

Environmental influence on the spread of dengue

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ABSTRACT

Dengue Fever (DHF) is a contagious disease caused by the dengue virus and transmitted through mosquito bites. This disease develops in many tropical and sub-tropical areas such as Indonesia. There are two populations of living things that are involved in the spread of dengue, namely humans, called the host and female *Aedes aegypti* mosquitoes, which are known as vectors of the dengue virus. Therefore, the spread of dengue can be modeled following the host-vector model. The existence of the *Aedes Aegypti* mosquito vector greatly affects the spread and number of cases of dengue fever. Temperature or air temperature is one of the environmental factors that affect the life of the *Aedes Aegypti* mosquito. Based on the results of the study, it can be concluded that the physical and socio-cultural environment has a significant effect on the incidence of dengue. The better the environment, the lower the incidence of dengue. On the other hand, when the environment has poor conditions, the incidence of dengue will be higher.

KEYWORDS: Dengue; Enviroment; Mosquito.

1. Introduction

Dengue Hemorrhagic Fever (DHF) is an important health problem in the world, especially in tropical countries such as Indonesia.[1] This infectious disease has a great influence on the mortality rate of children and adults. In addition, this disease can also reduce labor productivity. [2] The disease has increased drastically in recent decades. It is estimated that there have been 390 million dengue infections every year. Another study states that there are 390 million people from 128 countries in the world at risk of contracting the Dengue virus.[3]

The risk of contracting dengue is owned by all regions in Indonesia because the virus and its infectious mosquito, namely the *Aedes aegypti* mosquito, have spread widely in residential housing and public facilities throughout Indonesia.[4] Dengue transmission is transmitted by the *Aedes aegypti* mosquito through its bite with a virus in its body, namely the dengue virus from one patient to another.[5]

The results of environmental epidemiology studies show the level of health community or the occurrence of a disease in a community group is a result and the reciprocal relationship between the community itself and the environment.[6] In turn, as an element directly involved in the reciprocal relationship Whatever happens as a result of the interaction process in the form of change The environment will affect and be felt by the community.[7] In certain cases, the life of mosquitoes in their habitat, whether on the beach, forest or mountain, is so harmonious and follows the balance of nature. Forest or mountain mosquitoes, for example, they previously met their blood needs for the growth of their eggs from the bodies of animals in the forest. Without having to chase humans,

humans are relatively spared from mosquito bites.[8]

The environment influences the physical environment such as air temperature, humidity, rain, wind, sunlight, water currents, chemical environment, biological environment (flora and fauna) and socio-cultural environment.[9] Mangrove plants, mosses, algae and various other types of plants can affect the life of mosquito larvae because they can block sunlight.[10]

2. Objectives

The object of this research is the incidence of dengue spread in the people of North Sumatra. The subject of the research sample is the community. The focus of this study is the influence given by the environment in spreading the incidence of dengue. The environment that is the object of research is the physical environment and the socio-cultural environment of the community.

3. Scope and Methodology

This type of research uses quantitative research with a case study approach. Quantitative research is research that outlines numbers to explain research variables. The population in this study is 7,731 people with dengue fever in North Sumatra Province in 2019. The sample in this study was 748 people who were taken from purposive random sampling in each district in North Sumatra Province. Data collection techniques using questionnaires and structured observation sheets. data analysis techniques using Amos.

4. Literature Review

Dengue

Dengue disease is spread through mosquito bites. In Indonesia, the main vector of the disease Dengue is the *Aedes aegypti* mosquito and the secondary vector is *Aedes albopictus*. The density of these vectors in the human environment causes an increased probability of transmission of the dengue virus to humans.

Dengue criteria without danger signs are nausea, vomiting, rash, aches and pains, tornité test positive, as well as leucopenia. In dengue with red flags, the symptoms are the same as the symptoms of dengue without red flags followed by abdominal pain, Prolonged vomiting, there is fluid accumulation, mucosal hemorrhage, lethargy, weakness, enlargement of the liver > 2 cm and an increase in hematocrit along with a relatively rapid decrease in platelet count.

