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Mapping of Dengue Fever Incidence in Majjene Province, West Sulawesi 2016

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ABSTRACT

Majene province is an endemic area of dengue haemorrhagic fever. Several factors played a role in changes of dengue haemorrhagic fever cases were rainfall, population density and vector density of dengue haemorrhagic fever in term of larva-free numbers. This study aimed to describe the dengue haemorrhagic fever patients distribution in Majene district, West Sulawesi province. The study had been used observational with descriptive design. The study population was all positive dengue haemorrhagic fever patients recorded in Maejn Health Office report in 2016. The study samples were 199 positive patients. The data was analysed with SPSS program and ArcGis. The result indicated that spatial trend pattern in dengue haemorrhagic fever cases tend to concentrate in one area such as coastal areas especially urban areas which had high rainfall of 100-200 mm. In area with high rainfall also had very dense population that contributed transmission rapid spread. Besides, larvae free number did not meet the requirement issued by Ministry of Health which was> 95%. The dengue haemorrhagic fever program should be prioritized in areas with high rainfall and dense population. In additions, the larvae free program achievement will be further enhanced by increase budget and improved as cross program.

Keywords: *Dengue haemorrhagic fever, larvae free, dense population, rainfall*

Introduction

Dengue virus infection is worldwide health threat affecting at least 3.6 billion people living in more than 125 tropics or subtropics countries.[1,2] An approximately 50-100 million dengue fever and 200,000-500,000 dengue haemorrhagic fever (DHF) caused 24,000 mortality annually.[3,4]

World Health Organization (WHO) declared dengue and dengue haemorrhagic fever to be endemic in the Asian sub-continents.[3] Dengue virus is belonging to the genus Flavivirus (group B arbovirus, RNA virus) and includes structural and non-structural proteins.[5] There are four distinct serotypes such as DENV-1, DENV-2, DENV-3 and DENV-4 which transmitted to human through Aedes aegypti and Aedes albopictus mosquitoes.[6]

Aedes (Stegomyia) aegypti is the main vector global and found in urban environment and Aedes (Stegomyia) albopictus was considered secondary importance in transmission expect in Asian countries which present in rural or semi-urban habitats.[7] DHF is characterized by sudden onset of fever, thrombocytopenia and vascular leak syndrome and affected children under 15 years.[8] DHF can be correlated with poor outcomes depending on the facilities availabilities for patient management.[2]

DHF is one important public health problem in Indonesia. The mosquitoes transmission (vectors) of DHF are Aedes aegypti, Aedes albopictus and Aedes scutellaris. The existence of vectors (larvae of Aedes aegypti) in the area indicated presence of Aedes aegypti mosquitoes population in that area.

DHF vector density level can be observe through larvae surveillance. The larvae surveillance was carried out with calculation were obtained to find out the larvae index included larvae free number, house index, container index and breteau index. All regions in Indonesia are in risk of contracting dengue diseases. DHF is influenced by environmental conditions, population mobility, population density, presence of artificial and natural containers in landfills (TPA) and other garbage places.

High population density increases dengue infection since flying distance of mosquitoes is estimated at 50 meters. Besides, temperature and humidity are also among environmental conditions that affects development of Aedes aegypti.

In Majene district, dengue haemorrhagic fever incidence found increased annually. In 2015, there were 16 DHF patients who treated and increased to 199 DHF cases and four mortality cases were recorded. Meanwhile, Majene regency had DHF cases and outbreaks due to surge in cases and mortality. This study had represented in map form. Map can illustrate dengue haemorrhagic fever distribution that occurred in 2016 based on environmental factors such as climate change, population density and larvae free percentage. This study aimed to describe the dengue haemorrhagic fever patients distribution in Majene district, West Sulawesi province.

Methodology

The study was used observational study with descriptive research design to determine dengue haemorrhagic fever distribution by observe with population density and climate change and larval density based on Geographic Information Systems (GIS). The study location was conducted in Majene district, West Sulawesi province between February and April 2017. This district was selected due to this region was endemic to dengue haemorrhagic fever and included in outbreak area in 2016.

