



Spatial Epidemiology of Dengue Hemorrhagic Fever in Pasir Lapangan Village, Sarudik District in 2022

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ABSTRACT

Dengue Hemorrhagic Fever (DHF) is still a public health problem in Indonesia and even the world. DHF is a disease caused by a severe virus and transmitted through endemic mosquitoes characterized by increased blood vessel permeability, hypovolemia and impaired blood clotting mechanisms. One way to describe the problem of environmentally based diseases is by using a spatial epidemiology approach. Spatial epidemiology is a geographical description and analysis of diseases related to demographic, environmental, behavioral, socio-economic, and genetic risk factors by focusing on disease mapping in an area, geographic correlation studies, and disease clusters. Pasir Lapangan Village has a high incidence of DHF due to high population density and mobility. This is because the population density continues to increase and is increasingly vulnerable to DHF transmission if not accompanied by efforts to prevent *Aedes Aegypti* mosquitoes. The results of the study showed that the level of vulnerability to Dengue Hemorrhagic Fever based on population density and climate mapping in Pasir Lapangan Village, Sarudik District in 2018 tended to show high results.

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1. Introduction

DBD is an endemic disease transmitted by the Dengue virus through the bite of Arthropods, namely the *Aedes Aegypti* and *Aedes Albopictus* mosquitoes. This disease is one of the many health problems in Indonesia. The number of sufferers and the area of spread are increasing considering the increase in movement space and population density. (Batuah, nd), (Majid, 2021).

Dengue fever (DBD) is currently considered a scourge for public health problems in Indonesia and even the world. DBD is a disease caused by a severe virus transmitted by the *Aedes Aegypti* mosquito. (Risky, 2019), (Dinata, 2018). This disease is quite susceptible to attacking people in countries such as Southeast and South Asia, the Pacific, and Latin America with signs of increased blood vessel permeability, hypovolemia, and disorders of the blood clotting mechanism. (Anandika, 2020), (Yudhastuti, 2020). DBD is a type of arbovirus disease, namely a virus transmitted from the bite of arthropods such as mosquitoes.

The types of viruses that cause DHF, such as types Den-1, Den-2, Den-3, and Den-4 from the Arthropod-Borne viruses group. The main vectors for DHF are the *Aedes aegypti* mosquito in urban areas and the *Aedes albopictus* mosquito in rural areas. (SANDRA, Hadisaputro, & Sofro, 2019), (Arafiyah,

Rizal, Buono, & Subrata, 2015). DBD is included in the category of Vector Borne Disease or Diseases caused by vectors. DBD diagnosis is often wrong, and is often associated with other diseases, such as flu and typhus. This is caused by the Dengue virus which is asymptomatic or has unclear symptoms (Anwar, 2020), (SETYOASTUTI, nd).

Dengue fever sufferers often experience symptoms of cough, runny nose, nausea, vomiting, and diarrhea. Dengue virus can occur simultaneously with typhoid and flu infections, so it is necessary to understand the flow of infectious diseases and clinical observations of the Dengue virus. (Batuah, nd), (MEDAN, n.d.). The incubation period of DHF lasts 14 days. People who experience DHF will show symptoms such as high fever for 2-7 days, muscle pain, headache, nausea to vomiting, stomach feels bloated, enlarged liver, black stools, there are red spots due to bleeding manifestations, and thrombocytopenia (decreased platelet count) (Triyana, 2016), (QOIRUNISA, 2019). The clinical symptoms described are the basis for finding DHF cases by conducting clinical observations. (Wawan Kurniawan & Aat Agustini, 2021), (Batuah, nd).

The number of sufferers has the potential to increase every year and its spread is also increasingly widespread, because there are still many endemic areas. DHF outbreaks have occurred in one hundred countries covered by WHO (World Health Organization), such as Southeast Asia, the Eastern Mediterranean, Africa, America, and the Western Pacific (Felta, 2021), (Munggaran, 2018). The Americas, the Western Pacific, and Southeast Asia are the worst affected by the disease, with Asia accounting for approximately 70% of the world's dengue cases. (Batuah, nd), (Oey-Gardiner & Abdullah, 2021). WHO reported that the number of dengue fever cases in the world has increased by more than eight levels over the past twenty years from 505,430 cases in 2000 to more than 2.4 million in 2010, and increased again in 2019 to 4.2 million cases, while deaths caused by dengue fever between 2000 and 2015 increased from 960 to 4,032 cases. (Podung, Tatura, & Mantik, 2021), (Herawati et al., 2021). The highest number of dengue cases in Asia in mid-2019 was in Bangladesh (101,000), Malaysia (131,000), the Philippines (420,000), and Vietnam (320,000) (MAGNIFICENT, 2022), (Fatahna, 2021).

DBD in Indonesia had an incidence rate (IR) of 24.75 per 100,000 population in 2018, then showed an increase in 2019 with an average incidence of 51.48 per 100,000 population. (Warsini & Sriwiyati, 2020), (Mayasari et al., 2019). The number of DHF cases in Pasir ladang sub-district, Sarudik district in 2022 was 2,918 cases, which reached the highest number of cases among other districts or cities, namely 610 cases (Sarindang Health Service, Sarudik District 2022). Climate changes that can affect DHF include changes in temperature, humidity, wind speed, and rainfall in an area (Septian, Anwar, & Marsum, 2017), (Septiriani & Sudaryo, 2022).

