



REGIONAL VULNERABILITY TO DENGUE HEMORRHAGE FEVER (DHF) CASE IN PUSKESMAS MRANGGEN 3

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Article details:

Received: 1st May 2021

Accepted: 13th May 2021

Published: 31st May 2021



Abstract

Community Health centers (Puskesmas) Mranggen 3 (3rd Public Health Center of Mranggen) area has DHF case annually. Environmental health factor is one of important indicators determining the health degree. This research aimed to find out the regional vulnerability index of DHF case. This study was an analytical observational research with spatial approach. The result of research showed that the regional vulnerability

indexes of DHF case are 6.6% high, 32.9% moderate, and 14.5% low vulnerabilities. Regional vulnerability indexes without DHF case are 19.7% high, and 26.3% moderate vulnerabilities. Regional vulnerability results from the examination on house sanitation, larva free Index (LFI) and Container Index (CI), population density, and settlement pattern. Regional vulnerability Index in 76 RWs (neighbourhood associations in Puskesmas Mranggen 3 area can detect the areas with low, moderate, and high vulnerabilities in the region either with or without case; in addition, regional vulnerability is important to prevent and to control DHF case in micro scale.

Keywords: DHF case, Regional Vulnerability, Spati

To cite this article :

Dwi Kartini, Mursid Raharjo, N. (2021). Regional Vulnerability To Dengue Hemorrhage Fever (Dhf) Case In Puskesmas Mranggen 3. *International Journal of Health, Education and Social (IJHES)*, 4(5), 1–9.



Introduction

Vector born disease is still an endemic disease potentially causing epidemic or extraordinary incidence, thereby requiring the attempt of controlling vector transmission (Sumampouw, 2017). Dengue Hemorrhage Fever (DHF) is a disease found widely in most tropical and subtropical areas, particularly South East Asia (Lestari K, 2007).

The spread of DHF case in Indonesia was found in 481 Regencies/Cities in 34 provinces in 2019, with 137,761 cases (Kementerian Kesehatan R.I., 2019 [RI's Ministry of Health], 2019). DHF disease in Central Java Province is a serious problem, as indicated with 35 regencies/cities (100%) having been affected with DHF disease up to 2019 (Dinas Kesehatan Provinsi Jawa Tengah, 2019 [Central Java Province's Health Office], 2019). There were 167 DHF cases in 2019 in Demak Regency (IR : 14.36 per 100,000 people)(Dinas Kesehatan Kabupaten Demak [Health Office of Demak Regency], 2019). Based on the data of Puskesmas Mranggen 3, DHF case is a serious problem in that region; it can be seen from the incidence of DHF case every year with 133 DHF cases in 2019-2020 (Puskesmas Mranggen 3, 2019).

Very few studies have been conducted on vulnerability index in DHF cases in regional level. Identification and analysis of environment health factor in Puskesmas Mranggen 3 have not been available until today. This research aims to find out the regional vulnerability to DHF case by house sanitation, larva free index (LFI), CI, population density, and settlement pattern. This research on regional vulnerability to DHF case is very important. The objective of research is to conduct analysis on regional vulnerability, and thus, the result can be used to detect, to prevent and to control the region with high risk of DHF case.

Methods

This study was an observational research with cross-sectional design using spatial approach. The variable used to measure the value in the field was regional vulnerability including house sanitation, LFI, CI, population density, settlement pattern and DHF case. The map of village area was analyzed into regional polygon of 76 RWs using ArcGIS.

Table 1. Weighing and scoring of research variable in Puskesmas Mranggen 3

NO	VARIABLE	CATEGORY	SCORE	WEIGHT
1	House sanitation	< 80% of total score	1	30
		80 – 100% of total score	2	
2	Larva Free Index	< 95 %	1	25
		≥ 95%	2	
3	Container Index	≥ 10 %	1	25
		< 10 %	2	
4	Population Density	Low (≤150)	1	10
		Moderate (151-200)	2	
		High (201-400)	3	
		Very dense (≥401)	4	
5	Settlement Pattern	Settlement	1	10
		Housing	2	



The unit of analysis used was 76 RWs in Puskesmas Mranggen 3 area. Regional vulnerability was obtained through weighing house sanitation, LFI, CFI, population density, and settlement pattern variables, considering the risk factor. The weights of house sanitation, LFI, CI, population density, and settlement pattern are 30%, 25%, 25%, 10%, and 10%, respectively.

