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Spatial Analysis of Dengue Haemmorrhagic Fever Incidence in Salatiga City, Central Java, Indonesia

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Abstract

Background: Dengue Haemmorrhagic Fever (DHF) is the most important mosquito-borne viral disease affecting humans, transmitted by a mosquito vector. In Indonesia, the highest epidemic peak was in 2010 with 86 cases per 100,000 person-years. Central Java Province placed the second rank of DHF incidence with 45.53 per 100,000 person-years in 2013. Salatiga City is one of the highland areas in Central Java, which had a high level of DHF incidence with 317 per 100,000 person-years in the year 2013. However, there was no information about the spreading of DHF. This research aimed to spatially analyze DHF incidence in Salatiga City.

Methods: It was an observational research using cross-sectional design. The study population was all DHF cases occurred in the year of 2011-2015. Data collection was conducted by documentation study and measuring the coordinate position of DHF cases using Geographic Positioning System (GPS). Data would be analyzed to get a mapping of DHF spread using ArcGis 9.3.

Results: Over the year of 2011 to 2015, the incidence of DHF was fluctuating. The highest number of cases occurred in 2013, but the largest infected area occurred in 2015,eventhough the number of cases decreased significantly. There was a changing pattern in the spreading of DHF cases. Spatial analysis indicated that DHF tends to spread from the central of the city to the rural area near the Ring Road of Salatiga.

Conclusion: DHF cases had undergone the changing in spreading pattern. It started from the central of the city to the rural area near the ring road Salatiga.

Keywords: Spatial analysis, Dengue Hemmorrhagig Fever, Salatiga; Indonesia

1. INTRODUCTION

DHF is the most important mosquito-borne disease, with the mosquito vector found in nearly 100 tropical countries in the world. The global distribution of *Aedes aegypti*, the mosquito vector for the dengue viruses, is comparable to that of malaria, and an estimated 2.5 billion people live in areas at risk for epidemic transmission.[1]

Indonesia is one of the largest countries in the dengue endemic region, with a population more and least of 251 million. Superimposed epidemic peaks occurred at irregular intervals and a progressive increase in intensity. The highest epidemic peak was observed in 2010 with 86 DHF cases per 100,000 person-years.[2]

DHF was still a serious public health problem, especially in Central Java Province Indonesia. Data indicated that all of 35 districts were endemic of

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DHF in this area. The number of cases of DHF increased in 2011 to 2013 with an incidence rate of 15.27, 19.29, and 45.53 per 100.000 population respectively. The high incidence of DHF was related to the area of unstable climate and rainfall. It was a potential breeding site for *Aedes aegypti* as the vector. Besides it, the low participation of the community in reducing mosquito breeding sites lead to the occurrence of extraordinary cases of DHF.[3]

Salatiga city is one of the endemic districts in Central Java, although the incidence was not so high compared to the other districts. Based on District Health Office (DHO) Salatiga report, the incidence varied from 15; 15; 58; 9, and 36 cases in the year of 2011 to 2015 respectively. Salatiga city is a high land area with low temperature. Demographically, the population were densed and mobile. Mobility of the inhabitants, who come in and out of Salatiga may become a risk factor for the incidence and faster spread of DHF . Three factors related to the spread of DHF in Indonesia i.e. the increases of population size, dengue vector-density and human mobility.[2]

A study conducted in Saudi Arabia showed that age, the presence of larvae in the house, watered container in the houses, and living close to constructing the building were the good predictors of dengue occurrence.[4] Many experts suggested that dengue cases would increase in the future, including geographic expansion and the incidence. Therefore, it is important to elaborate on some of the potential factors that drive dengue activity.[5]

Recently, modern contributing factors to the rapid expansion of vector-borne communicable disease include globalization factors, such as travel and trade, associated with vector accommodating trends in modern human settlement and suitable climate conditions. The contributions of increased mobility, both of vector and human populations, may be the most important variable to explain the recent increase in dengue transmission.[6]

Analysis and calculation of the standard *Aedes* larval indices, such as House Index (HI), Container Index (CI) and Breteau Index (BI), were carried out, to estimate the prevalence and infestation level of vectors in the locality. For epidemiological purposes, the HI indicates the potential spread of the virus through an area once an infected case becomes established. Unused wells, tree holes, discarded tyres, empty coconut shells, broken earthen pots, plastic cups, and packets, etc. were considered as breeding sites.[7] A value of HI greater than 5% and/or of BI greater than 20% for any locality are indications that the locality is prone to dengue.[8]

All those factors were possibly the risk factors for the increasing and spreading of DHF in the locality. This study aimed to analyze DHF spreading and related possible factors as a basic of Early Warning System (EWS) in Salatiga City.

