



Spatial Pattern Of Distribution Of Dengue Fever In Gorontalo City In 2019-2020

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Abstract

Gorontalo City is an endemic area of dengue hemorrhagic fever, in 2019 the Incidence Rate was 55.06 per 100,000 population, in 2020 there was a decrease in the Incidence Rate but not significantly at 49.36 per 100.00 population. The complexity of risk factors associated with the spread of Fever BLOODING DENGUE often causes related agencies to be less appropriate in planning prevention and control programs in their coverage areas. Therefore, an analysis of the distribution pattern of dengue hemorrhagic fever was carried out so that it could be utilized by the relevant agencies in controlling dengue hemorrhagic fever cases. The purpose of this study was to determine

the pattern of distribution of dengue hemorrhagic fever cases in Gorontalo City. This research is a type of descriptive research with a spatial analysis approach. The analytical method used is Average Nearest Neighbor (ANN). The number of samples in this study were 138 which were analyzed based on kelurahan units. The results of the analysis showed that in 2019 there was a spatial pattern with $NNR\ 0.608 < 1$ which means the distribution pattern is clustered, while in 2020 there is a spatial pattern with $NNR\ 0.624 < 1$ which means the distribution pattern is clustered. This study concluded that the distribution of dengue fever cases in Gorontalo City in 2019 and 2020 showed a clustered pattern. Areas with a clustered distribution pattern indicate areas that are prone to dengue hemorrhagic fever.

Keywords: Spatial analysis, distribution pattern, Dengue Hemorrhagic Fever

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INTRODUCTION

Dengue Hemorrhagic Fever is an infectious disease that is still a public health problem in tropical and sub-tropical countries in Southeast Asia, Central America, Latin America, and the Western Pacific. Dengue fever cases are estimated to be around 500,000 cases every year requiring hospitalization, children are the most sufferers of dengue hemorrhagic fever. If you don't get good treatment, the Case Fatality Rate (CFR) can reach 20%, but if the case is treated with intensive therapy, the Case Fatality Rate will decrease to less than 1%. (WHO, 2006) In 2017 the Incidence Rate of FEVER cases Dengue hemorrhagic fever in Indonesia was 26.1 per 100,000 population, then in 2018 it increased to 24.75 per 100,000 population, and in 2019 there was a significant increase, namely the Incidence Rate of 51.48 per 100,000 population. (Ministry of Health, 2020)

In 2015 the Incidence Rate of Dengue Hemorrhagic Fever in Gorontalo City was 34.6 per 100,000 population and the Case Fatality rate was 5.6%. Then in 2016 experienced an extraordinary event with an Incidence rate of 84.3 per 100,000 population, and a Case Fatality Rate of 3.6%. In 2017 there was a decrease in the Incidence Rate by 36.1 per 100,000 population and the Case Fatality Rate by 1.3%. However, in 2018 the number of cases increased again with an Incidence Rate of 57.2 per 100,000 population and a Case Fatality Rate of 2.4%. Then in 2019 the Incidence Rate was 55.06 per 100,000 population, and the Case Fatality rate was 7.8%. In 2020 the Incidence Rate is 49.36 per 100.00 population, and the Case Fatality Rate is 2.1%. (Gorontalo Health Office, 2020)

The complexity of the risk factors associated with the spread of dengue hemorrhagic fever causes the relevant agencies to be less appropriate in planning prevention and control programs in their coverage areas. A good dengue fever surveillance system will help the health office to identify vulnerable areas that are the focus of the program. However, often the surveillance data for dengue hemorrhagic fever is only in the form of case numbers and standard epidemiological measures. The presentation of data is also often only in the form of tables or graphs. In fact, a more informative and interesting way of analyzing and presenting data can be done by using Geographic Information System (GIS) techniques. The spatial



analysis approach along with the presentation in the form of Geographical information is very useful in analyzing surveillance data. (Achmadi, 2010) With this GIS, it can be used to identify areas that are prone to the spread of dengue fever, its distribution pattern, and the distance between cases (Duncombe, 2012).) The use of GIS can also be used in planning, monitoring and evaluating dengue fever control programs in an area. The GIS method can provide recommendations for disease prevention strategies (Megawaty, 2017) therefore it is necessary to do research related to the pattern of distribution of dengue hemorrhagic fever cases.

