ATLANTIS PRESS

Advances in Health Sciences Research (AHSR), volume 14

1st International Conference on Inter-Professional Health Collaboration (ICIHC 2018)

Analysis And Spread Of Dengue With Spatial Approach Of Geographic Information System (Sig)

Deri Kermelita
Jurusan Kesehatan Lingkungan
Politeknik Kesehatan Kementerian Kesehatan Bengkulu
Bengkulu, Indonesia

Mualim
Jurusan Kesehatan Lingkungan
Politeknik Kesehatan Kementerian Kesehatan Bengkul
Bengkulu, Indonesia

Abstract: ***Dengue Hemorrhagic Fever (DHF) is a disease caused by dengue virus transmitted through the bite of Aedes aegypti and Aedes albopictus mosquitoes. Health profile of Bengkulu Province, recording cases of dengue fever in 2013-2015; in 2013: 443 cases, four people died. In 2014: 467 cases, with 2.8% Case Fatality Rate (CFR). The year 2015: 872 cases, with 52.5% Case Fatality Rate (CFR). The map is a representation of the surface of the earth that is drawn, scaled down to an absolute scale, equipped with symbols as an explanation. The Geography Information system (GIS) can connect various data at specific points on the earth, combine them, analyze them and finally map the results. To find out the pattern and extent of the spread of Dengue Hemorrhagic Fever with the Spatial Approach of Geographic Information Systems (GIS) in the City of Bengkulu in 2016. The research is descriptive observational. I am using a total population sample of 567 cases. Data collection uses a review of lists and determination of case coordination points. Analysis of using univariate and spatial analysis. The highest population density in Teluk Segara District (9,945 people / Km2), the highest incidence of DHF in Gading Cempaka sub-district with IR: 332.09 per 100,000 population, Mortality in the highest dengue case in the sub-district of Ratu Samban CFR; 4.76 per 100,000 population, the pattern of spread of DHF with cluster patterns. The results of the study can be used to develop an intervention program strategy for the prevention of Dengue Fever.***

Keywords— Spreading, Dengue Hemorrhagic Fever (DHF), Spatial

I. INTRODUCTION

Aedes aegypti mosquitoes are estimated to have infected 100 million cases of dengue occur in the world each year, in Southeast Asia in 1997 recorded 136,030 deaths due to DHF with CFR 0.76%[1]. DHF outbreak is still a constraint for people in various regions considering the number of deaths so much, especially in toddlers and children[2]. The development of a morbidity rate of dengue disease based on Indonesia health profile from 2012 until 2015; the year 2012 occurred 90,245 cases, 816 of them died. The year 2013 occurred 112,511 cases with the death of 871 people, in 2014 occurred 100,347 cases with the number of deaths 907 people, by 2015 the number of DHF patients reported as many as 129,650 cases with the number of deaths of 1,071 people (IR/Mortality rate = 50.75 per 100,000 population and CFR / death rate = 0.83%). An increase in the number of cases and the number of deaths that occurred in 2015 When compared to 2014[3].

Until now, dengue disease is still a health problem in Bengkulu province. Based on data on the health profile of Bengkulu Province, recorded cases of dengue in 2013 until 2015 with details: in 2013 there are 443 cases with the number of deaths of 4 people and most cases of DHF occurred in the city of Bengkulu 173 cases with the incidence of death 2 people occurred in sub-district Ratu Agung working area of Kuala Lempuing puskesmas 1 person and puskesmas Sawah Lebar, 1 person. In 2014 there are 467 cases of dengue, and 13 people died with case fatality rate (CFR) 2.8%. While in 2015 there were 369 cases with Case Fatality Rate (CFR) 52.5%.

Several methods of vector control have been widely known and used by dengue control programs at the central and regional levels: environmental management, biological control, chemical control, community participation, individual protection, and legislation. Control of DHF is primarily intended to break the chain of transmission, namely by controlling the vector. The epidemiological approach is the best way to gain an understanding of the problem and planning for the prevention of illness. Epidemiological approaches include the spread, the frequency of disease in humans, the site of the disease and the planners and decision-making at the stages and stages of development[4]. A GIS (geographic information system) can connect various data at a certain point on earth, combine, analyze and ultimately map out the results. The data to be processed in the GIS is that spatial data is a geographically oriented data and is a location that has a particular coordinate system, as the reference base. So GIS applications can answer some questions such as; location, condition, trend, pattern and modeling. This ability distinguishes GIS from other information systems[5]

.