Transmission of dengue disease in humans, hereinafter referred to as hosts, occurs through the bite of an infected mosquito (vector). A healthy host will not get sick as long as there is no interaction with the infected vector. In general, the host will experience an incubation period after 10 bites by a vector infected with the dengue virus.

Environment.

The environment is an external factor of the individual which is classified as a human environmental factor basically consists of two parts, namely the internal environment in the form of a dynamic and balanced state called hemostasis, and the external environment outside the human body. This external living environment consists of three components:

a. Physical environment

Environmental factors that affect the spread of dengue cases include: physical environmental factors (house density, presence of containers, temperature, humidity); biological environmental factors (the presence of ornamental plants, yards, mosquito larvae); social and environmental factors (education, employment, income, population mobility, population density, PSN) [11].

The density of the house will affect the existence of the container. This is because every house usually has a container. This container is intended as a water reservoir used by the community. Most of the water stored in the container is clean water used daily. The water condition is a favorite place for *Aedes aegypti* mosquitoes as a breeding ground.[12]

Population density also supports or is one of the risk factors for the transmission of dengue disease. The denser the population, the easier it is for the *Aedes* mosquito to transmit its virus from one person to another. Population growth that does not have a certain pattern and unplanned and uncontrolled urbanization are one of the factors that play a role in the re-emergence of the extraordinary incidence of dengue fever.[13]

The distance of the house affects the spread of mosquitoes from one house to another, the closer the distance between the houses, the easier it is for mosquitoes to spread to the house next door Adjacent residents' houses have a high risk of contracting dengue disease because the *Aedes* flight distance is short, which is 100 meters.[14]

b. Social environment

The social environment has an important role in the spread of dengue disease. In an area, if the community has a perception/view of the importance of maintaining cleanliness to prevent dengue disease, it will affect the incidence of BDB in that area.[15]

Community habits that are detrimental to health and do not pay attention to environmental cleanliness such as the habit of hanging clothes, nap habits, the habit of cleaning landfills, the habit of cleaning the yard, and also community participation, especially in the context of cleaning mosquito nests, will pose a risk of transmission of dengue disease transmission in the community. This habit will be worse where it is difficult for people to get clean water, so they tend to store water in water reservoirs, because the landfill is often not washed and cleaned regularly and eventually becomes a potential breeding ground for *Aedes aegypti* mosquitoes.

Aedes Aegypti rests on clothes that are hanging in the room that has been worn, because on clothes there are several substances that can attract mosquitoes such as amino acids, lactic acid and other substances. Mosquitoes are attracted to the scent of the human body because of the carbon dioxide from breathing. Furthermore, if the clothes are hung, it will increase the population of mosquitoes living in the house

5. Result and Discussion

Based on the results of the research for the physical environment conditions in the house, the following data were obtained:

Tabel 1. Physical environment conditions in the house

Kriteria	Frequency	Percent
Good	346	46.3
Bad	402	53.7
Total	748	100.0

Based on Table 1, information was obtained that the physical environment in the house with good condition was as many as 346 houses or 46.3%, while the physical environment condition in the house was not good as many as 402 houses or 53.7%. From this data, it is known that the majority of environmental conditions in the respondents' homes are not good.

Based on the results of the research for the socio-cultural conditions of the community, the following information was obtained:

Tabel 2. Socio-Cultural

Kriteria	Frequency	Percent
Good	402	53.7
Bad	346	46.3
Total	748	100.0

Based on Table 2, it is known that the good habits of the community are as many as 402 houses or 53.7%, while the bad habits of the people are as many as 346 houses or 46.3%. From this data, it is known that the majority of people have habits related to the prevention of dengue fever.