Research conducted by Ratna Maya Paramita (2017) proved that rainfall is spatially related to DHF incidents (Paramita & Mukono, 2017). Another study conducted by Yulia Iriani in 2012 in Palembang City also showed that there was a spatial relationship between rainfall variables and the increasing number of DHF incidents because rainfall can trigger increased vector breeding grounds. (Dhamayanti, 2013), (Prasetyowati et al., 2016).

Other studies have also shown that temperature and dengue fever incidence are spatially related. Temperature is a very important environmental parameter for increasing vector breeding and bite rates (APRILIYANINGSIH, 2019), (Rau, Komariyah, & Pitriani, 2019). The suitable temperature for dengue fever migration ranges from 21.6 to 32.9 °C (Ridha et al., 2019a). The results of research by Daswito (2019) prove that wind speed has a spatial relationship with dengue fever incidence. This means that wind speed is one of several risk factors that cause dengue fever incidence. This is clarified if wind speed tends to hinder flight and affect egg placement in suitable habitats. An increase in speed of 1-4 m/s can prevent mosquitoes from flying in the environment.

In addition to temperature, rainfall, and wind speed, air humidity also plays a role as a risk factor for dengue fever. Air humidity in an area is a factor that affects the survival of mosquitoes, the lower the humidity level in an area can shorten the life of mosquitoes. Humid air causes water to evaporate from inside the mosquito, so that the mosquito experiences dehydration (Pascawati, Lazuardi, & Nugroho, 2021). In addition to climate variability, there is a population density factor as a cause of DHF. The population density factor is proven in research that shows that population density is significantly related

to DHF (Safitri, 2016). One way to describe the problem of environmental-based diseases is by using a spatial epidemiology approach. (MUHAMMAD, 2023), (Saputri, 2016).

Spatial epidemiology is a geographical description and analysis of diseases related to demographic, environmental, behavioral, socio-economic, and genetic risk factors by focusing on disease mapping in an area, geographic correlation studies, and disease clusters (Elliott & Wartenberg, 2004). The spatial epidemiology approach is useful because it can describe disease patterns, identify disease clusters, and predict risk factors for disease occurrence using health problem mapping and to support the determination of surveillance decisions and efforts to overcome the disease, this is important to help make decisions about DHF problems (Sunaryo, 2015; Pfeiffer et al., 2008). According to the explanation, researchers are interested in conducting a study related to the Spatial Epidemiology of Dengue Fever. The selection of Sarudik District as a research area is because there are still problems with DHF in Pasir Lapangan Village, Sarudik District. The spatial epidemiology approach is expected to provide information on spatial descriptions based on climate variability and population density on DHF incidents so that it can increase effectiveness in overcoming the problem.

2. Methods

2.1 Research design

The spatial epidemiological approach is used to determine the epidemiological picture of the incidence of Dengue Hemorrhagic Fever in Pasir Lapangan Village, Sarudik District in 2022 by using the variables studied, namely environmental factors including rainfall and population density so that the level of vulnerability to DHF incidents in Pasir Lapangan Village in 2022 can be determined based on these variables.

2.2 Place and Time of Research

This study was conducted in Pasir Lapangan Village, Sarudik District from May to July 2022.

2.3 Population and Sample

a. Data collection and data sources

Data collection for this study was carried out by observing secondary data from related agencies.

Table 1.
Research Data Sources

Data	Data source
Cases of dengue fever (DBD) per district/city	Sibolga City Health Service
Climate variability	Meteorology, Climatology and Geophysics Agency (BMKG) Serang
Population density per district/city	Central Statistics Agency (BPS) of Sibolga City
City district area map	Google Maps

b. Data analysis

Data analysis in this study consists of univariate analysis and spatial analysis.

c. Univariate analysis

Data that has gone through the data processing stage is subjected to univariate analysis using MS.Excel software to see the distribution of DHF frequency and population density.

3. Results and Discussion

per person so that the results of this study indicate that Pasir Lapangan sub-district has a high incidence of DHF.

Pasir Lapangan Village has a high incidence of DHF due to high population density and mobility. This is because the increasing population density is increasingly vulnerable to the transmission of DHF if not accompanied by efforts to prevent the *Aedes Aegypti* mosquito (Chandra, 2020). Sibolga City is geographically located in a coastal area and is a transit point for several people from outside the island. Therefore, it is very possible that people who cross Sibolga City carry agents that cause DHF. In addition, the incidence of DHF in Sibolga City can also be influenced by the implementation of the Mosquito Nest Eradication Program (PSN).

The PSN program that must be implemented includes 3M plus through the 1 house 1 mosquito larvae movement (Provincial Health Office 2022). The procurement of these efforts can provide increased knowledge, attitudes, and behavior of individuals and communities in overcoming problems in order to prevent DHF (Wurisastuti, Sitorus, & Surakhmi Oktavia, 2017). The ineffectiveness of the DHF disease program, and the lack of public education about Mosquito Nest Eradication (PSN). Therefore, the Health Office needs to conduct socialization to the community to increase the effectiveness of the program and increase public awareness of Mosquito Nest Eradication (PSN) efforts.

4. Conclusion

The conclusion of this study is that the level of vulnerability to dengue fever (DHF) based on population density and climate mapping in Pasir Lapangan Village, Sarudik District in 2022 tends to show high results.

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