2. METHOD

It was an observational research using cross-sectional design. The study population was 127 DHF cases occurred and registered in DHO of Salatiga City. At the first stage, the research identified all cases of DHF occurred in the year of 2011-2015. Basic information related to the identity of DHF cases was recorded: name of cases and parents, age, and address. Then, house visits were conducted to collect the data. Data collections were done by interviewing and observing the houses where the cases lived, whether there were mosque, school, market, industry, public places which may have related to DHF incidence. Geographic coordinate of DHF incidence was also measured using Geographic Positioning System (GPS) in Universal Trans Mercator (UTM) Unit. Data analysis were done in these steps: data entry of DHF cases identity and geographic coordinate in notepad sheet, create a basic map of Salatiga City in the shapefile (shp) format, spatial analysis using ArcGis 9.3. Finally, this study resulted in a map of spatially DHF distribution in Salatiga City using ArcGis 9.3 Ethical clearance was issued by Commission on Health Research Ethics of Faculty of Public Health, University of Diponegoro No. 185/EC/ FKM/2015.

3. RESULTS

The number of DHF cases were fluctuated over the five years. In the year of 2011, the number of DHF cases was low with 10 cases. It was known that the peak of DHF incidence occurred in the year 2013 with 54 cases and then decreased in the next year.

All DHF cases occurred in 2011 -2015 were analyzed to find whether a village was endemic of DHF or not. There were four villages which were infected area in the first two years. The number of infected areas were increased, and 19 villages (82.6%) were infected in the year 2015.

In this analysis, we divided the endemicity into three phenomena. *Firstly*, there were eight villages in Salatiga City which were endemic of DHF for the first three years. *Secondly*, in the next three years, there were five villages which were DHF endemic. *Thirdly*, there were two villages which were endemic of DHF over five years respectively.

These data indicated that there was a trend in DHF cases spreading of in Salatiga City. Although the number of endemic areas decreased (five

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villages) in 2015, the number of the infected areas increased to 19 villages. It was the largest infected area over five years latest in Salatiga City. It means that DHF had been spreading to another area in the recent year. This information can be used as the reminder for the stakeholders to scale up the promotion and prevention effort in DHF control.

