

# Threatening Factor Exposure Triggers Recurrence of Asthma in Children

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**Keywords:** Childhood Asthma, Relapse, Trigger Factor.

**Abstract:** Asthma is an important health problem because of the high recurrence rate in children, if not handled properly, asthma can reduce the quality of life of children, interfere with growth, limit daily activities, interfere with sleep, increase school attendance, and lead to academic achievement in school decreased. The threat of trigger factors for recurrence is overwhelming and varies in every child. Usually, there are one or more factors of some dominant factors, so that efforts to educate health better focus on the factors that threaten the recurrence. This study aims to identify the factors of the threat of exposure to asthma triggers in children. The design of this research is analytical descriptive with the cross-sectional design. The number of respondents was 53 children with asthma. Bivariate analysis showed that the trigger factors associated with the occurrence of recurrence of asthma were allergen exposure ( $p = 0.177$ ), physical activity ( $p = 0.69$ ), foods (0.036) and weather (0.192). The result of the multivariate analysis showed the strength of the strongest relationship until weakest relapse of asthma in children was the activity (OR = 0,241) and allergen (OR = 0,05). It is expected that management of asthma through education in children or parents can be more focused on avoiding the threat factors of exposure trigger recurrence.

## 1 BACKGROUND

Asthma in children continues to be one of the most common chronic diseases in childhood. This is a common disease in children). Most asthma-related deaths occur in low- and middle-income countries (WHO, 2017). Although not occupying the top spot as a cause of morbidity or mortality in children, if not handled properly, asthma can reduce the quality of life of children, interfere with growth, limit daily activities, interfere with sleep, increase school attendance, and lead to academic achievement in school decreased (National Heart Lung and Blood Institute, 2007). The results of the survey using the International Study on Asthma and Allergy in Childhood (ISAAC, 2013) have been conducted in 155 centers of asthma in 56 countries, one of which is Indonesia aimed at the age group of 6-7 years and 13-14 shows the results varies in some countries with asthma prevalence between 2.1 - 32.2% (IDAI, 2016). Asthma is an important health problem because of the high recurrence rate in children, in 2013, 3.4 million (school-aged children) SAC experienced asthma exacerbations, SAC with asthma

and exacerbations had 18.9 times more visits to emergency departments (Sullivan et al., 2017). The threats to the occurrence of recurrence are exercise, exposure to allergens or irritants, weather changes, or viral respiratory infections (Page et al., 2017). The exact mechanisms for the cause of asthma are not known exactly but there are several factors that trigger an asthma attack. The term trigger factor or current precipitating factor is more commonly used which includes allergens, exercise, air pollution, occupational factors, respiratory infections, nasal and sinus problems, sensitive to drugs and food, gastroesophageal reflux disease (Gastroesophageal Reflux Disease / GERD) and psychological factors (emotional stress) (Lewis, Bucher, Heitkemper, & Dirksen, 2013). Asthma control in children is very difficult to achieve because children are still dependent on their parents or caregivers to make decisions about their health (Conn, Halterman, Lynch, & Cabana, 2007). Recurrence of asthma in children often occurs due to the threat of trigger recurrence has not been identified by nurses, health workers or parents. Parents are aware of the symptoms of asthma that worsen, they are not

always clear what triggers relapse (Searle, Jago, Henderson, & Turner, 2017). The threat of trigger factors for recurrence is overwhelming and varies in every child, usually, there are one or more factors of some dominant factors, so that efforts to educate health better focus on the factors that threaten the recurrence. It is, therefore, the purpose of this study to explore the threat factors of the trigger for childhood asthma relapse.

## 2 METHODS

### 2.1 Participants

Children aged 6 - 11 with diagnoses of asthma by doctors at Pediatric Department in Mardi Waluyo Hospital Blitar, Indonesia. Children who come to a child health center, with parents between January and February 2018 to complete the contents of the questionnaire provided by the researcher. Questions in the questionnaire involve parents and children in filling in. The inclusion criteria in this study were 1) parents with asthma children aged 6-11 years 2) parents who can communicate orally and written well 3) parents with children with asthma without any other illness that aggravate the condition of children such as tuberculosis, sepsis, typhoid fever, bronchitis, and pneumonia. The exclusion criteria in this study were 1) the child suffered the severe attack and the threat of stop breathing 2) the elderly with hearing, psychiatric disorder. Determination of sample size in this study using software G Power (Buchner, 2010) with the statistical test: Logistic regression. Using 1% error rate and 95% power. Determination of the value with the lowest and highest value p value refers to the previous research (Brigham, Goldenberg, Stolfi, Mueller, & Forbis, 2016) p the lowest value of 0.675 and the highest of 0.001 to obtain the number of samples of 53 participants. Sampling in this research is done by probability sampling method through simple random sampling.