The variables scored and weighed by the effect of regional vulnerability to DHF cases were then overlaid. From the result of overlay, it can be found the lowest vulnerability index of 1.1 and the highest one of 2.2, later classified into 3 grades or levels. Grade 1 with the range of 1.1-1.4 belongs to low vulnerability, scoring 3. Grade 2 with the range of 1.5-1.8 belongs to moderate vulnerability, scoring 2. Grade 3 with the range of 1.9-2.2 belongs to high vulnerability, scoring 1.

Ethical approval for this study has been obtained from the Ethical Commission for Medical Research, Faculty of Public Health, Diponegoro University, No. 10/EA/KEPK-FKM/2020 on January 26, 2021.

Results

1. DHF case identification

DHF is one of diseases developing annually in Puskesmas Mranggen 3 region. Considering the data of patients, there have been 133 cases: 90 in 2019 and 43 cases in 2020 in 76 RWs. The case spread indicates 41 RWs (53.9%) with DHF, and 35 RWs (46.1%) without DHF.

Table 1: DHF case in Puskesmas Mranggen 3 in 2019-2020

RW	Village	DHF Case	RW	Village	DHF case
3	Banyumeneng	1	25	Batursari	5
5	Banyumeneng	4	28	Batursari	3
6	Banyumeneng	2	29	Batursari	1
1	Batursari	2	30	Batursari	2
2	Batursari	3	32	Batursari	2
3	Batursari	5	34	Batursari	6
4	Batursari	7	35	Batursari	1
5	Batursari	2	38	Batursari	5
6	Batursari	1	1	Kebonbatur	20
7	Batursari	3	2	Kebonbatur	2
11	Batursari	1	7	Kebonbatur	3
10	Batursari	2	10	Kebonbatur	4
11	Batursari	13	12	Kebonbatur	2
12	Batursari	2	14	Kebonbatur	1
13	Batursari	3	16	Kebonbatur	2
15	Batursari	4	18	Kebonbatur	1
17	Batursari	2	20	Kebonbatur	2
20	Batursari	1	23	Kebonbatur	1
21	Batursari	3	24	Kebonbatur	1
22	Batursari	5	26	Kebonbatur	1
23	Batursari	1			
Total					133



2. Identification of House Sanitation

House sanitation indicates that out of 76 RWs, 32 (42.1%) are unqualified, and 44 (57.9%) are qualified.

3. Identification of Larva Free Index (LFI) and Container Index (CI)

Larva Free Index (LFI) of 50% is found in 1 (one) area, LFI of 60% in 1 (one) area, LFI of 65% in 1 (one) area, LFI of 70% in 2 (two) areas, LFI of 75% in 10 (ten) areas, LFI of 80% in 7 (seven) areas, LFI of 85% in 7 areas, LFI of 90% in 6 (six) areas, LFI of 95% in 32 (thirty two) areas, and LFI of 100% in 9 (nine) areas.

The lowest container index (CI) with score of 0% is found in 2 RW areas: RW 9, RW 18, RW, 26, RW 37, and RW 40 of Batusari Village, and RW 5, RW 10, RW 15, and RW 27 of Kebonbatur Village. The highest one with score of 21.67% is found in RW 22 of Batusari Village.

4. Identification of Population Density

Population density in 9 RWs (11.8%) belongs to moderate category, while that in 57 RWs (75%) belongs to high, and that in 10 RWs (13.2%) belongs to very dense category.

5. Identification of Settlement Pattern

Housing settlement pattern is found in 22 RWs (28.9%) and housing pattern is found in 54 RWs (71.1%).

6. Spatial data of Regional Vulnerability to DHF case by house sanitation, house index, Container Index, population dense and settlement pattern.