METHOD

This research is a type of descriptive research. The study was conducted in April 2021, using secondary data obtained from relevant agencies, namely the Gorontalo City Health Office and the Gorontalo City Central Statistics Agency. As for the case data for dengue fever cases, it was obtained at the Gorontalo City Health Office, while for population data it was obtained from the Gorontalo City Central Statistics Agency. This research was conducted in five working areas of the Community Health Center which are endemic areas of Dengue Hemorrhagic Fever in Gorontalo City. The sample in this study was all cases of dengue hemorrhagic fever recorded in 2019 and 2020, as many as 138 samples. The instruments used in this research are the Global Positioning System (GPS) smartphone and Arcgis 10.3 software. The analysis used in this study to determine the distribution pattern of Dengue Hemorrhagic Fever is the Average Nearest Neighbor. Average Nearest Neighbor (ANN) value is expressed by Nearest Neighbor Ratio (NNR) = 1 means random patterned events (random), $NNR < 1$ means clustered events (Clustered), $NNR > 1$ means events spread (Dispersed). (Rosli, 2010)

RESEARCH RESULT

This research was conducted in five working areas of the Community Health Center which are endemic areas of Dengue Fever, namely the East City Public Health Center, Central City Community Health Center, South City Community Health Center, Pilolodaa Community Health Center, and Duingingi Community Health Center. In 2019 cases of dengue hemorrhagic fever occurred in twenty-three kelurahan in the five working areas of the Community Health



Center, out of a total of twenty-five kelurahan. Then in 2020 cases of dengue hemorrhagic fever spread to nineteen villages. The following is the distribution of the number of cases and the incidence rate of dengue hemorrhagic fever in 2019 and 2020:

Table 1 Distribution of the Number of Cases and IRs of Dengue Hemorrhagic Fever in the city of Gorontalo in 2019 and 2020

Community Health Center Working Area	Year 2019		Year 2020	
	Amount Case	IR Per 100.000	Amount Case	IR Per 100.000
East City Community Health Center	17	62,57	13	54,14
Southern City Community Health Center	16	77,34	4	19,71
Central City Community Health Center	10	36,54	10	36,49
Dungingi . Community Health Center	17	66,25	20	78,61
Pilolodaa Community Health Center	11	96,66	20	175,28
Total	71	63,25	67	61,72

Based on table 1 in 2019, the number of cases was 71 cases with an Incidence Rate of 63.25 per 100,000 population. Then in 2020 the number of cases was 67 with an Incidence Rate of 61.72 per 100,000 population. The Pilolodaa Community Health Center is a Community Health Center that has the highest Incidence Rate, where in 2019 it was 96.66 per 100,000 population and in 2020 it was 175.28 per 100,000 population.

The entire working area of the Community Health Center in Gorontalo City has a population density level in the very dense classification, because the density level is more than 401 people/km². The following is the distribution of population distribution and population density in Gorontalo City (National Standardization Agency, 2003)

Table 2. Distribution of Population and Population Density In Gorontalo City in 2019-2020

Region Community Health Center Work	Year 2019		Year 2020	
	Population	Density	Population	Density



	(Soul)	(life/km2)	(Soul)	(life/km2)
East City	27.167	5106	24.011	4979
Southern City	20.686	7361	20.287	7168
Central City	27.360	5688	27.398	5660
Dungingi	25.657	5494	25.439	5412
Pilolodaa	11.380	1801	11.410	1821

Based on table 2, it is known that in 2019 and 2015 the largest population was in the work area of the Central City Public Health Center with a population of 27,360 people and 27,298 people, but in terms of population density the highest was the South City Public Health Center, which was 7,361 people. /Km2 and 7168 Souls/Km2.

The following is the distribution pattern of dengue fever cases based on an analysis of urban village units in 2019 and 2020:

Table 3. Distribution Pattern of Dengue Hemorrhagic Fever Based on Unit of Analysis Per Village in 2019 and 2020

Village	Year Event					
	2019			2020		
	Amount Case	Pattern scatter	NNR	Amount Case	Pattern scatter	NNR
Dungingi						
Tomulabutao	4	group	0,479037	4	group	0,5044060,
Huangobotu	4	group	0,299947	6	group	0,302132
Libuo	2	group	0,164493	5	group	0,345299
Tuladenggi	4	group	0,5345670	2	group	0,240817
Tomulabutao Sel	3	group	0,455933	3	group	0,54165
Tengah City						
Wumialo	1	-		2	group	0,425758
Dulalowo	1	-		5	group	0,420233
Liluwo	1	-		0	-	
Pulubala	2	Spread	3,335022	3	Random	1,304562
Paguyaman	3	group	0,631955	0	-	
Dulalowo Timur	2	Random	1.349993	0	-	
Selatan City						
Limba B	3	group	0,648817	0	-	