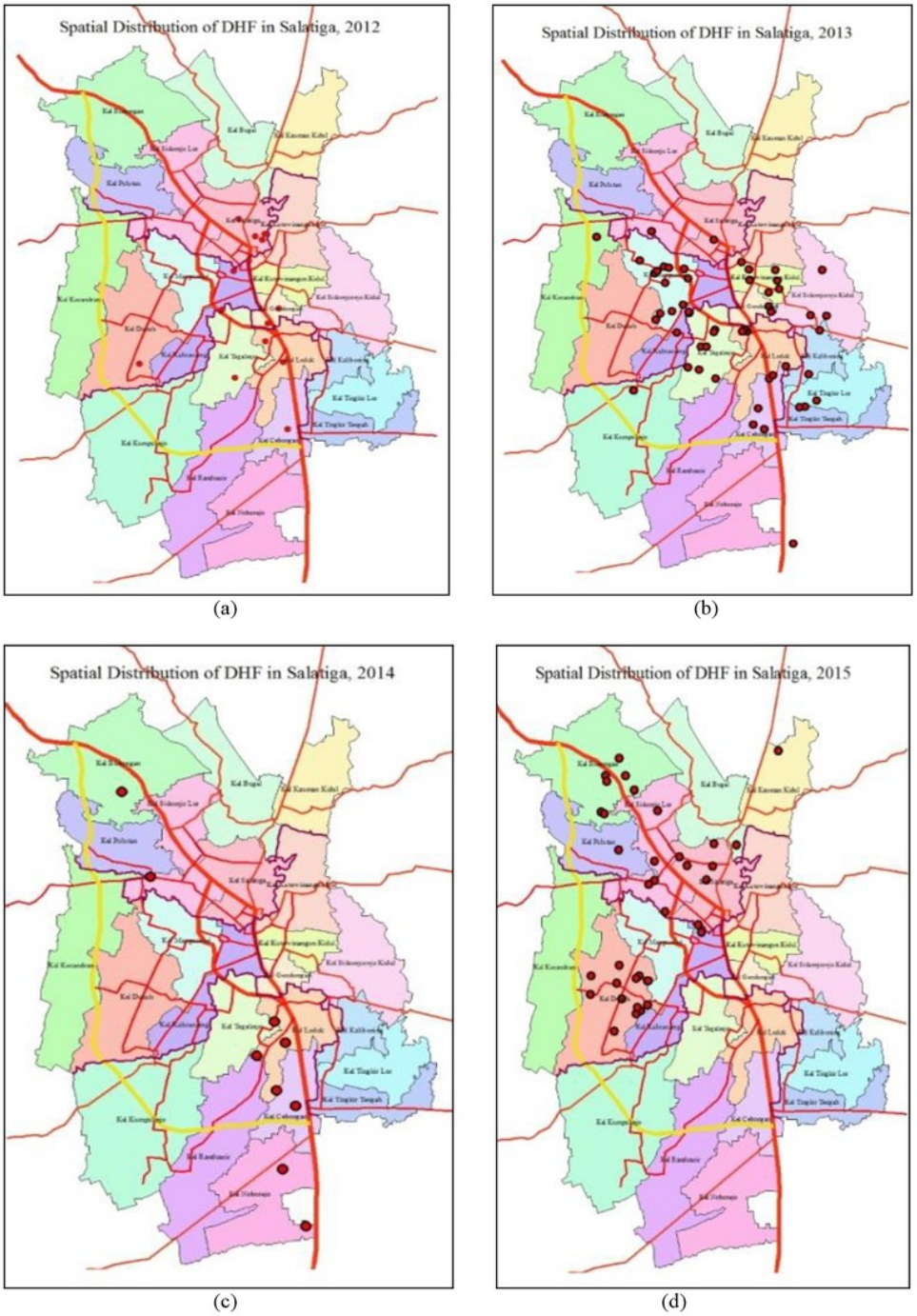

Fig. 1. Spatial analysis of DHF spreading in Salatiga City, 2011 - 2015

Fig. 1 illustrates the spatial distribution of DHF cases occurred five years latest in Salatiga City, Central Java Indonesia. In the first two years (2011 and 2012), the number of DHF cases indicated the same pattern in spatial distribution, see Fig 1 (a). The number of DHF cases reached the peak in 2013, and widerly spread from central of Salatiga City toward the rural area (Fig 1(b)). DHF follow five years pattern, although not always exactly. In the year of 2014, the DHF cases decreased to the low level dramatically and the cases distribution localized separately in the north and south area of Salatiga City (Fig 1(c)). However, it increased again in the next year. There was a specific pattern of distribution where the DHF cases distributed only in a half area of north of Salatiga City (Fig 1(d)).

4. DISCUSSION

In general, DHF incidence was fluctuated in five years pattern. DHF cases reached the peak in Salatiga City in the year of 2013. This pattern was similar to the other study, which illustrated that the number of DHF cases increased (with incidence rate 35-40/100,000) in Indonesia in year 2013.[2] Many factors were supposed contributing to DHF incidence. Socio-economic and cultural factors play a significant role in the incidence of DHF. It related to the behavioral practice and individual susceptibility. During dry and hot climate in India, the desert is cooler, thus become a major source of *Aedes* mosquito species breeding, particularly in a lower socio-economic group. Sometimes, water storage is done in baked-soil containers that water can not be cleaned perfectly.[9] Another expert also stated that demographic and societal changes such as population density, urbanization, and modern transportation probably contributed substantially to the increased incidence and geographical spread of dengue in Indonesia.[10] Salatiga was an urban area with high density of population. This research found that the average number of household per smallest unit of administrative area was 51. This density was twice higher than in the normal condition (25-30 household per unit). This factor may be related to the increasing number of DHF cases in Salatiga City.