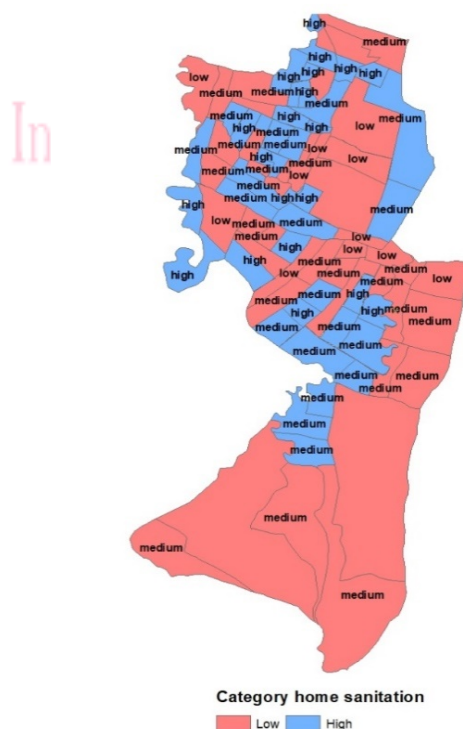


Figure 1. Regional Vulnerability to DHF case by house sanitation

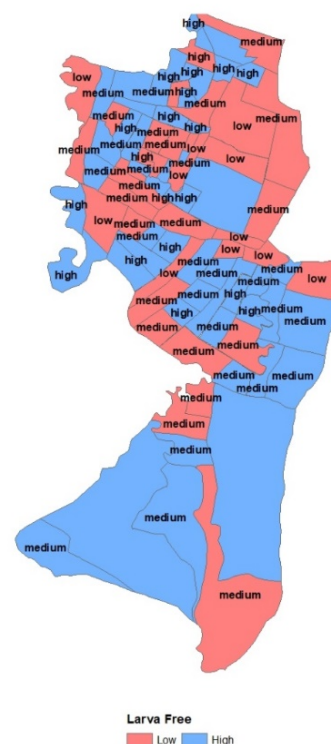


Figure 2. Regional Vulnerability to DHF case by Larva Free Index



Figure 3. Regional Vulnerability to DHF case by container index

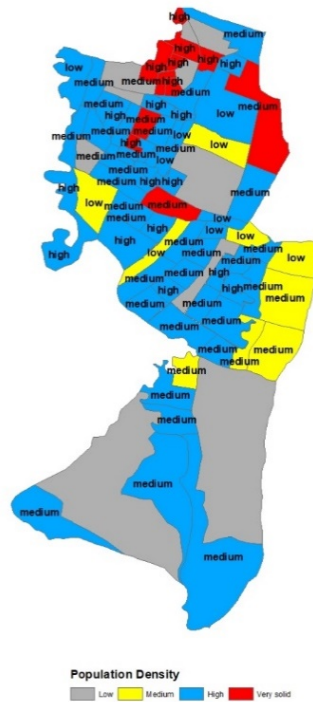


Figure 4. Regional vulnerability to DHF case by population dense

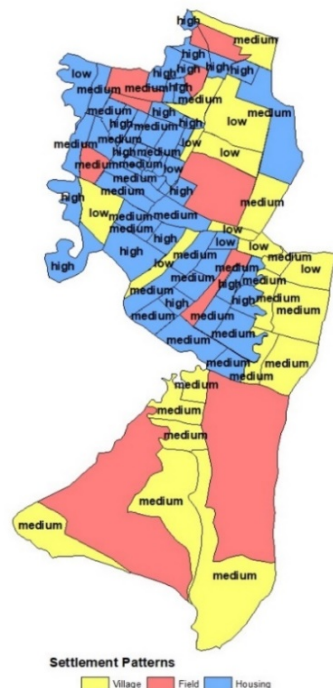


Figure 5. Regional vulnerability in DHF Case by settlement pattern

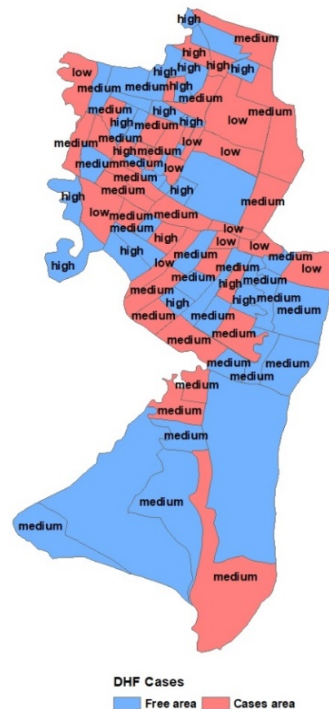


Figure 6. Regional vulnerability to DHF case by DHF Case



Figure 1 shows that the region with unqualified house sanitation (42.1%) has moderate and low vulnerabilities. The region with qualified house sanitation (57.9%) has high and moderate vulnerabilities.

Figure 2 shows that the region with Larva Free Index (LFI) not complying with standard quality (46.1%) has high, moderate, and low vulnerabilities. The one with Larva Free Index (LFI) complying with standard quality (53.9%) has high and moderate vulnerabilities.

Figure 3 shows that the region with high container index (CI) (43.4%) has high, moderate, and low vulnerabilities. The one with low container index (CI) (56.6%) has high, moderate, and low vulnerabilities.

Figure 4 shows the region with moderate population density (11.8 %) has moderate and low vulnerabilities. The one with high population density (13.2 %) has high, moderate, and low vulnerabilities. The one with very dense population (13.2%) has high and moderate vulnerabilities.

Figure 5 shows that the region with settlement and village patterns (28.9%) has moderate and low vulnerabilities. The one with housing pattern (71.1%) has high, moderate, and low vulnerabilities.

Figure 6 shows that the region with DHF case (53.9%) has high, moderate, and low vulnerabilities. The region with DHF case (46.1%) has high and low vulnerabilities.