### 2.2 Measurement

Measurement of recurrence of asthma using questions addressed to parents in the questionnaire Childhood Asthma Control Test for children 4 to 11 years (asthma.com, 2017) and open-ended questions about specific symptoms of childhood asthma relapse in the last 2 weeks such as: cough especially at night or early morning, shortness of breath, difficulty of sputum, breath sounds (wheeze) that

sounds if the child exhales, the weight on the chest (National Heart Lung and Blood Institute, 2007). Through the assessment found that asthma children in the last 2 weeks relapse or not relapse.

Measurements for the threat factor variables of asthma relapse were adapted from (Lewis et al., 2013) compiled into questionnaires used by (Putu, 2012), which were then modified according to the needs of this study. The threat factors for relapse are as follows: 1) allergens 2) physical activity 3) air and environmental pollution 4) respiratory infections 5) drug and food sensitivity 6) psychological condition 7) emotional stress condition 8) air condition/weather, with each -the threat factor of the relapse trigger is categorized by  $x > \text{median}$  (exposed),  $x < \text{median}$  (not exposed).

### 2.3 Statistical Analysis

#### 2.3.1 Univariate

Univariate analysis was conducted to describe the characteristics of each of the variables studied. Univariate analyzes for categorical data such as recurrence, child sex, long-suffering from asthma, and trigger threat factors are presented in the form of frequency distribution using percentages or proportions. In numerical data such as the child's age is described as the mean, median, maximum-maximum and standard deviations. All data were analyzed at the 95% significance level ( $\alpha = 0,05$ ).

#### 2.3.2 Bivariate

Bivariate analysis to analyze the relationship of the categoric variable with categoric variable was done by using chi-square statistic test. The chi-square statistical test aims to examine the difference in proportion. If the bivariate test results have  $p < 0.25$  then the variable can be entered in the multivariate model. However, if  $p \text{ value} > 0.25$  then still put into multivariate if the variable is substantially important.

#### 2.3.3 Multivariate

Multivariate analysis in this study to perform multivariate analysis, used multiple logistic regression analysis because it has the categorical dependent variable. The important variables included in the multivariate model are those with  $p\text{-value} < 0.05$ . The variables affect the dependent variable is known from the value of each  $p\text{-value}$ . The relationship strength sequence of the variables affects the dependent variable. In the logistic

regression, the order of strength of the relationship is known from the value of the Odd Ratio (OR).

### 3 RESULTS

Table 1 shows the number of respondents obtained is 53 children with diagnosis of asthma, the majority of them, male gender as much as 31 respondents (58.5%), as many of 35 respondents (66%) have suffered from asthma for more than 2 years and the majority of children experienced a recurrence in the last 2 weeks by 34 respondents (64.2%)

Table 2 Discussion of the respondents in this study was  $8.25 \pm 1.592$  years with the age range of 6-11 years.

Table 3 presents the distribution of respondents based on the exposure of the threatening factors of relapse, of all the factors of the majority of respondents exposed to these threat factors, allergen 38 respondents (71.7%), severe physical activity 27 respondents (50.9%), air pollution around the environment 32 respondents (60.4 %), respiratory infection 27 respondents (50.9%), food 31 respondents (58.5%), psychological 48 respondents (90.6%), emotional stress 30 respondents (56.6%), weather 30 respondents (56.6%). This table also shows of bivariate selection, not all variables show p-value <0.25 as a requirement to enter into multivariate test. Variables that will be included into the logistic regression analysis is a variable that in bivariate analysis has a value of  $p < 0.25$ . The variables were allergen ( $p = 0.177$ ), activity ( $p = 0.069$ ), foods ( $p = 0.036$ ), and weather ( $p = 0.192$ ). Table 4 above gives value Nagelkerke R square of 0.474 which means that contribution of four variable that is allergens, activities, eating, and weatherable explain accuracy by 47% and 34% others explained by other factors.

