Impacts of Climate Change on Dengue Haemorrhagic Fever Cases in Banjarbaru Municipal, South Kalimantan During the Year 2005-2010

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ABSTRACT

Environment is one of instrumental factor in the emerging and the spreading of dengue disease. The Climate change may causes affect to infectious disease pattern and the risk of transmission increase. Disease of dengue hemorrhagic fever (DHF) has become endemic in the major cities in Indonesia. It has been suspected that dengue outbreaks that occur each year in almost all of Indonesia is closely related to weather patterns. The purpose of this study was to determine the influence of climate change (rainfall, humidity and air temperature) with dengue cases in the Banjarbaru municipal during the year 2005-2010. The design of the study is a over times studies of ecology. The research was conducted in April-May 2010 and located in the Banjarbaru municipal, South Kalimantan by using secondary data. Data on the number of dengue cases was derived from the Banjarbaru Health Office reports. Climate data used are rainfall data, temperature and humidity obtained from the Meteorology and Geophysics Board (BMKG) Station of Banjarbaru and Syamsudin Noor Station of Banjarmasin. The results showed that rainfall, humidity, air temperature and free number larva had influence toward incidence of DHF (27%). The conclusion of this study is that the increased rainfall and humidity affected the increased in dengue cases. Therefore, it requires a good cooperation between the health department and BMKG as the party in charge for climates data.

Keywords: DHF, Climate change, impact

INTRODUCTION

Dengue Hemorrhagic Fever (DHF) is a disease caused by the dengue virus and transmitted by the mosquito *Aedes aegypti*. Until now the disease can only be controlled by the eradication of drug and vaccine vector because penyakit is still no.¹ Dengue hemorrhagic fever attacked many countries in the world such as Africa, the Middle East, Western Pacific, South-East Asia including Indonesia.² First reported dengue hit Indonesia in 1968, the Jakarta and Surabaya by the number of cases as much as 58 people (IR = 0.1 per 100,000) and 24 of whom died (CFR = 41.3%). Dengue has spread to all provinces in Indonesia.³ Data Incident Rate (IR) up to 2007 showed an increase in IR and the number of infected districts, especially after El Nino years (1973, 1983, 1998 and 2005).⁴

Climate variation causes dengue vector will easily multiply both tropical areas and sub-tropical. Climate variations may include rainfall, temperature and humidity, where the third factor is a factor supporting high and low populations of disease vectors.⁵ Banjarbaru City is one of the cities / districts in South Kalimantan. The city consists of 20 (twenty) villages spread over 5 (five) districts, and there are 16 (sixteen) the status of endemic dengue area. Based on data management in Banjarbaru City Health Department, since 2001 until 2010 there were 208 cases of dengue fever with the death of 5 people.⁶

The increase in cases and outbreaks of dengue affected by the mobility of the population and uncontrolled urbanization, lack of community participation in dengue control, the lack of quantity and quality of human dengue program managers at every level of administration, lack of cooperation and commitment to cross-program and cross-cutting in the control of dengue, reporting systems and control dengue late and not in accordance with the Standard Operation Procedure (SOP), climate change is likely to

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increase the number of dengue vector habitat, infrastructure, adequate water supply and even geography Indonesia in the tropics, support vector breeding and viral growth.⁷ Conditions Banjarbaru city that always increase the number of cases of dengue fever and is still a lack of assessment of the effect of climate change (rainfall, air temperature and air kelembahan) then further study the effect of climate on the incidence of dengue is very important in the prevention and early warning efforts DHF.

The purpose of this study is to analyze the influence of rainfall, temperature and humidity of the cases of Dengue Hemorrhagic Fever (DHF) Municipal Banjarbaru during year 2005-2010.

MATERIALS AND METHODS

This study is a quantitative and descriptive research design used in this research is the study of ecological time trend to examine the influence of rainfall, humidity and temperature of the dengue cases and Numbers Free Flick (ABJ) of 2005-2010 in the Municipal Banjarbaru.

As the subjects in this study are the data of dengue cases in the Municipal Banjarbaru period 2005-2010. The variables studied in this research include independent variables (climate data include rainfall, humidity and temperature) and the dependent variable (DHF case data). Data was collected through observation of the documents in the report Banjarbaru City Health Department, Bureau of

Meteorology, Climatology and Geophysics Agency (BMKG) Class I Banjarbaru Station Climatology and Meteorology, Climatology and Geophysics Agency (BMKG) Class II Station Climatology Syamsudin Noor Airport Banjarmasin. Univariate analysis is used to provide an overview of the distribution of DHF cases, and fluctuations in rainfall, humidity and temperature that are numeric, then used the size of the maximum value, minimum value. To elucidate the mechanism of a casual relationship between rainfall, humidity, air temperature against dengue cases performed pathway analysis (path analysis).