The results of the research related to the incidence of dengue can be seen in the following table

Tabel 3. Dengue incidence

Kriteria	Frequency	Percent
Good	402	53.7
Bad	346	46.3
Total	748	100.0

Based on Table 3, it is known that the low category DHF cases are 387 samples or 51.7%, the medium category is 255 or 34.1%. Meanwhile, DHF cases that are included in the high category are 106 samples or 14.2%.

The results of the research to determine the influence of environmental conditions on the incidence of dengue fever, it can be seen that the results of the research hypothesis test can be seen.

Tabel 4. Hypothesis Results

Variabel	P value	Result
Physical environment	0,023	Signifikan

Socio-Cultural	0,001	Signifikan
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Based on the results of the hypothesis test, it is known that the P value for the influence of physical environmental conditions on the incidence of dengue fever shows a value below 0.05. The test results obtained a p value of 0.023 which is smaller than 0.05 so that the hypothesis is accepted. that is, the physical condition of the environment has a significant effect on the incidence of dengue fever.

Based on the results of the hypothesis test, it is known that the P value for the influence of socio-cultural conditions of the community on the incidence of dengue fever shows a value below 0.05. The test results obtained a P value of 0.001 which is smaller than 0.05 so that the hypothesis is accepted. that is, the physical condition of the environment has a significant effect on the incidence of dengue fever.

Based on the results of the study, it is known that the environment has an influence on the spread of dengue. The environment around the respondents, such as the condition of the house, will have an impact on the spread of existing dengue. A dirty environment such as a lot of garbage around the house will make the development of mosquitoes more and more ceat. This condition will make the spread of mosquitoes in the community will increase significantly. The more mosquitoes that are spread, the higher the chance of spreading dengue. This condition will be inversely proportional if the condition of a clean home environment will reduce the development of mosquitoes. It will indirectly inhibit the spread of dengue if the condition of people's houses.

The results of the study showed that the environment of people's home conditions in Kondsii was not good, reaching 53.7%. This means that more than half of the samples in this study have house conditions whose environment is included in the category of not good. Based on the results of research in the field, it was found that most of the respondents did not meet the requirements for the ventilation area of their houses. The condition of the physical environment of the house that does not meet the requirements provides a great opportunity for dengue disease to occur. The physical environmental conditions of the house in question are file ventilation, humidity, and lighting. Ventilation is a house building which is not only a place for air circulation and as a place for light to enter. In theory, an unhealthy house can cause various diseases if the house does not have adequate ventilation. The condition of the house with ventilation conditions that are not installed with mosquito screens will make it easier for mosquitoes to enter and bite humans in the house.

The results of the study found that the habits of most residents who do not open doors or windows in the morning and during the day so that the incoming sunlight is less than optimal. In addition, the condition of the respondent's house which is quite close also affects the intensity of light that can enter the house, as well as the number of trees around the house and ornamental plants outside the house that also block the entry of sunlight. This provides opportunities for mosquitoes because a place with minimal light will be used as a resting place.

Houses with less lighting and added to the house are densely populated and have habits that can support the reproduction and spread of *Aedes aegypti* mosquitoes. Light is the main factor that affects mosquitoes to rest in a place, if the light intensity is low and the humidity is high, these two things make good conditions for the development and spread of mosquitoes. At low light intensity, mosquitoes will fly and mosquito larvae will survive longer in a room in a container if it is dark.

6. Findings

The results of the study found that the physical and socio-cultural environmental conditions of the community have a significant influence on the incidence of dengue. A physical environment that can support mosquito breeding will make the incidence of dengue even higher. On the other hand, when the physical condition of the environment is good and does not indicate a mosquito breeding place, the incidence of dengue will be low. The physical condition of the environment is also determined by the socio-cultural conditions of the community where they live their daily lives. This means that the social environment can also determine the high and low incidence of dengue fever.