Table 5 shows the chi-square test of Hosmer and Lemeshow test with p-value of significance of 0.775 ( $p > 0.05$ ), then  $H_0$  is accepted that the model has sufficient to explain the data (goodness of fit)

Table 6 shows that accuracy prediction in this reasearch is 77.4 %

Table 8 shows the results of variables that affect the recurrence of asthma in children are allergens, physical activity, food and weather. The strength of the relationship can be seen from the value of OR (EXP (B)). The strength of the largest and smallest relation is activity (OR = 0,241) and allergen (OR = 0,057). Testing on alone evidently allergen ( $p = 0.018$ ), food ( $p = 0.008$ ), weather ( $p = 0.026$ ) has a significance value <0.05 while activity ( $p = 0.056$ )

has sig value > 0,05 meaning on alone allergens, food, and weather have a significant influence to relaps, and activities have no effect on recurrence but in a manner at the same time all four variables have an effect on recurrence with a value of  $p = 0.007$ . Thus, it can be we conclude that the equation obtained is :  $g(x) = (\text{constant} = 6.130) + (-2.856 (\text{allergen})) + (-1.421 (\text{activity})) + (-2.006 (\text{food})) + (-2.914 (\text{weather}))$ . Value of free variable: 1 if exposed and 0 if not exposed

### 4 DISCUSSION

This study shows that the majority of children with 58.5% of asthma have an average age of 6-11, an average score of 8.25 years, 66% of children have had asthma for more than 2 years, and 64% of them have relapsed in the last 2 weeks. From the results of the survey conducted (Zahran, Bailey, Damon, Garbe, & Breyse, 2018) in the United States, the number of boys is 51% more than women with 5-11 age range of 39%, this indicates that at this age group is a condition where children are more frequently exposed to the risk factors for recurrence. There were 8 recurrence threat factors which were assessed in this study. The majority of respondents received the exposure, namely: allergen (71%), physical activity (50.9%), pollution (60%), respiratory infections (50.9%), food (58%) , psychological (90%), emotion (56%), and weather (56.6%). Only 4 factors had a requirement to pass a multivariate assay suspected to be associated with recurrence experienced by a child with asthma (see Table 4). This shows that asthma is a unique chronic respiratory disease, not all children have the same

Table 1: Respondent demographic.

Variables	N	%
Gender		
Man	31	58.5
Women	22	41.5
Long-time suffering from asthma		
> 2 years	35	66
<2 years	18	34
Recurrence in the last 2 weeks		
Relapse	34	64.2
No relapse	19	35.8

Table 2: Distribution of respondents by age.

Variables	Mean	Median	SD	Min-Max
Age	8.25	8	1.592	6-11

Table 3: Distribution of respondents based on exposure to threatening triggering factors of recurrence.

No.	Variables	N	%	Mean	Median	SD	Min-Max	Relapse		No relapse		p-value
								N	%	n	%	
1.	Allergens			7.34	7	1.4	4-10					0.177 *)
	Exposed	38	71.7					27	71.1	11	28.9	
	Not exposed	15	28.3					7	46.7	19	53.3	
2.	Activity			6.72	7	1.53	4-10					0.069*)
	Exposed	27	50.9					21	77.8	6	22.2	
	Not exposed	26	49.1					13	50	13	50	
3.	Pollution			7.11	7	1.20	5-9					0.987
	Exposed	32	60.4					20	62.5	12	37.5	
	Not exposed	21	39.6					14	66.7	7	33.3	
4.	Infection			9.55	10	2.53	3-13					0.918
	Exposed	27	50.9					18	66.7	9	33.3	
	Not exposed	26	49.1					16	61.5	10	38.5	
5.	Food			14.47	15	2.75	8-19					0.036*)
	Exposed	31	58.5					24	77.4	7	22.6	
	Not exposed	22	41.5					10	45	12	54.5	
6.	Psychological			2.47	2	0.85	1-4					0.774
	Exposed	48	90.6					30	62.5	18	37.5	
	Not exposed	5	9.4					4	80	1	20	
7.	Stress			4.74	5	1.13	3-7					0.468
	Exposed	30	56.6					21	70	9	30	
	Not exposed	23	43.4					13	56.5	10	43.5	
8.	Weather			2.19	2	0.83	1-4					0.192*)
	Exposed	30	56.6					31	68.9	14	31.1	
	Not exposed	23	43.4					3	37.5	5	62.5	

triggering factor of recurrence, asthma in children becomes a very interesting material to do research to get the best formulation for each place in providing preventive measures in lowering the number recurrence in children. It is explained in Table 5 that the four variables are able to explain the accuracy of 47% and the other 34% explained by other factors. Table 7 shows that the prediction accuracy in this study is 77.4%. the strength of the relationship of each variable can be seen through indigo Odd Ratio (OR), which sequentially from the strongest relationship to the weakest is the activity (OR = 0.241), allergen (OR = 0.057), food (OR = 0.050), weather (OR= 0.004) Here's a discussion on 4 factors that are suspected to have an effect on recurrence in this study.