Limba U1	0	-		2	group	0,534506
Limba U2	6	group	0,562523	0	-	
Biawao	2	Random	0,920226	1	-	
Biawu	5	group	0,325242	1	-	
Pilolodaa						
Dembe I	4	group	0,223546	16	group	0,778852
Lekobalo	6	group	0,306200	1	-	
Pilolodaa	1	-		3	group	0,372269
Kota Timur						
Heledulaa Utara	2	group	0,622593	1	-	
Heledulaa Selatan	1	-		0	-	
Ipilo	10	group	0,706719	1	-	
Padebuolo	1	-		2	group	0,677203
Moodu	3	group	0,300364	6	group	0,359899
Tamalate	0	-		3	group	0,351649

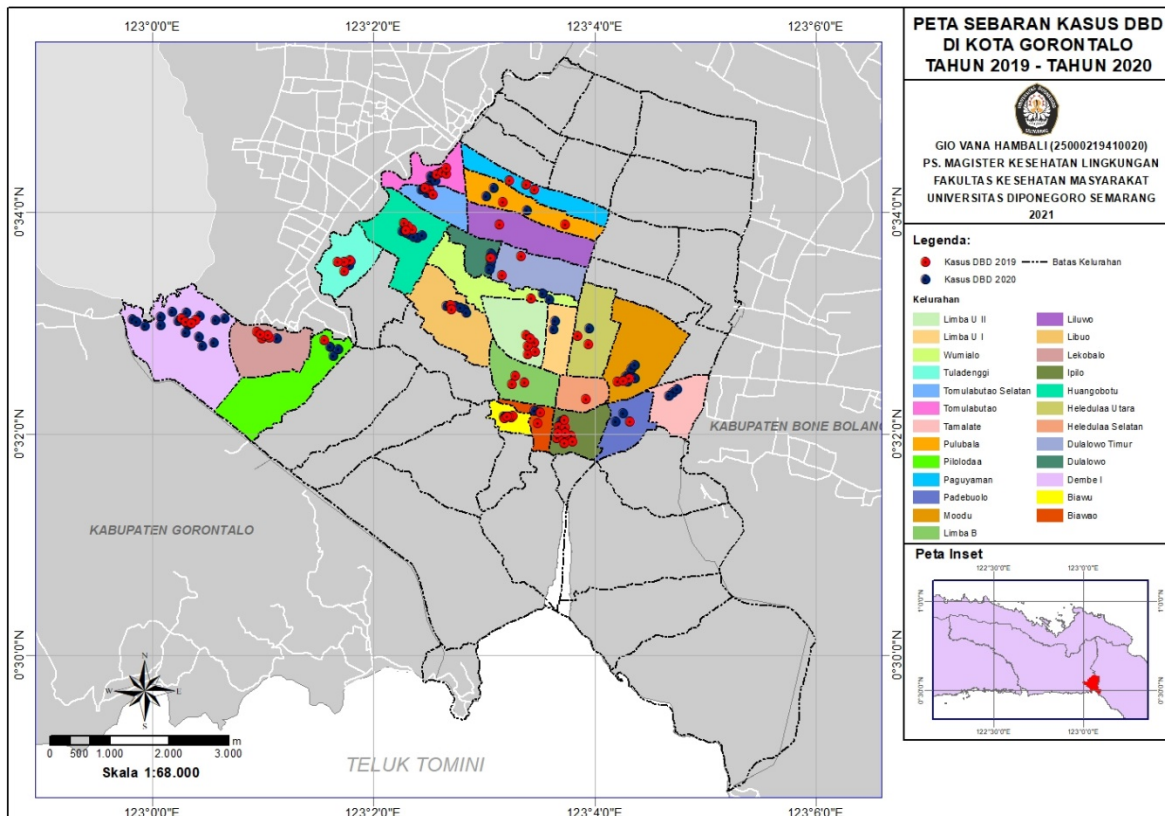




Figure 1. Map of the distribution of dengue hemorrhagic fever cases in 2019 and 2020