II. METHODS

This type of research is descriptive, with observational analytic research design. Secondary data collection based on DHF case data at Bengkulu City Health Office and primary data from collecting point of the coordinate of DHF patient. A population that is all the incidence of Dengue recorded in the Health Office of Bengkulu City in 2016. The sample is DHF patients based on data from Bengkulu city health office that has an exact address totaling 567 cases. The tool used in supporting this research is the data checklist table, the observation table of DHF events plotting and Global Positioning System (GPS) Garmin Ex-Trex 30 type. Data processing using some supporting software such as Excell data processing software and special processing software Google Earth. The point pattern method used in this study using spatial analysis of simple analysis of disease, Nearest Neighbor Index (NNI) and Convex hulls.

The value of NNI and convex hulls are known from the calculation of the geographic location of DHF events generated through special processing software. Analysis of NNI values generated based on Cromley and McLafferty, 2002; NNI = 1 means the incidence of DHF in the random-patterned observation area (random); NNI <1 means the incidence of DHF in the clustered observation area; NNI> 1 means the incidence of DHF in the dispersed pattern.

III. RESULT

TABLE I. FREQUENCY DISTRIBUTION OF CASES OF MORBIDITY AND MORTALITY OF DENGUE HEMORRHAGIC FEVER IN BENGKULU CITY IN 2016

Information: K= Case, M= Died, IR= Incidens Rate per 100.000 population, CFR= Case Fatality Rate (%)

Table 1. shows that it is known that the incidence of DHF in the population of Bengkulu city (IR DBD: 157.72) is highest in Gading Cempaka 332.09 sub-district and the highest death rate of DHF (CFR DBD: 1,41) cases in Ratu Samban sub-district 4.76. Based on the research that has been done, the incidence of dengue in the city of Bengkulu Year 2016 can be described as follows.

Figure 1. Map of Distribution of Dengue Hemorrhagic Fever in Bengkulu City 2016

Based on Figure 1. it is known that yellow dots can symbolize dengue cases on the map — the case of DHF most prevalent in Gading Cempaka sub-district.

TABLE 1. DISTRIBUTION OF FREQUENCY OF SPREADING OF DENGUE HEMORRHAGIC FEVER RATE BY AGE GROUP IN BENGKULU CITY 2016

No	DISTRICTS	Age Group (Year)				
		0-5	5-11	12-25	26-45	>45
1	Gading Cempaka	23	47	31	33	13
2	Kampung Melayu	5	7	6	1	4
3	Muara Bangkahulu	12	15	24	26	5
4	Ratu Samban	9	5	2	2	3
5	Ratu Agung	5	17	19	13	12
6	Selebar	19	33	37	31	5
7	Singaran Pati	4	7	6	3	4
8	Sungai Serut	4	13	11	11	1
9	Teluk Segara	12	11	9	5	2
	Kota Bengkulu	**93**	**155**	**145**	**125**	**49**
	Percent (%)		**27,3**	**25,5**	**22,0**	**8,6**

Table 3 shows that it is known that the incidence of DHF in the population of the city of Bengkulu much-infecting age group 5-11.

TABLE 2. PATTERN AND BROAD ANALYSIS OF DENGUE HEMORRHAGIC FEVER SPREAD IN BENGKULU CITY 2016

No	DISTRICTS	K	IR	M	CFR
1	Gading Cempaka	147	332,09	2	1,36
2	Kampung Melayu	23	55,08	0	0
3	Muara Bangkahulu	82	181,25	3	3,65
4	Ratu Samban	21	78,87	1	4,76
5	Ratu Agung	66	127,69	0	0
6	Selebar	125	247,71	1	0,8
7	Singaran Pati	24	47,23	0	0
8	Sungai Serut	40	188,64	1	2,5
9	Teluk Segara	39	142,08	0	0
Bengkulu City		**567**	**157,72**	**8**	**1,41**

No	DISTRICTS	Parameter			
		An (Area Ha)	Case Point	NNI	Distribution Patterns
1	Gading Cempaka	144.200	147	0,65	*Clustered*
2	Kampung Melayu	231.400	23	0,76	*Clustered*
3	Muara Bangkahulu	231.800	82	0,67	*Clustered*
4	Ratu Samban	28.400	21	0,65	*Clustered*
5	Ratu Agung	110.200	66	0,68	*Clustered*
6	Selebar	463.600	125	0,78	*Clustered*
7	Singaran Pati	144.400	24	0,65	*Clustered*
8	Sungai Serut	135.300	40	0,78	*Clustered*
9	Teluk Segara	27.600	39	0,68	*Clustered*

In table 4 shows can be seen that the value of NNI incidence DBD Bengkulu City is below the number 1 which means the pattern of DHF incidence spread in Bengkulu City is clustered pattern.