#### 4.1 The Association of Allergen with Recurrence of Asthma in Children

The result of univariate analysis showed that the average of allergen exposure was 7.34 with a minimum value of 4-10. Exposure to allergens in this study includes exposure to allergens indoors or outdoors consisting of mites, room dust, outdoor dust, foul odour and animal dander. The result of

bivariate analysis showed that allergen variable was eligible for multivariate test with  $p = 0.177$  ( $p < 0.25$ ). In multivariate test alone allergen variables have significant effect on recurrence with value  $p = 0.018$  where  $p < 0.05$ . The results of this study are in line with several research results that have been done with different environmental conditions. It has been 50 years since dust mites were first appreciated to be the main source of allergens in house dust, and by extension into the main trigger of respiratory illness due to allergies. Dust mites are a major contributor to asthma in many parts of the world and well-defined first-line allergens that cannot be visually identified (Wilson & Platts-Mills, 2018). The most predictive triggers of asthma exacerbations are dust allergens predicted as a trigger for asthma relapse in children (OR, 1.65, 95% CI, 1.13-2.43,  $P = 0.01$ ) (Chipps et al., 2018). This proves that allergens should be avoided in order not to recur asthma in children. Efforts to avoid allergens by modifying the home environment are important in the effort to reduce the rate of childhood asthma relapse, some avoiding dust mites can be explained in the review done by commonly also described in (IDAI, 2016).

Table 4: Distribution of respondents by age.

Variables	Mean	Median	SD	Min-Max
Age	8.25	8	1.592	6-11

Table 5: Nagelkerke R square value.

Cox & Snell R Square	Nagelkerke R Square
0.345	0.474

Table 6: The chi-square value of the Hosmer and Lemeshow Test.

Chi-square	Df	Sig.
3.261	6	0.775

Table 7: The predicted accuracy of the study.

Observed		Predicted		
		Recurrence		% Correct
Recurrence	Relapse	Relapse	No Relapse	
		No Relapse	27	7
	Relapse	5	14	73.7
Overall Percentage				77.4

#### 4.2 The Association of Food and Drug with Recurrence of Asthma in Children

The result of the univariate analysis shows that the average of exposure is 14.47 with minimum-maximum value 8-19. The food in this study was food exposure containing preservatives, dyes and flavoring, consumption of animal protein, vegetable, while medicines were the consumption of febrifuge, antibiotics, prescription drugs, and drugs that may have been consumed in the last 2 weeks. The result of the bivariate analysis showed that the variable of food was eligible for the multivariate test with  $p = 0.036$  ( $p < 0.25$ ). In multivariate test alone food variables have a significant effect on recurrence with value  $p = 0.008$  where  $p < 0.05$ . Study of the results of the III Phase III Asthma and Allergies in Childhood (ISAAC) questionnaire, with more specifically collected data on the association of risk of asthma incidence with the diet consumed. Vegetable intake is negatively associated with the risk of symptoms in children 6-7, but this association is attenuated in the 13-14 age group. Fastfood / burger intake is positively associated with all three results in older children. Higher intake of fruits and vegetables is associated with a lower prevalence of

allergy symptoms in Latin American children. In contrast, fast-food intake was positively associated with the prevalence of wheeze in adolescent age (Cepeda et al., 2017). Research conducted by (Singh, Jindal, & Goyal, 2017) for children with asthma showed that family history of asthma, passive smoking, and food allergies were significantly associated with asthma, food allergies had a value of  $p < 0.001$  OR 3.03 (95% CI: 2.25-4.0). In this study, the factors of consumption of drugs and foods became the trigger factor for recurrence, but most of the children cannot keep the diet continuously, because in the age group 6-11 years is the age of school where food and snacks in school become a factor making them unable to adhere to the diet. Food factors need to be wary of factors causing recurrence in children with asthma. The choice of schools that tighten food consumption contains preservatives, dyes, and flavoring as an option for the avoidance of this factor.