The population were 119 dengue haemorrhagic fever positive patients recorded in Majen health Office report. The samples were 199 positive patients in 2016. The primary data was obtained by conducted direct case survey, observed patient coordinates used GPS. The patients who moved to domicile was still taken coordinates at residence place on positive dengue haemorrhagic fever detection.

The secondary data were obtained from dengue haemorrhagic fever data from relevant agencies such as Majene District Health Office. Meanwhile, climate variation in form of monthly report at Majene Meteorology Station in 2016. The population density data was obtained from Majene Central Statistical Agency. The larvae free numbers per Public Health Centre (Puskesmas) was obtained from related office. The data was analysed with SPSS and GIS Arc computer programs. The data was represented in form of maps, tables, graphs and narrative.

Result and Discussion

In Table 1, 65 respondents (54.6%) were male and 64 respondents (45.6%) were female. Meanwhile, 55 respondents (46.2%) were aged between 0 year and 10 years old. Besides, there were 40 respondents (33.6%) aged between 11 years and 20 years old. There was only a respondent aged between 51 years and 60 years old. In additions, 67 respondents (56.3%) were students and 32 respondents (26.7%) were unemployment.

Table 1: Patient Distributions with dengue haemorrhagic fever based on characteristics in Majene district 2016

Characteristics	Total (n)	Percentage (%)
Gender		
Male	65	54.6
Female	64	45.6
Age group (years old)		
0-10	55	46.2
11-20	40	33.6
21-30	10	8.4
31-40	6	5
41-50	2	1.7
51-60	1	0.8
>60	5	4.2
Employment		
Unemployment	32	26.9
Student	67	56.3
Civil servant/ lecturers	6	5
Housewives	6	5
Entrepreneur	3	2.5
Farmers/Fisherman	5	4.2
Total	119	100

Based in Table 2, there were seven respondents with mobility history from endemic areas from Makassar city. Meanwhile, seven respondents came from Malunda subdistrict. Meanwhile, 5 respondents were from Mamuju regency.

Table 2: Patient distribution with dengue haemorrhagic fever based on mobility history in Majene district 2016

Mobility history	Total (n)	Percentage (%)
Endemic area	16	13.4
Not traveling	103	86.6
Total	119	100

Table 3 showed average rainfall occurred in Majene district in 2016. There were 4 sub district with extreme categories and another 4 sub district with high rainfall categories. Highest rainfall occurred in Ulumanda subdistrict with 240 mm and Tammeroddo had recorded rainfall with 208 mm (extreme) and lowest rainfall was in East Banggae with 142 mm (high).

Table 3: Rainfall distribution in Majene district 2016

Sub district	Rainfall	Category
Banggae	168	High
East Banggae	142	High
Pamboang	162	High
Sendana	160	High
Tammeroddo	208	Extreme
Tubo Sendana	207	Extreme
Malunda	205	Extreme
Ulumanda	240	Extreme

Table 4 showed Banggae subdistrict had highest population density of 1579 population/km2 while Ulumanda district which had population of 19 population/ km2. There were 4 subdistrict had very dense population included Banggae and East Banggae. Meanwhile, Pamboang and Sendana had dense population. Ulumanda subdistrict had normal population density.

Table 4: Population density population by category in Majene district 2016

Sub district	Population/km^2	Category
Banggae	1579	Very dense
East Banggae	1010	Very dense
Pamboang	311	Dense
Sendana	269	Dense
Tammeroddo	202	Less dense
Tubo Sendana	212	Less dense
Malunda	97	Less dense
Ulumanda	19	Normal

In Table 5, the larvae free numbers achievement in each subdistrict in Majene did not reached Ministry of Health target set which was >95%. Highest achievement in Pamboang subdistrict was 92.2% and lowest was in Banggae subdistrict, 78.8%.