IV. DISCUSSION

Frequency Distribution of Case- Distribution, Morbidity, and Mortality of Dengue Hemorrhagic Fever.

Based on data from the Directorate of Disease Control and Zoonosis Ministry of Health until the end of January 2016 Bengkulu City is one of two cities and seven provinces in Indonesia who experienced Extraordinary Occurrence (KLB) dengue disease. Based on the results of the 2016 study of an increase in the number of new cases of dengue fever with IR 157,72 per 100,000 population, this figure is far above the national IR number of 77.96 per 100,000 population. Incidence Rate (IR) is the frequency of new illnesses or cases infected in a community in a place or region or country at a particular time (generally one year) compared to the number of people who may be affected by the new disease. This IR number is useful for; knowing the health problems faced, knowing the risks to be exposed to health problems faced, knowing the burden of the task that must be held by a health care facility.

Throughout the history of dengue fever in Indonesia, the highest death rate occurred when the first time the disease was discovered in 1968 in Surabaya. Of the 58 people infected, 24 lives were lost. Gorontalo, Maluku, West Papua, North Sulawesi, and Bengkulu are the five provinces in Indonesia with the highest mortality rate in 2015 with the highest number to touch 6.06 percent.

Frequency Distribution of Case Distribution of Dengue Hemorrhagic Fever Cases by Gender.

DHF is a disease that can be transmitted by mosquitoes to humans5. Everyone can suffer dengue disease. The incidence of dengue fever based on gender is almost equal6. Dengue disease can be suffered by anyone either young or old, children or adults, men or women. However, over the past decade, dengue disease tends to increase in proportion in adult groups compared to age 5-14 years7.

A pattern of Dengue Hemorrhagic Spread

Utilization of spatial analysis techniques can provide information on the location of the spread of DHF events and the pattern of actual distribution through the face of the earth. According to Achmadi (2005), disease mapping can provide a relatively complex geographic information about the incidence of disease, whereas according to Lai et al. (2009) disease mapping can provide disease information based on geographic phenomena. As the research by Widyawati et al. (2011) with the use of spatial analysis in Pademangan Barat Village, it is known that the point of distribution of DHF incidence can describe the incidence of DBD geographically in the field.

The distribution of DHF events can be identified by the geographic characteristics around the point of occurrence. Disease mapping can be utilized to prepare measures of DHF prevention by applying spatial analysis techniques11. As the study by Rasidim with the spatial analysis is known that the incidence of DHF during the years 2003-2009 with the number of incidents of 6,076 cases in the District of Seremban Malaysia can show the pattern of the spread of cases of the cloud-dengue group (cluster) [11].

Based on the research that has been done, it is known that the spread of Dengue fever in Bengkulu City can be described through the point of distribution based on geographical location in the field. As the results obtained, it is known that the incidence of DHF in the city of Bengkulu increased since 2015 by 65%. Based on the sub-districts, it is known that the incidence of DHF in Gading Cempaka sub-district is the highest in the case of 147 cases, with 100% spread in all areas of Bengkulu city. Increase in the area of the spread of DHF events indicates that the area of risk of transmission of dengue disease is widespread. Information on the area of DHF transmission can be used by Puskesmas staff to increase the coverage of health services through DBD prevention activities. Dengue prevention activities that can be done include periodic larvae (PJB) and mosquito nest eradication (PSN) DBD.

The pattern of dengue fever case spread in Bengkulu City formed clustered group. If a region has geographic and geographically distant diseases patterns, it may indicate that the probability of a causal factor on the incidence of DHF is increasing13. Based on the result of NNI value of DHF incidence in Bengkulu City, it means that the distance between DHF patients with each other is closer and indicates that the probability of causal factor is increasingly increasing, so it needs analysis to find the source of DHF disease especially related to individual behavior factor.

