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The Existence of AedesAegypti Mosquito Breeding Base Based on Geographic Information Systems in DarulImarahDistrict, Aceh BesarRegency

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ABSTRACT

Efforts to control Dengue Hemorrhagic Fever (DHF) require complete and accurate information. The spread of the virus can be seen from the perspective of spatial information (geospatial), one of the main components is a picture of the earth both in whole or in part made in analog or digital format. Darul Imarah districtis one of the endemic districts of DHF with 32 cases in 2017. The distribution of cases is made in the form of spatial mapping.The aim of this research is to map the existence of Aedesaegypti breeding place based on geographic information system (GIS) in DarulImarahDistrict. This research method is descriptive observational survey using geographic information system modeling through spatial analysis. The research subject is the data of dengue hemorrhagic fever cases in 2017 and Aedesaegypti breeding places in the case home environment. Data analysis was performed descriptively, then presented with spatial analysis.The results of the analysis note that the existence of breeding places and dense housing has the potential for DHF. The home environment of DHF patients found less than 100 meters in the presence of breeding places. Through the use of this information, it is expected that the Puskesmas and village servants can move the community's participation in the practice of eradicating mosquito nests so that they can exercise control at vulnerable points / potential in dengue transmission.
Keywords: Breeding place, Aedesaegypti, Geogafis Information System.

INTRODUCTION

Dengue Hemorrhagic Fever (DHF) is an infectious disease caused by dengue virus which spreads the fastest in the world. This disease is caused by the dengue virus which is transmitted by female mosquitoes, namely from the species *Aedesaegypti* and *Aedes albopictus.*[1] In Indonesia, dengue fever is still a health problem until now and in Aceh Province, dengue fever is one of a serious problem, with the 2016 Incidence Rate (IR) reaching 91.9 / 100,000 population, nationally IR has increased compared to 2015 reaching 30.17/100,000 population.[2]Aceh Besar Regencyis one of the endemic areas of DHF in Aceh with high dengue cases every year. In 2016 there was case increase total 149 cases (IR = 38.9/100,000 population) comparedto 2015 which only numbered 78 cases (IR = 20.3 / 100,000 population).[3]

The presence of dengue cases in Aceh Besar Regencyis supported by several influential factors, such as height of this area less than 100 mdpl, densely populated areas, high vector density and also the community behavior in eradicating mosquito nests that are not optimal yet.[3] DBD vector mosquito breeding sites are puddles in artificial reservoirs such as drums, bathtubs, barrels, buckets, and so on; natural water reservoirs such as tree holes, banana leaves, taro leaves, stone holes, or vases, tires and old bottles, drinking places for birds. Various efforts have been used by health agencies to break the chain of transmission of dengue fever including the discovery and treatment of sufferers, vector control and cross-sectoral cooperation. Vector control activities that have been carried out are fogging and eradication of mosquito breeding activities by involving community participation.

In addition, efforts to control DHF require complete and accurate information, such as thematic maps that present information on the main location of patterns and distribution of cases. Monitoring carried out using tables and graphs cannot yet show trends and spatial patterns. Techniques and methodologies that can be used as a program reference effort that serves to analyze

the incidence of diseases on the surface of the earth, namely spatial analysis. Spatial approach with the use of GIS is important to do because by using analysis in GIS it can be seen population density and larvae with frequency of DHF cases. The aim of this study is to map the existence of *Aedesaegypti*breeding place based on geographic information system (GIS) in DarulImarahDistrict in 2018. The implementation of GIS in handling DHF cases is expected to increase the effectiveness of spatial decision making and be able to integrate the location description with the characteristics of phenomena found in a location.

METHODS

The research method used is descriptive observational survey using Geographic Information System (GIS) modeling through spatial analysis to get an overview of the distribution of DHF cases, DHF prone zones as well as a spatial picture of environmental factors in the incidence of DHF. The study was conducted in the Darul Imarah District.

The research was conducted in the Darul Imarah District, Aceh Besar District. The time of the research was conducted in July - August 2018. The research subjects were data on cases of dengue hemorrhagic fever in 2017 and the housing environment where cases/sufferers lived in Darul Imarah Aceh Besar District. Data analysis was carried out spatially using GIS (Geographical Information System). Spatial analysis of the existence of breeding places for Aedes aegepty mosquitoes using the buffer method.