Discussion

The regional vulnerability, by House Sanitation, shows that there are regions with low, moderate, and high vulnerabilities. Environmental sanitation highly affects the existence and density of *Ae. aegypti* mosquito in settlement environment, so that it should be prioritized in controlling DHF vector (H. Prasetyowati et al., 2018). Environment with good quality and low health degree is the one with high vulnerability for the proliferation of *Aedes aegypti* dan *Aedes albopictus* mosquito, so that DHF disease and epidemic can transmit more widely (Sumunar, 2017).

Regional vulnerability, by Larva Free Index (LFI) and Container Index (CI), indicates that there are regions with low, moderate, and high vulnerabilities. Revi Rosavika Kinansi's study found that the DHF vector density in Vector-Specific Research area is still very high in 2015 and Larva Free Index (LFI) in the four provinces is less than 95%. This condition potentially increases DHF cases (Revi Rosavika Kinansi, Wening Widjajanti, 2017). This finding is in line with the finding of research on CI in Demakan Regency, 7.08%. This condition potentially results in the high DHF transmission within society. The result of spatial analysis shows that the spread of DHF case occurs most frequently in Mranggen Sub District with even distribution pattern in all villages. The higher the population density and the housing density, the higher is the IR of DHF ($p\text{-value} < 0,05$) (Musyarifatun Farahiyah, 2014).

Regional vulnerability, by Population Density, shows that there are regions with low, moderate, and high vulnerability. Masrizal in his research found that the higher the population density, the higher is the DHF incidence rate (Syauqiannur et al., 2019). The spread of DHF case is found most widely in the land with low altitude and in the region with high population density (Paomey et al., 2019). Irma Prasetyowati in her study indicated the relationship between population density and DHF incidence rate in Bondowoso Regency. The increase of DHF case in 2011-2013 is Extraordinary Incidence requiring full attention because it will tend



to increase over years. A series of activities are conducted in dealing with DHF case to prevent the increase in patient number and DHF-related mortality in Bondowoso Regency (I. Prasetyowati, 2015).

Regional vulnerability, by Settlement Pattern, indicates that there are regions with low, moderate, and high vulnerabilities. The region with high vulnerability, just like that in Gilingan Village, is supported with less good physical condition. Gilingan village has high population density, dense settlement, and worsened with disorganized settlement pattern (Faizal Kusuma Jati, 2014). The DHF case spreads normatively in the land use area with settlement characteristics (Muliansyah & Baskoro, 2015).

Eni Yuniastuti and Diah Respati explained that settlement pattern also affects the spread of DHF disease. Settlement pattern is whether or not the settlement is constructed in organized and disorganized manners, viewed from house building width, road-related direction, and building shape uniformity. The pattern can be identified by layout, size, and uniformity of dwellings. Settlement pattern affects the proliferation of *Aedes aegypti* mosquito vector, if the settlement pattern is organized and planned very well, the condition of an environment or area will be good, thereby will reduce the proliferation of mosquito vector (Yuniastuti & Suryo, 2015).

The regional vulnerability to DHF case shows that there are regions with low, moderate, and high vulnerabilities. DHF spread indicates the positive spatial autocorrelation every year in the period of 2011-2015. The DHF case spreading pattern is cluster (occurring in cluster). Thus, the region where the case cluster is found is the one vulnerable to DHF disease (Ruliansyah et al., 2017).

This research was conducted in 2019 using secondary data obtained from Meteorology, Climatology, and Geophysics Agency (BMKG), Central Bureau of Statistic, and Health Office of Semarang City. Regional vulnerability is determined by weighted overlay method. Vulnerability to DHF is identified by air temperature, humidity, rainfall, larva free index, endemism, and population density. Regional vulnerability to Dengue Hemorrhage Fever (DHF) incidence in Semarang city is 14.1% of urban area width in Semarang City belonging to not-vulnerable, 53.1% to vulnerable, and 32.8% to very vulnerable categories (Kleden et al., 2019). The region vulnerable to DHF has high endemism because the number of DHF case increases over years (Setiawan et al., 2017).

Conclusion and Recommendation

Considering the result of research and discussion, the following discussions can be drawn.

1. Regional vulnerability index in 76 RWs in Puskesmas Mranggen 3 area can detect the regions with low, moderate, and high vulnerabilities.
2. The development of vulnerability index is limited to house sanitation, LFI, CI, population density and settlement pattern, excluding other environment health factors.
3. Vulnerability index assessment can be applied to a wider scope of DHF endemic area.
4. Regional vulnerability assessment is important to prevent and to control DHF case in micro scale.



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