The pattern of spreading of known DHF events through spatial analysis can be used to overcome the DHF outbreak by conducting an investigation that leads to the found source[14]. Information on the pattern of dengue fever spread can be used to develop a health program intervention strategy[15]. Dengue fever disease pattern in Bengkulu City can make it easier for health center staff to intervene health program than spread pattern. Further spatial analysis such as the broader area comparison in the future is necessary so that it can be known which areas are more clustered DHF spread patterns in other regions. Therefore, it is necessary to analyze the comparison of spreading patterns between regions in the City of Bengkulu.

V. CONCLUSION

The highest population density in Teluk Segara sub-district (9,945 inhabitants / Km2). Morbidity of DHF incidence in the population of Bengkulu city (IR DBD: 157.72) was highest in Gading Cempaka sub-district with IR: 332.09 per 100,000 population, the highest mortality rate in CFR districts CFR: 1.41; 4.76 per 100,000 population. The pattern of spread of DHF incident in Bengkulu City patterned clustered (clumped) with the width has spread across all districts in the city of Bengkulu.

The pattern of spreading of known dengue cases through spatial analysis can be utilized for the prevention of DHF outbreak using investigations that lead to the source found (Davis et al., 2014)[13]. Dengue fever disease pattern in the area of Bengkulu City actually can make it easier for health center officers to intervene health program than spread pattern. Activities and efforts undertaken to suppress the high number of dengue fever is the responsibility of all the special community in the city of Bengkulu such as doing mutual help, getting clean and healthy life, doing fogging and jumantik by the public health officer and doing counseling to the community about how to prevent and prevention of dengue disease by Puskesmas officers.

REFERENCES

[1] WHO, (2005). Complete Guide to Prevention and Control of Dengue and Dengue Hemorrhagic Fever. Jakarta: Medical Book Publishers (EGC).

[2] Sungkar, 2007. Eradication of Dengue Hemorrhagic Fever: A Challenge That Must Be Answered — Jakarta: Department of Parasitology, Faculty of Medicine, University of Indonesia.

[3] Ministry of Health RI 2015. Republic of Indonesia Health Profile 2015

[4] Prahasta, E. 2009. Geographic Information System Basic Concepts (Geodesy and Geomatic Perspectives). Bandung: Informatics

[5] WHO. 2004. Dengue Fever Dengue Diagnosis, Treatment, Prevention, Control 2. Edition Jakarta: EGC

[6] Ministry of Health RI 2010. Window Epidemiology Bulletin: Main Topics of DHF Volume 2, August 2010.

[7] Ministry of Health RI 2014. Republic of Indonesia Health Profile 2013

[8] Achmadi, UF. 2005. Regional Based Disease Management. Kompas Book Publishers: Jakarta.

[9] Lai. P.C, F.M. So and K. W Chan. 2009. Approach to Spatial Epidemiology in Mapping and Analysis of Diseases. London: CRC Press

[10] Widyawati, I.F. Nitya, S Syaukat, R.P. Tambunan, and T.E.B Soesilo. 2011. The Use of Geographic Information Systems Effectively Predicts the Potential of Dengue Fever in the Endemic Village. Makara Health Journal 5 (1): 21-30.

[11] Rasidim M.N.M, Sahani. M, Othman. H. Hot. R, Idrus. S. Ali. Z.M, Choy. E.H, and Rosli. M.H. 2013. Application of Geographic Information System for Time-Mapping Mapping: A Dengue Event in Seremban District, Negeri Sembilan, Malaysia. Science Journal Malaysia 42 (8): 1073- 1080. Society, Environmental Engineering, Nuha Medika, Yogyakarta.

[12] Timmreck, T. C. 2005. Epidemiology of an Introduction. Translation: Fauziah, Apriningsih, and Palupi. Jakarta: EGC

[13] Davis, G.S, N. Sevdalis, and L.N. Drumright. 2014. Spatial and Temporal Analysis to Investigate the Transmission of Infectious Diseases in Health Care Arrangements. Journal of Hospital Infections 86 227-243.

[14] Aziz, S., Ngui, R., Lim, Y.A.L., Sholehah, I., Nur Farhana, J., Azizan, U.S. and Wan Yusoff, W.S. 2012. Spatial Pattern of Dengue Distribution

2009 in Kuala Lumpur Using GIS Application. Journal Tropical Biomedicine 29 (1): 113–120.2009.

[15]