RESULT

1. Overview of Research Locations

Darul Imarah District has 24.35 km^{2}area, which is divided into 32 villages, 117 hamlets and 4 Mukim. A large portion of this district is directly bordered by the capital of Aceh Province, the city of Banda Aceh. Distance between DarulImarah District to the capital of Aceh BesarRegency ± 60 km, and distance DarulImarah District to the capital of Aceh Province ± 10 km with the required travel time from the district to the provincial capital ± 30 minutes using public transportation.The population in DarulImarah District, Aceh Besar Regency in 2018 was 53,177 people with 27,030 male and 26,147 female. [5]The level of population development by sex can be seen from the development of comparisons between male and female populations per 100 population.

2. Distribution of DHF Cases in DarulImarah District

The results of the study based on the distribution of DHF cases of in DarulImarah District, Aceh BesarRegency in 2017 can be seen in table below:

Table 1. Distribution of DHF cases in DarulImarah District, Aceh BesarRegency, 2017.

No	Village	Total DHF case	(%)
1.	Lamcot	7	23
2.	Lamblang Manyang	1	3
3.	LamblangTrieng	2	6
4.	KutaKarang	1	3
5.	Lampeuneun	1	3
6.	Tingkeum	1	3
7.	Lambheu	1	3
8.	Gue Gajah	2	6
9.	Punie	4	13
10.	Lee ue	3	9
11.	Pasheu Beutong	1	3
12.	Ajun Jeumpet	5	16
13.	Garot	3	9
Jumlah		**32**	**100**

Sumber : Data Sekunder (2018)

From the table 2, it can be seen the number of DHF cases in DarulImarah District in 2017, the highest incidence of DHF cases occurred in Lamcot Village as many as 7 cases (23%)

and AjunJeumpet Village as many as 5 cases (16%). If we examined about the range of regions, both villages are closely related to the capital city of Aceh.

The distribution of dengue cases in DarulImarah sub-district based on the village area can be seen as follows:

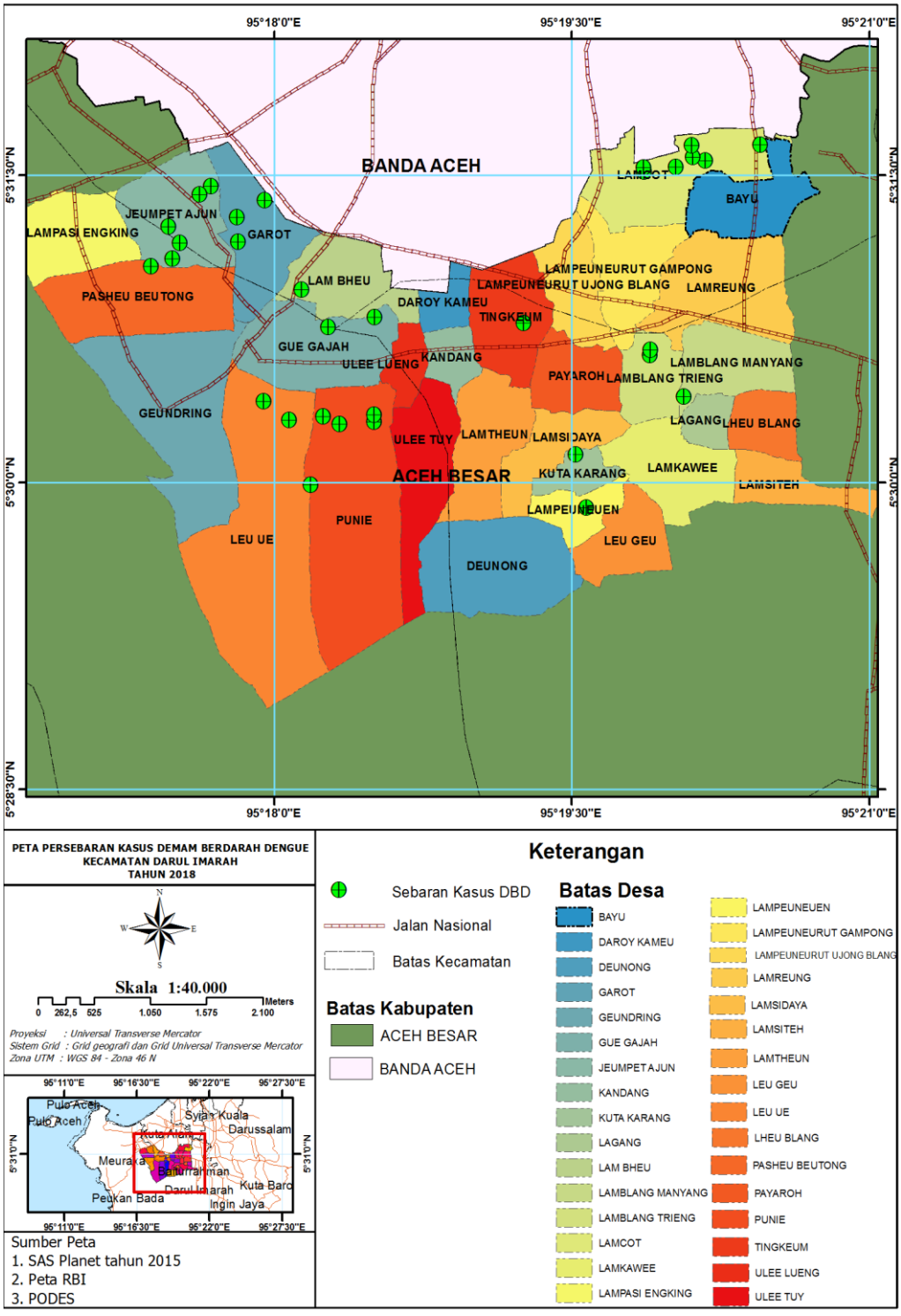

Figure 1. Distribution of DHF cases in DarulImarah sub-district in 2018

From Figure 1 above it is known that the highest DHF cases occur in Lamcot Village. Spatial mapping results show that Lamcot Village has a high level of house density. This shows the tendency of displacement and distribution of cases can occur from a dense environment, conversely from an environment with low housing density, the distribution of DHF cases may also be low. More details can be seen in the following picture:

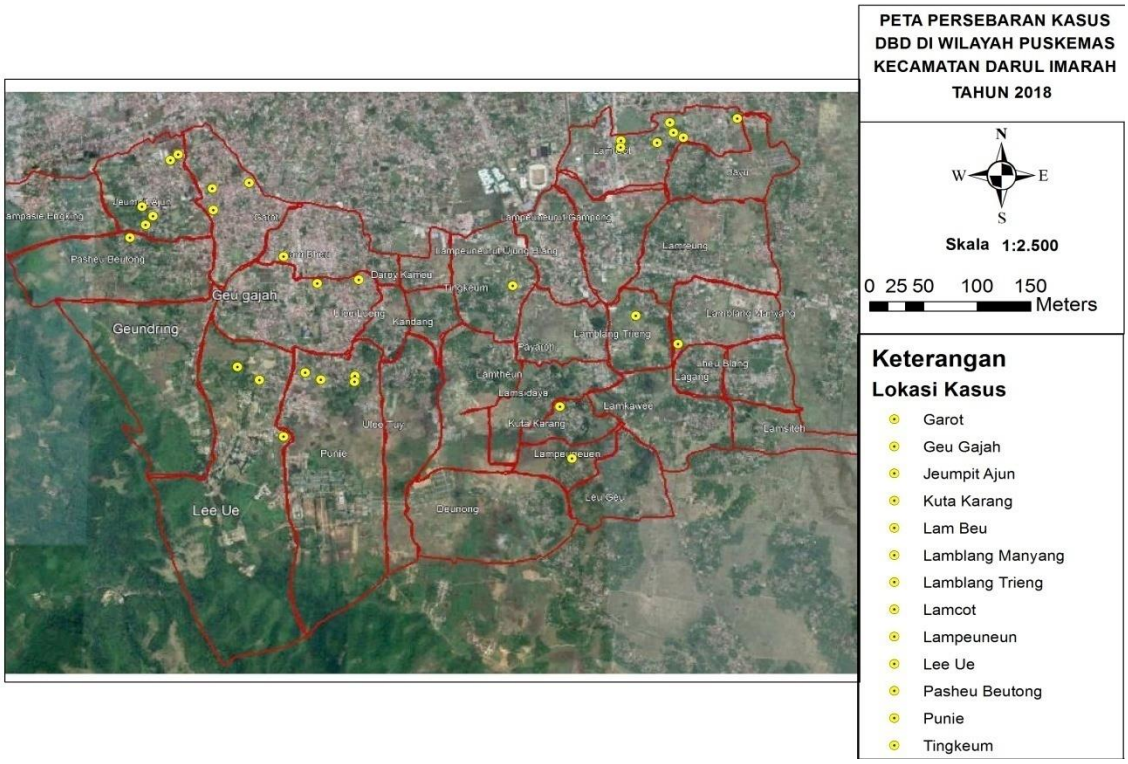

Figure 2. Map of Spatial Distribution of DHF Cases in 2018 DarulImarah District

3. Distribution and Habitat of DHF Vector Developmental Areas

From observations at the location of the incidence of DHF cases, it is known that there are 19 points of the presence of breeding places of *Aedesaegypti* with the discovery of 12 points of Water Reservoir, namely 2 points of AjunJeumpet Village, 1 point of Garot Village, 1 point of Lambheu Village, 1 point of Lamcot Village 2 points LeuUe Village, 3 points Punie Village and 1 point KutaKarang Village. 2 points of Natural Water Reservoir, 1 point AjunJeumpet and 1 point Lamcot Village. 5 points without Water Reservoirs, namely 1 point PasheuBeutong Village, 1 point Lamcot Village, 2 points LamblangTrieng Village, 1 point Lampeuneun Village.

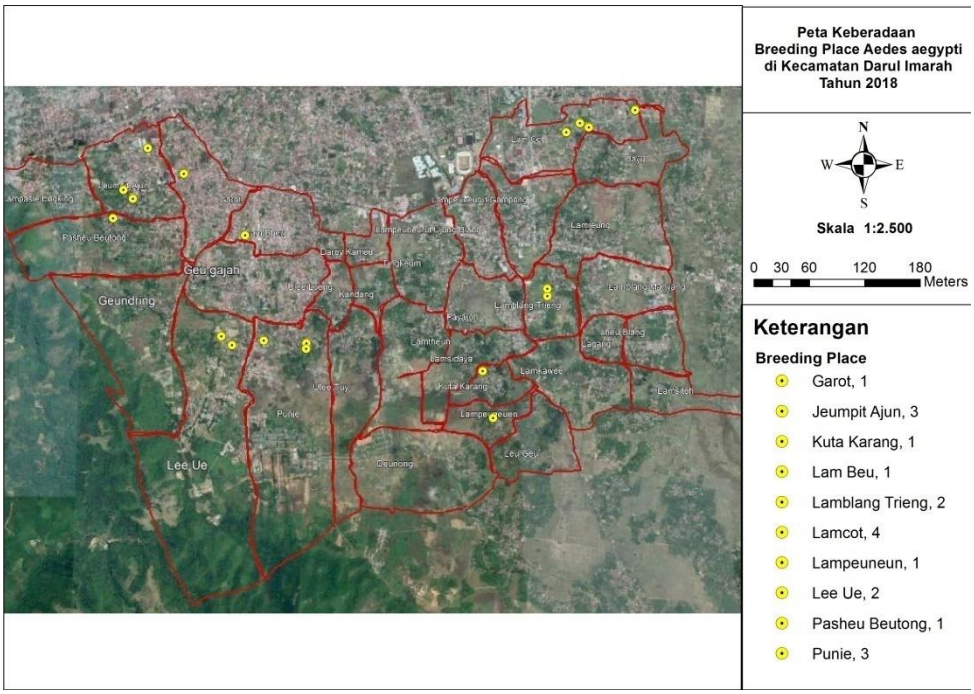

Figure 3 Map of Spatial Distribution of DHF Mosquito Breeding Sites in DarulImarah District 2018

Distribution of breeding places of *Aedes aegypti* mosquitoes based on the type of breeding place can be seen in Figure 4 below:

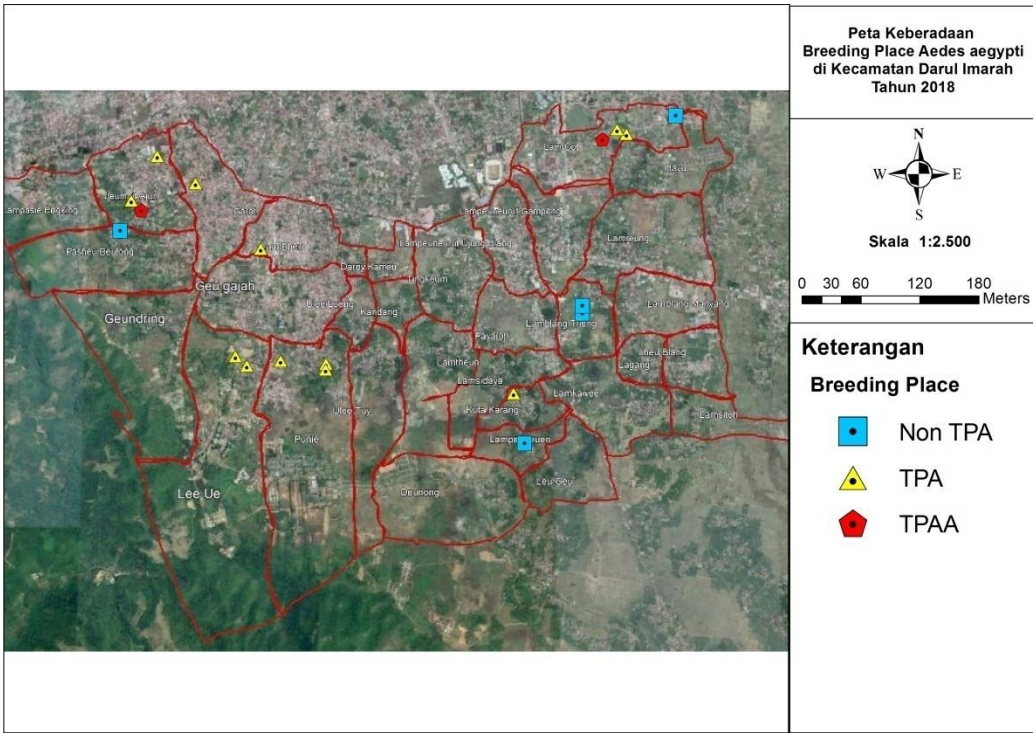

Figure 4 Map of Spatial Distribution of DHF Mosquito Breeding Places by Breed in the DarulImarah District 2018.

Spatial analysis of the existence of *Aedesaegypti* breeding place on the incidence of DHF was done using the buffer method. Distribution of breeding places and DHF incidents in DarulImarah District can be seen in Figures 3 and 4 which explain the distribution of breeding places. Breeding places were found in DarulImarah District with 19 points. Breeding places are found in the form of piles of used tires, bathtubs, wells, coconut shells, bottles, buckets, and flower vases.

Buffering in the <40 meter zone shows that mosquitoes originating from the breeding point have the potential to cause DHF transmission because 32 cases of DHF enter the buffer zone. In the zone <40 meters breeding place has the potential for DHF transmission to reach other villages. The existence of Breeding place in the case area is in the zone <100 meters which has the potential to cause DHF transmission because all DHF sufferers are at *Aedesaegypti* normal flight distance.

Discussion

1. Distribution of DHF Cases in DarulImarah District

Based on the results of the mapping of DHF incidence spread s in the DarulImarah District, which is illustrated through the distribution points based on geographical location in the field. The number of DHF sufferers in each village has varies. The number of DHF cases in 2017 mapped as many as 32 cases distributed in 13 villages in DarulImarah District, Aceh Besar Regency. The villages in DarulImarah District that occurred in the case of DHF included AjunJeumpet Village, Lamcot Village, Punie Village, LheuUe Village, Tingkeum Village, Garot Village, PasheuBeutong Village, Lampeuneun Village, Punie Village, LheuUe Village, Tingkeum Village, Garot Village, Pasheu Beutong Village, Lampeuneun Village, Punie Village, LheuUe Village, Tingkeum Village, Garot Village, PasheuBeutong Village, Lampeuneun Village, Pampie Village, Tampe Gampong Village, GampongLamu Regency, Many , LamblangTrieng Village, and KutaKarang were the villages that were the focus of this research.

The results of spatial analysis showed that the highest DHF cases were in Lamcot Village with 7 cases. This can be due to the geographical conditions of the Lamcot village that strongly supports the proliferation of vectors that cause DHF. Lamcot Village has a very large population, with several housing complexes. The condition of the house is also very close one to another.

