the study period for all groups, whether exposed to ETS or not was 10 weeks (Fig. 1), indicating asthma exacerbation patients would experience an attack in week 10. Specifically, for asthma patients exposed to ETS, they would

experience asthma exacerbation attack faster, which was in week 8. On the other hand, those who were not exposed to ETS would experience asthma exacerbation attack in more than 12 weeks.

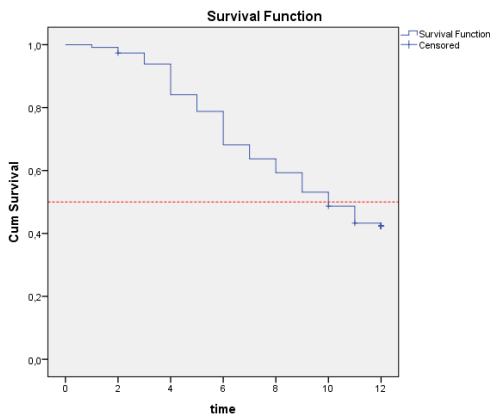


Figure 1 Survival curve for asthma exacerbation for all group

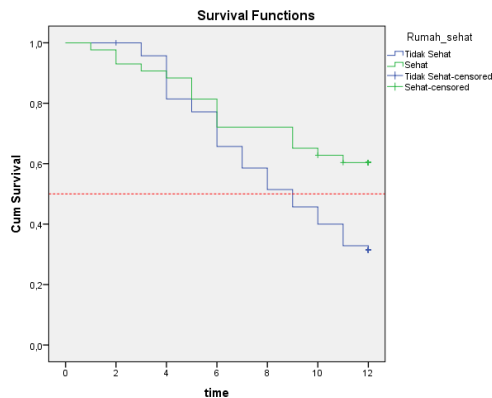


Figure 2 Survival curve for asthma exacerbation and Household.

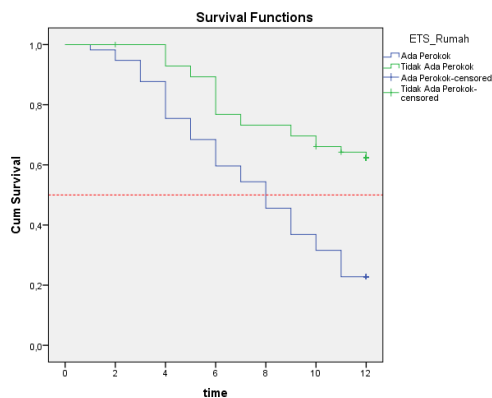


Figure 3 Survival curve for asthma exacerbation and ETS

Smoker activity in the house causes exposure to Environment Tobacco Smoke (ETS) in the household. At the time of smoking, nicotine and particulates in the tobacco were distilled and sucked, then they were released with smoke. The smoke from the burning of tobaccos did not just evaporate into the air, but nicotine in the form of particles will experience aerodynamics or settle to the surface of the room so that it attached to dust or objects around us, such as clothes, carpets, walls, furniture or chairs. This nicotine dust would not disappear in a short time so that it would be inhaled by other people even though the smoker has left the place [15], [16].

A person who inhales nicotine allergens would experience

sensitization phase, namely the person's IgE antibodies increase. Nicotine then binds to IgE antibodies that attach to mast cells and cause these cells to degenerate to emit various kinds of mediators. Some mediators that were released were histamine, leukotriene, eosinophil factor. This would cause the effect of local edema on the small bronchiole wall, thick mucus secretions in the lumen of the bronchioles, and smooth muscle spasm of the bronchioles, causing inflammation of the airways. Bronchial spasm that occurs was a response to mast cell mediators, especially histamine, which works directly on bronchial smooth muscle. Inflammatory cells such as eosinophils, T cells, mast cells and Antigen Presenting Cell (APC) were key cells in asthma pathogenesis [3], [17].

The number of children living in unhealthy houses experienced an asthma exacerbation attack was 48 children (73.85%), while the number of those living in a healthy house was 17 children (26.15%). The physical environment of the house was statistically significant for the survival of children asthma exacerbation (log rank test $p = 0.009$). Indoor air quality was a problem that needs attention because it would affect human health. Air quality in the room was good if the air was free from pollution, irritation, discomfort or disruption of occupants' health [18].

The control effort on pollutants in the household was done by environmental sanitation, namely creating a healthy and comfortable house which consists of 3 (three) aspects, namely lighting, airing, and air temperature and indoor humidity. Ventilation could reduce tobacco smoke pollutants by diluting or carrying pollutants out of the house. The higher the wind speed, the greater the dilution and pollution of pollutants and sources of emissions. Insufficient ventilation would cause an increase in the humidity of the room so that it became a good medium for the growth and development of microorganisms. Temperature increase could be a catalyst or help accelerate the chemical reaction of changes in an air pollutant. Humidity would help the deposition process of pollutants, which greatly affects the pollutants in the house, which eventually would have an impact on occupants' health [19].

CONCLUSION

The results of the preliminary study at the analysis stage Household physical environments and exposure to tobacco smoke increased the risk of asthma exacerbation attacks in children. Therefore, it is necessary to make the house be healthier and stop tobacco smoke exposure in the family.

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