Based on table 2, the results of the analysis of the Average Nearest Neighbor in the case of Dengue Hemorrhagic Fever in 2019 based on kelurahan units with a clustered pattern of distribution occur in eleven villages with a total of 41 cases, as for the distribution pattern that spreads (Dispersed) only occurs in one villages, then for a random distribution pattern that occurs in five villages. In 2020 the distribution pattern based on the results of the analysis of the Average Nearest Neighbor in groups (Clustered) occurred in nine villages, while the random distribution pattern occurred in five villages. In 2019 in the villages of Wumialo, Dulalowo, Liluwo, Limba U1, Pilolodaa, South Heledulaa, Padebuolo, and Tamalate, no analysis was carried out, due to the small number of cases and no cases of dengue hemorrhagic fever. As for 2020, the Liluwo, Paguyaman, East Dulalowo, Limba B, and South Heledulaa villages were also not analyzed.

Table 3. Analysis Results of Average Nearest Neighbor (ANN) Case summary of dengue hemorrhagic fever

<i>Average Nearest Neighbor Summary</i>	Year 2019	Year 2020
<i>Observed Mean Distance</i>	165 meters	158 meters
<i>Nearest Neighbor Ratio</i>	0.608	0.624
<i>Z-Score</i>	-6.307	-5.886
<i>p-value</i>	0.00000	0.00000

Based on the results of the statistical analysis of the Average Nearest Neighbor (ANN) in the 2019 case of Dengue Hemorrhagic Fever, the results of the Nearest Neighbor Ratio (NNR) of $0.608 < 1$ mean that the pattern of spread of dengue fever in Gorontalo City is in groups or Clustered. Based on ANN calculations, the results of the Observed Mean distance were also obtained, which is the average distance between cases, which means that every 165 meters one patient is found. The Z-Score value is $-6.307 < -2.58$, which means that there is a spatial pattern for dengue hemorrhagic fever cases in 2019. As for the results of the spatial statistical analysis of the Average Nearest Neighbor (ANN) in the 2020 dengue hemorrhagic fever case, the results of the Nearest Neighbor Ratio (NNR) of $0.624 < 1$ which means that the



distribution pattern is clustered. The results of the Observed Mean distance calculation obtained 158 meters, which means 158 meters found one patient. Z-Score value $-5.886 < -2.58$, which means that there is a spatial pattern to the incidence of dengue hemorrhagic fever in Gorontalo City in 2020.

DISCUSSION

Based on the results of the Average Nearest Neighbor (ANN) analysis per kelurahan which has a clustered distribution pattern in 2019, there are eleven villages namely Moodu, Ipilo, Lekobalo, Limba U2, Biawu, Tamulabutao, Huangobotu, Libuo, Tuladenggi, South Tamulabutao. Judging from the number of cases in 2019, Ipilo Village has the distribution of the most number of cases, which is ten cases with a clustered distribution pattern. Ipilo Village is included in the working area of the East City Public Health Center which has a very dense population density classification where the population density is 5,106 Km² and the Incidence Rate is high at 62.57 per 100,000 population. Based on information from the East City Public Health Center that the working area of the East City Public Health Center is one of the areas that is right in the City Center which shows the existence of a very dense building distance, because it is an industrial center in Gorontalo City so it is not just a lot of house buildings. but also shops. This is in line with the results of research which states that the distribution of dengue fever cases in Karangmalang district is concentrated in areas with high population density, low ABJ status and areas with dense settlements. (Setyaningsih, 2014) Inna Firindra Fatati stated that the factors One of the factors that affect the number of cases of Dengue Hemorrhagic Fever in Central Java Province in 2015 is population density. (Fatati, 2011) In line with research conducted by Yuli Yana which stated that mobility outside the village, and the presence of public places can be a potential for transmission of dengue fever.(Yana, 2017)

The results of the Average Nearest Neighbor (ANN) analysis per village in 2020 have a clustered distribution pattern, which is found in nine villages namely Tamulabutao, Huangobotu, Libuo, Tuladenggi, Dulalowu, Dembe 1, Pilolodaa, Moodu, and Tamalate villages. Dembe 1 village is the village that has the highest distribution of dengue fever cases in 2020 in the working area of the Pilolodaa Community Health Center, which is as many as



16 cases. Based on the analysis of village units, Dembe 1 sub-district has a clustered distribution pattern. Judging from the population density, Dembe 1 village is a village located in the Pilolodaa Community Health Center which has a very dense population density classification, but when compared to other Community Health Centers it is still relatively low. However, if viewed from the territorial aspect, Dembe 1 Village borders the administrative area of Gorontalo Regency which has the same health problems. As well as transportation access between regions is very good, making it easier for the transmission of dengue hemorrhagic fever. This is in line with research conducted by Munsyir et al which states that good access between areas makes it easier for the disease to spread to other areas. (Munsyir, 2010) Research conducted by Sofia stated that the spread of mosquito habitat is caused by mobility. population and transportation. (Sofia, 2014)