Environmental conditions with many population housing complexes, usually has a high population density tend to cause high housing density, which can cause a high incidence of DHF as well. *Aedesaegypti* is a mosquito with a short flight distance of 100 meters or domestic. Resident houses that are close to each other make it easy for mosquitoes to move from one house to another so that the closest neighbors have a greater risk of contracting dengue. Areas that are infected with dengue fever in general are densely populated cities/ sub-dristrict and the distance between houses that are close to each other facilitates disease transmission.[6]

DarulImarah District region is located at an altitude of 15mdpl, this allowing dengue-transmitted mosquito species to live and thrive. DHF can be transmitted by mosquitoes in areas with certain characteristics. Dengue transmitting mosquito species can be found in areas with a height less than 1000 mdpl.[7]

2. Distribution and Habitat of Development of DBD Vector

From 32 cases of DHF sufferers in DarulImarah District, 19 breeding places were found as *Aedesaegypti* breeding sites. These breeding sites include: Water Reservoirs, was found 12 points obtained from 7 villages, namely 2 points of the AjunJeumpet Village, 1 point of Garot Village, 1 point of Lambheu Village, 2 points of Lamcot Village, 2 points of LamcotVillage , Village Punie 3 point, andGampongKutaKarang 1 point. The types found in the form of bathtubs, wells, and rainwater reservoirs.

The Natural Water Reservoir was found as many as 2 points which were obtained from 2 regions of the village, namely 1 point AjunJeumpet Village, and 1 point Lamcot Village. The type found in the form of a coconut shell and banana midrib. Without Water

Reservation Site was found as many as 5 points obtained from 4 villages, namely 1 PasheuBeutong Village, 1 point Lamcot Village, 2 points LamblangTrieng Village, 1 point Lampeuneun Village. The types found were used tires, flower vases, bottles.

The high population density and urbanization have a role in dengue transmission because it affects the increase of mosquito breeding places such as water storage, used tires and trash bins.[8]One of the existence of *Aedesaegypti* as DHF vector is influenced by the existence of mosquito breeding sites. The more breeding places found in an area affect the development of mosquito populations. The presence of *Aedesaegypti*breeding places in large numbers can increase the risk of breeding and development of *Aedesaegyti*population, so that the DarulImarah District area is a receptive area for dengue transmission.

Buffering in the <40 meter zone shows that mosquitoes originating from the breeding point have the potential to cause DHF transmission because 32 cases of DHF enter the buffer zone. In the zone <40 meters breeding place has the potential for DHF transmission to reach other villages. The existence of Breeding place in the case area is in the zone <100 meters which has the potential to cause DHF transmission because all DHF sufferers are at *Aedesaegypti* normal flight distance. Tuyishimire (2013) explained that people who live close to the existence of breeding places have a high risk of dengue transmission and are in the average fly distance of mosquitoes tend to be more easily infected with DHF.[9]

*Aedesaegypti*ability to fly (female) an average of 40 meters to a maximum of 100 meters, but passively due to wind or being carried by a vehicle can move further. So the existence of mosquito breeding places in that radius is a risk factor for residents in the settlement to get DHF. The results of the study have shown that in the 40 meter buffer zone, almost all DHF sufferers are located at <40 meters distance from the breeding place in the Darul Imarah District. This showed the house of dengue sufferers is in the area with the highest risk of transmission. This study is in line with research by Boewono (2012) and Rohani et al (2010) which states that the majority of DHF sufferers are at a distance of <40 meters from the breeding places of *Aedesaegypti* larvae.[10,11]

The high prevalence of DHF is influenced by the high patient density on the existence of breeding places. Residents who live <100 meters should be a priority for prevention and control of dengue transmission.

CONCLUSION

1. Spatial mapping results show that the area that has a high DHF case is one area that has a high density of home environment. The number of cases of DHF in 2017 in DarulImarah District was 32 cases distributed in 13 villages. The distribution of dengue cases in DarulImarah District showed uneven distribution in all villages in the district area.
2. The environment of DHF sufferers found <100 meters from the existence of breeding places. The incidence of dengue is increasingly found at a distance of <40 meters from the existence of breeding places, which means that the exixtence of mosquito breeding places in that radius can be a risk factor for residents in the settlement to be affected by DHF.

SUGGESTION

1. Through the use of information from the results of spatial analysis of DHF incidents, the Puskesmas and the village are expected to be able to mobilize community participation, so that they can control at vulnerable points/potential in dengue transmission.
2. Counseling needs to be done continuously to be able to increase knowledge and change people's behavior so they want to control and eradicate mosquito nests that cause DHF.

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