RESULTS

Dengue cases in the Municipal Banjarbaru Based on the results of recording the incidence of dengue in Banjarbaru Health Department can be seen in the table below. It appears that all cases of dengue fever in the city during the period of 2005-2010 Banjarbaru many as 629 cases. Highest number of cases was found in the year 2010 as many as 208 cases, while the lowest case in 2006 that as many as 53 cases, Rainfall in the city during the period 2005-2010 Banjarbaru can be seen in the following table.

Rainfall in the Municipal Banjarbaru which vary in each month showed that the average rainfall in the city during the period 2005-2010 Banjarbaru ranged from 171.6 mm to 243.3 mm, a relatively moderate rainfall.

Humidity during the period 2005-2010 can be seen in the following table

Table 1. Cases of Dengue Haemorrhagic Fever in the Municipal Banjarbaru During the Period 2005-2010

No	Year	Number of patients (person)	Insidence Rate (IR/100.000 person)	Number of death (person)	Case Fatality Rate (%)
1	2005	64	44,7	3	4,7
2	2006	53	34,7	1	1,9
3	2007	83	52,8	3	3,6
4	2008	85	51,3	0	0,0
5	2009	136	81,1	7	5,1
6	2010	208	116,1	5	2,0
Total		629			

Sources: Banjarbaru Health Departement, 2010

Table 2. Monthly Rainfall in City Banjarbaru the Year 2005-2010

Month	Rainfall (mm)					
	2005	2006	2007	2008	2009	2010
January	269,3	455	305,8	262,6	351,1	361,6
February	281,0	336,4	434,2	279,4	154,0	232,9
March	296,6	321,3	481,5	487,8	175,3	347,1
April	175,6	197,4	401,5	258,3	267,0	246,7
May	214,8	128,6	191,3	69,9	211,2	154,1
June	94,3	192,3	188,1	227,8	38,7	302,8
July	45,2	18,6	194,1	210,9	69,5	179
August	41,7	31,5	60,4	88,4	25,1	280,3
September	25,7	20,9	25,0	93,4	21,0	334,0
October	194	16,6	82,7	145,2	146,2	258,1
November	195,0	117,9	250,3	364,6	345,9	303
December	274,2	375,3	305,4	429,2	254,5	320,4
Mean	175,6	184,3	243,3	243,1	171,6	276,6
Min	25,7	16,6	25,0	69,9	21,0	154,1
Max	296,6	455,0	481,5	487,8	351,1	361,6

Table 3. Air humidity Per Month at City Banjarbaru the Year 2005-2010

Month	Air Humidity (%)					
	2005	2006	2007	2008	2009	2010
January	87,4	87,5	86,4	85,2	88,1	87,6
February	86,3	86,8	87,5	84,3	86,21	85,9
March	86,4	84,9	84,8	85,9	84,0	86,5
April	85,7	85,3	86,2	85,7	83,1	84,8
May	85,5	83,8	84,0	80,1	83,7	84,5
June	83,3	86,8	86,1	83,3	79,6	87,1
July	80,2	78,7	84,4	85,1	78,5	88,2
August	76,6	73,5	79,7	83,2	73,4	86,7
September	73,1	71,4	75,3	80,3	72,7	87,0
October	83,8	66,6	79,7	84,8	79,9	85,5
November	85,3	78,3	86,5	86,2	82,7	85,8
December	87,3	84,0	85,9	90,0	87,5	86,8
Mean	83,4	80,6	83,9	84,5	81,6	86,4
Min	73,1	66,6	75,3	80,1	72,7	84,5
Max	87,5	87,5	87,5	90,0	88,1	88,2

Humidity was seen that the highest humidity of 90%, this was a very extreme humidity that has ever happened in the city during the period of 2005-2010 Banjarbaru.

The air temperature during the period 2005-2010, namely high of 28.2⁰ and a low of 23.1⁰ Celcius. More can be seen in the following table.

Furthermore, to determine the influence of climate change which include rainfall, humidity, air temperature with the incidence of dengue fever, used path analysis. Path

analysis was used to explain the mechanism of the causal relationship between rainfall (X1), humidity (X2), air temperature (X3), the incidence of dengue disease (Y1). Analysis of the influence of point rainfall, humidity, air temperature against dengue disease incidence is shown in the following table:

Based on the table below it appears that the magnitude of the direct influence between the variables can be seen from the coefficient Standardized Beta Coefficients.