Table 5: Larvae free number distribution achievement in Manene district 2016

Subdistrict	Total house	Checked house	Larvae free	Percentage
Banggae	7787	3757	2962	78.8
East Banggae	6555	3170	2742	86.5
Pamboang	4208	2730	2516	92.2
Sendana	4419	1665	1456	87.4
Tammeroddo	2371	560	514	91.8
Tubo Sendana	1721	730	658	90.1
Malunda	3775	1195	1077	90.1
Ulumanda	1688	720	657	91.3

Discussion

In this study, the maps showed distribution pattern of dengue haemorrhagic fever patients more likely to be close together due to ability flying vector ability caused of dengue haemorrhagic fever which was only between 50m and 100m.

In additions, the dengue haemorrhagic fever also strongly influenced by height of the area since the result obtained in Majene district was mostly in the coastal areas along Majene district.

In Majene district, the coastal areas were most resided areas and connected with South Sulawesi, West Sulawesi and Central Sulawesi province which meant community in Majene district were living in lowland that were very potential as breeding place for dengue.

Meanwhile, positive dengue haemorrhagic fever patients in Majene district were widely spread in urban areas which very closely related to environment sanitation such as waste management. In urban areas, waste production was more than rural areas which contributed in Aedes mosquitoes breeding area if did not treated well.

The dengue haemorrhagic fever incidence was widespread in areas with high rainfall (100-200mm) than areas had extreme rainfall (>200mm). High rainfall category was found in Southern part of Majene district while extreme rainfall category was found in Northern part of Majene district.

High dengue haemorrhagic fever incidence in high rainfall areas compared to extreme rainfall areas due to inundation created breeding ground for Aedes mosquitoes while extreme rainfall caused flood lead water flows full with Aedes mosquitoes larvae. The rain affected the mosquitoes life in two ways such as increased relative humidity and breeding ground.

Baggae subdistrict which had highest number of positive dengue haemorrhagic fever patients in Majene district which was 76.9% in adjacent to the shoreline. In general, distribution of dengue haemorrhagic fever patients in all sub district was more prevalent in adjacent areas to the coast.

Population density was resident number living per unit area (km^2). Denser the area, greater potential for disease transmission. The population density affected the vulnerability of an area to several diseases especially those that were closely related to the environment. The disease was more easily transmitted to the areas that were densely populated due to transmission range was getting closer. In additions, density and population were among the factors that influenced dengue incidence in the region.

The region had very dense population such as in urban areas had public facilities included health facilities (hospitals, public health centres and general practitioners), other public facilities such as markets, schools, tourist attraction, hotels that caused dengue haemorrhagic fever was very easily transmitted the diseases.

Besides, population mobility was also risk factors caused dengue haemorrhagic fever spread in Majene district. Most positive dengue haemorrhagic fever patients came from endemic areas such as Makassar city and Mamuju regency.

The larvae free number achievement in seven district was <95% that did not meet the Ministry of Health requirement. The presence of Aedes larvae mosquitoes in the region indicated that there was potential for dengue haemorrhagic fever to occur.

The spot check activities were not carried out in all houses or building in their respective areas due to lack of energy and costs allocated. Tubo Sendana subdistrict had 90.1% larvae free achievement but did not received by positive dengue haemorrhagic fever patients. The larvae free numbers was measure of larvae density in an area to reduce the dengue fever risk or dengue haemorrhagic fever transmission which necessary to eradicate mosquito nests.

Conclusion

In conclusion, positive dengue haemorrhagic fever patients found more in areas with high rainfall (100-200mm) compared to areas with extreme rainfall. High rainfall was caused inundation as breeding ground for Aedes mosquitoes. Meanwhile, areas with very dense population had more dengue haemorrhagic fever patients. The population density also affected dengue transmission since flying vector of disease was estimated to be only 50-100 meter. All subdistrict in Majene district had <95% larvae free number or did not fulfil the requirement of Ministry Health.

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