#### 4.3 The Association of Weather with Recurrence of Asthma in Children

The univariate analysis result shows that the average of exposure is 2.19 with minimum-maximum value 1- 4. The weather in this study is exposure to high and hot weather conditions experienced by children during the last 2 weeks. The result of bivariate analysis showed that the weather variable was eligible for multivariate test with  $p = 0,192$  ( $p < 0.25$ ). In the multivariate test by itself the weather variable had a significant effect on recurrence with the value  $p = 0.026$  where  $p < 0.05$ . Generally asthma attacks are caused by cold air (59.2%) (Dharmayanti, Hapsari, & Azhar, 2013). Studies conducted by (Hyrkäs, Ikäheimo, Jaakkola, & Jaakkola, 2016) found that patients with less controlled asthma were more susceptible to cold-breathing respiratory symptoms and even worsened asthma control increased the prevalence of symptoms. In this study recurrence often occurs in cold air conditions, this study was conducted in Blitar City, East Java Indonesia, at the time of the study, the weather in the study location was in cold and rain conditions during January to February, the majority of respondents complained of shortness of breath when approaching night until late afternoon. This is in accordance with the theory that the assumption that asthma is defined as a condition when there is a disturbance in the respiratory system that causes patients experiencing wheezing, shortness of breath, coughing, and tightness in the chest, especially during the night or early morning

Table 8: Variables associated with recurrence of asthma in children.

Variables	Coefficient	SE	Wald	df	P-value	OR	95% IK	
							Min	Max
Exposed to allergen	-2.856	1.208	5.586	1	.018	.057	.005	.614
Exposure to activity	-1.421	.744	3.651	1	.056	.241	.056	1,037
Exposed food	-3.006	1.127	7.119	1	.008	.050	.005	.450
Exposure to the weather	-2.914	1.305	4.984	1	.026	.054	.004	.701
Constant	6.130	2.282	7.219	1	.007	459446		

(National Heart Lung and Blood Institute, 2007). Efforts that can be done is to adjust the self-protection against weather changes such as the use of hats, masks, jackets or scarves when needed.

#### 4.4 The Association of Activity with Recurrence of Asthma in Children

The result of the univariate analysis shows that the average of exposure is 6.72 with a minimum value of 4-10. Activities in this study consist of cycling, swimming, running, climbing stairs, walking fast. The result of the bivariate analysis showed that the activity variable was eligible for the multivariate test with  $p = 0.069$  ( $p < 0.25$ ). In the multivariate test alone the activity variable had no significant effect on recurrence with  $p\text{-value} = 0.056$  where  $p > 0.05$ . In previous studies found no association between physical activity, asthma control levels, spirometric measurements and quality of life (Lim, Ko, Benton, Berge, & Mak, 2017). But in fact, there are several studies that mention that physical activity causes the occurrence of recurrence of asthma in children. Exercise can trigger acute exacerbations in almost all individuals with asthma. Heat loss, water loss, postexertional rewarming, and the role of some mediators have been proposed as a possible mechanism responsible for airway obstruction caused by exercise (Hughes, 2014). Physical training should be part of the overall management plan for people with asthma. In this study, physical activity of swimming, sport, cycling, and running was most commonly found in asthmatic children, but only a few children had a recurrence after physical activity. Recurrence after an activity is suspected to have 3 other factors that also affect in this study, possibly when doing activities outside the room also exposed to large, eat or even weather. The goal of asthma treatment alone is to get a controlled condition, with a minimum of recurrence rates during physical activity. When treated correctly, individuals with asthma should be able to participate in sports gradually.

## 5 CONCLUSIONS

The threat factors of trigger recurrence of asthma in children vary with each other, in this study obtained 4 threat factors that trigger the recurrence of children with asthma in the Pediatric Department, Mardi Waluyo Hospital. Sequentially from the strength of the relationship are activity, allergen, food, weather. From this research can be known the recurrence characteristics of children with asthma triggered by these 4 factors. Avoidance of these trigger factors will have many benefits. Activity can be controlled, quality of sleep gradually improving, children can attend school and can achieve. Benefits that parents get, is not the amount of time consumed to manage the recurrence of asthma in children, the costs incurred for treatment becomes more effective. Therefore, nursing intervention in the form of education, home visit, in children or parents can be focused on these 4 factors. The hope of further research at the same place is to provide education formulated from this study. Will be more effective and efficient in providing education.

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