Table 4. Monthly air temperature in the municipal Banjarbaru the Year 2005-2010

Month	Air temperature (°C)					
	2005	2006	2007	2008	2009	2010
January	26,5	26,2	26,8	26,6	26,2	26,3
February	26,9	26,6	26,3	26,8	26,4	27,2
March	26,9	26,8	26,7	26,2	26,9	27,1
April	27,0	27,0	27,0	26,7	27,5	27,7
May	27,0	27,3	27,3	27,2	27,3	28,0
June	27,1	26,1	26,8	26,2	27,7	26,9
July	26,6	26,6	26,3	25,3	26,4	26,2
August	27,0	26,6	26,4	26,0	27,1	26,5
September	27,8	27,2	27,1	26,7	28,1	26,5
October	26,7	28,2	27,3	26,5	27,3	26,8
November	26,9	27,8	26,4	26,7	27,4	27,0
December	26,3	27,3	26,6	23,7	26,7	26,1
Mean	26,9	27,0	26,7	26,3	27,1	26,9
Min	26,3	26,1	26,3	23,7	26,2	26,1
Max	27,8	28,2	27,3	27,2	28,1	28,0

Table 5. Effect of Path Coefficient Rainfall, Humidity and Air Temperature Air for Disease incidence of dengue in city Banjarbaru

Model	Unstandardized Coefficients		Standardized coefficients	
	B	Std. Error	Beta	
1 (Contants)	-5.337	14,206		
Rainfall(X ₁)	5,71	0,003		0,003
Humidity(X ₂)	0,127	0,79		0,242
Air Temperature(X ₃)	0,185	0,383		-0,056

a. Dependent variable: Number of Cases of DHF (Y1)

From the above results, the obtained path diagram with the effect of variable values X1, X2, X3 to Y1 in Figure 1.

Figure 1. Relations Line Diagram X1, X2, X3, the Y1

Table 6. Influence Line Analysis of Precipitation, Humidity, Air Temperature for Disease incidence of dengue in Municipal Banjarbaru

No	Variable	Municipal Banjarbaru		
		Direct	No direct	Total
1.	Rainfall	0,00	0,27	0,27
2.	Humidity	0,24	0,01	0,25
3.	Air temperature	-0,06	-0,01	-0,01

In full, the influence of direct, indirect and total effect of rainfall, humidity, air temperature on the incidence of dengue in the municipal Banjarbaru viewed in the table below.

DISCUSSION

The results of path analysis to explain the mechanism of the causal relationship between rainfall, humidity, air temperature Municipal Banjarbaru, the variables that have influenced the incidence of dengue disease was variable rainfall has the greatest effect at 27.0% followed by air humidity of 25.0%. The increase in dengue cases in the municipal Banjarbaru not affected by air temperature. Temperatures negative contribution (-1.0%) in cases of dengue fever, so that the temperature does not influence the occurrence of dengue cases in the municipal Banjarbaru. Increased rainfall followed by an increase in air humidity. These conditions increase the incidence of dengue in the municipal Banjarbaru. Humidity gives the most impact on the incidence of dengue. Humidity has been found to be the most critical factor in the disease.⁹ As with other vector-based diseases, dengue show patterns related to climate mainly because humidity affects the spread of vector mosquitoes and the possibility of transmitting the virus from one human to another human. This mosquito vector is sensitive to moisture.⁵

Rainfall has a significant effect on DHF cases, giving the sense that the rainfall factor becomes an important concern in a program to eradicate the disease, especially in anticipation of the occurrence of extraordinary events. In the rainy season where there was an increase in rainfall is a sign of the beginning (early warning) will be the possibility of increase in the number of dengue cases. High rainfall will have a significant influence in the transmission of diseases, especially those transmitted by mosquito vectors.⁸

Humidity has been found to be the most critical factor in climate or disease.⁹ As with

other vector-based diseases, dengue show patterns related to climate mainly because humidity affects the spread of vector mosquitoes and the possibility of transmitting the virus from one human to another human. This mosquito vector is sensitive to moisture.⁵

CONCLUSION

1. Variable rainfall has the most dominant influence on the incidence of dengue in the city Banjarbaru during the period 2005-2010.
2. Can be estimated that at the time of rainfall ranged from 275.4 mm - 359.1 mm, relative humidity ranged from 83.3% - 86.3% and the air temperature ranged from 26.8⁰ C Celcius - 27.4⁰ Celcius is a warning that can signal be an increase in outbreak cases of dengue fever.

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