Salatiga is a highlands area with high rainfall intensity. It may be one of the factors related to why the DHF increased and reached the peak in 2013. Rainfall intensity was one of the factors related to DHF incidence. The study in Sri Lanka found that temporal distribution of DHF was closely associated with the rainfall intensity. It indicated that there was a strong statistical association between dengue and rainfall. DHF incidence was relatively low during the heavy rainfall, because of the breeding habitats were throughout by high flow of rainfall, and then increase when the rainfall started to decrease, showing that about three to four weeks lag time between the rainfall and dengue outbreaks.[11]

DHF was an urban disease frequently rather than rural area. In general, it was endemic in densed population. Central of Salatiga City was the center of government offices take places, which is also high populated residence area. This fact was relevant to Karyati's statement that there is a clear annual geographical distribution of DHF incidence with concentrations mainly in high density populated areas.[2]

2 Other factors potentially contributing to DHF incidence and distribution include population growth, urbanization, lack of sanitation, poor water storage, increased long-distance travel, and ineffective mosquito control. These factors provide an increase in the breeding habitats of the mosquito. The rapid growth of cities due to population growth has led to overcrowding, and substandard sanitation, allowing more mosquitoes to live closer to more people.[12]

This research found that the house index (HI) was still high (11.24%). It was an important indicator of community participation in DHF control. It is suggested to control DHF effectively to decrease HI level. Singapore had experienced a successful vector control program that brought down dengue incidence between 1974 and 1985, when the HI came below 2%.[9]

Over the last five years, DHF had undergone the changing in distribution pattern in Salatiga City. Based on figure 1, The DHF occurred more frequent in central of Salatiga City. The city development of ring road as a new way to overcome traffic density passing the main road of Salatiga City has implication to DHF distribution, which tend to spread from the center of Salatiga City to the rural area where the ring road sited. Based on figure 2 (b,d), the DHF cases tend to spread and near the ring road. This pattern may be caused by the increasing of population mobility or traffic density. Other research stated that rapid urbanization and population growth had been identified as strong contributing factors to the increase of global dengue transmission and geographic expansion.[5]

5. CONCLUSION

The DHF cases had undergone the changing in spreading pattern, from the central of the city to the rural area near the ring road Salatiga. The DHO of Salatiga City shoud pay attention on DHF

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surveilance regarding to spreading dinamic of DHF cases.

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REFFERENCES

1. Liyd L. Environmental Health Project: best practice for dengue prevention and control in the Americas. Washington: US Agency for International Development; 2003.
2. Karyanti, M.R, Uiterwall, C.S.P.M, Kusriastuti, R., Hadinegoro S.R, Rovers M.M., Heesterbeek H, et al.The changing incidence of Dengue Haemorrhagic Fever in Indonesia: a 45-year registry-based Analysis. *BMC Infectious Diseases 2014,* 14(412): 3-7.
3. Province Health Office of Central Java Central Jawa Health Profile, 2013.
4. Kholedi A.A.A, Balubaid O, Milaat W, Kabbash I.A, Ibrahim A. Factors associated with the spread of dengue fever in Jeddah Governorate, Saudi Arabia. Eastern *Mediterranean Health Journal (EMHJ)* Vol. 18 No.1, 2012. p. 15-23
5. Murray N.E.A, Quam M.B, Smith A.W. Epidemiology of dengue: past, present and future prospects. *Clinical Epidemiology 2013*: 5, p. 299–309.
6. Gubler D.J. Dengue, Urbanization and Globalization: The Unholy Trinity of the 21(st) Century. *Trop Med Health*. 2011;39(Suppl 4):3–11.
7. Biswas D.K, Bhunia R, Basu M. Dengue fever in a rural area of West Bengal, India, 2012: an outbreak investigation. *WHO South-East Asia J Public Health 2014*; 3(1): 46–50.
8. Nizam K. Pests and vector management: aedes index. 2010. http://www.scribd.com/doc/41670075/Lecture-10-Aedes-Index - accessed 27 February 2014.
9. Bhatia, R., Aditya P. Dash A.P, Sunyoto, T. Changing epidemiology of dengue in South-East Asia. *WHO South-East Asia Journal of Public Health.* January-March 2013 2(1): 23-27.
10. Setiati, T.E., Wagenaar J.F, Kruit M.D, Mairuhu A.T, Gorp E.C, Soemantri A. Changing epidemiology of dengue haemorrhagic fever in Indonesia. *Dengue Bull 2006*, 30 :1–14.
11. Pathirana S, Kawabata M., Rohitha G.R. Study of potential risk of dengue disease outbreak in Sri Lanka using GIS and statistical modelling. *Journal of Rural and Tropical Public Health 2009*. Vol. 8: p. 8-17
12. Rahman H.A. Climate Cange and Dengue Fever Diseases: Any Association? International Scientific Journal Environmental Science. Environmental & Occupational Health Programme School of Health Sciences, Universiti Sains Malaysia. http://environment. scientific-journal.com.

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