Based on research conducted by Andri et al., the distribution pattern of Dengue Hemorrhagic Fever in Pangandaran is concentrated or clustered. (Ruliansyah, 2011) Based on research conducted by Agricia et al in the working area of the Kedung Mundu Public Health Center Semarang with the results of a group distribution pattern (Clustered) which states that infectious diseases know no administrative boundaries. So that the two regions that have the same problem must synchronize programs in controlling infectious diseases. (Kusuma, 2016)

CONCLUSION

This study concluded that the distribution of dengue fever cases in Gorontalo City in 2019 and 2020 showed a clustered pattern. Areas with a clustered distribution pattern indicate areas that are prone to dengue hemorrhagic fever.

REFERENCES

- Achmadi UF. Manajemen penyakit berbasis wilayah. Jakarta : Universitas Indonesia, 2010
- Badan Standarisasi Nasional. Tata Cara perencanaan lingkungan perumahan di perkotaan. Bandung : BSN. 2003.
- Dinas Kesehatan. Laporan Bulanan DBD Kota Gorontalo . Gorontalo: Pemerintah Kota Gorontalo .2020. WHO. Dengue Haemorrhagic Fever : early recognition, diagnosis, and hospital management. Geneva : Departement of Epidemi and pandemic alert ; 2006



- Duncombe J, Clements A, Hu W, Weinstein P, Ritchie S, Espino FE. Geographical Information Systems for Dengue Surveillance. *The American Journal of Tropical Medicine and Hygiene* 2012; 86(5): 753-5
- Fatati If, Wijayanto H, Sholeh Am. Analisis Regresi Spasial Dan Pola Penyebaran Pada Kasus Demam Berdarah Dengue (DBD) Di Provinsi Jawa Tengah. *Media Statistika [Online]*. 2017 Dec;10(2):95-105
- Kemendes RI. Profil Kesehatan Indonesia Tahun 2019. Kementerian Kesehatan Republik Indonesia; 2020.
- Kusuma AP, Sukendra DM. Analisis spasial kejadian DBD berdasarkan kepadatan penduduk. *Unnes J Public Health*. 2016;5(1)
- Megawaty DA, Simanjuntak RY. Pemetaan Penyebaran Penyakit Demam Berdarah Dengue Menggunakan Sistem Informasi Geografis Pada Dinas Kesehatan Kota Metro. *Explore Jurnal Sistem Informasi dan Telematika*. 2017;8(2):147– 151
- Munsyir, Mujida Abdul dan Ridwan Amiruddin. Pemetaan dan Analisis Kejadian Demam Berdarah Dengue di Kabupaten Bantaeng Provinsi Sulawesi Selatan. FKM UNHAS: Makassar. 2010
- Rosli, M.H., Er, A.C., Asmahani A., Mohammad Naim M.R., Harsuzilawati M. Spatial Mapping of Dengue Incident: A Case Study in Hulu Langat District, Selangor, Malaysia. *International Journal of Human and Social Sciences*. 2010;5(6), pp: 410 - 414.
- Ruliansyah A, Gunawan T, M SJ. Pemanfaatan citra penginderaan jauh dan system informasi geografis untuk pemetaan daerah rawan demam berdarah dengue. *J Aspirator*. 2011;3 (2) : 72-81
- Setyaningsih W, Setiawan DA. Pemodelan Sistem Informasi Geografis (SIG) Pada Distribusi Penyakit Demam Berdarah Dengue (DBD di Kecamatan Karangmalang Kabupaten Sragen. *J terpadu ilmu Kesehatan*. 2014;3,209–14.
- Sofia, Suhartono, dan Wahyuningsih, N.E. Hubungan Kondisi Lingkungan Rumah dan Perilaku Keluarga dengan Kejadian Demam Berdarah Dengue di Kabupaten Aceh Besar. *Jurnal Kesehatan Lingkungan Indonesia*, 2014; 12(1): 30-38
- Yana Y. Analisis Spasial Faktor Lingkungan Dan Distribusi Kasus Demam Berdarah Dengue. *Higeia Journal Of Public Health Research And Development*, 2017 ; 1(3)