7. Limitations and Research Gaps

The limitation of this study is that the research location only focuses on the location that has the highest cases so that it can not be generalized to other areas that have different environmental conditions. The problem of this research is the community slum environment which is often the focus of research.

8. Conclusion

Based on the results of the study, it can be concluded that the physical and socio-cultural environment has a significant effect on the incidence of dengue. The better the environment, the lower the incidence of dengue. On the other hand, when the environment has poor conditions, the incidence of dengue will be higher.

References

- [1] W. R. Wirantika and Y. Susilowati, "Pengaruh Pendidikan Kesehatan terhadap Pengetahuan dan Perilaku Siswa dengan Persebaran Demam Berdarah Dengue (DBD) Di Sekolah," *J. Heal. Sains*, vol. 1, no. 6, pp. 427–431, Dec. 2020, doi: 10.46799/jhs.v1i6.62.
- [2] A. Arivadany and M. Rizky, "Dampak Perubahan Iklim Terhadap Penyebaran Demam Berdarah : Tinjauan Literatur," *J. Kesehat. Tambusai*, vol. 5, no. 3, pp. 7107–7119, 2024.
- [3] R. R. Kinansi and A. Pujiyanti, "Pengaruh Karakteristik Tempat Penampungan Air Terhadap Densitas Larva Aedes dan Risiko Penyebaran Demam Berdarah Dengue di Daerah Endemis di Indonesia," *Balaba J. Litbang Pengendali. Penyakit Bersumber Binatang Banjarnegara*, pp. 1–20, 2020, doi: 10.22435/blb.v16i1.1924.
- [4] M. T. Handayani, M. Raharjo, and T. Joko, "Pengaruh Indeks Entomologi dan Sebaran Kasus Demam Berdarah Dengue di Kabupaten Sukoharjo," *J. Kesehat. Lingkung. Indones.*, vol. 22, no. 1, pp. 46–54, Feb. 2023, doi: 10.14710/jkli.22.1.46-54.
- [5] B. A. Izza, N. Ngadino, D. Nurmawati, M. Marlik, and Y. A. Mirasa, "Analisis Spasial Pengaruh House Index dengan Kasus DBD di Kecamatan Bangilan Kabupaten Tuban," *Balaba J. Litbang Pengendali. Penyakit Bersumber Binatang Banjarnegara*, pp. 149–158, 2023, doi: 10.22435/blb.v18i2.6214.
- [6] M. Halid, "Edukasi Dampak Demam Berdarah Dengue (DBD) dalam Meningkatkan Pengetahuan dan Sikap Masyarakat di Kelurahan Tanjung Karang Provinsi Nusa Tenggara Barat," *J. Masy. Madani Indones.*, vol. 1, no. 2, pp. 44–52, Jul. 2022, doi: 10.59025/js.v1i2.9.
- [7] Wismaridha, "Pengaruh Penyuluhan Kesehatan Terhadap Tingkat Pengetahuan Sikap Tindakan Dan Kebiasaan Keluarga Dalam Pencegahan Demam Berdarah Dengue di Kabupaten Sijunjung Tahun 2023," *J. Soc. Sci. Res.*, vol. 3, pp. 3671–3682, 2023.
- [8] N. P. Utami, "Pemodelan Pengaruh Vaksinasi Terhadap Penyebaran Demam Berdarah Dengue (DBD)," *JOSTECH J. Sci. Technol.*, vol. 2, no. 1, pp. 13–22, Mar. 2022, doi: 10.15548/jostech.v2i1.3706.
- [9] R. Wowor, "Pengaruh Kesehatan Lingkungan terhadap Perubahan Epidemiologi Demam Berdarah di Indonesia," *e-CliniC*, vol. 5, no. 2, 2024. doi: 10.35790/ec1.5.2.2017.16879.
- [10] A. Liliandriani, S. Elidayanti, and F. Fitriani, "Hubungan Lingkungan Fisik Rumah Terhadap Kejadian Demam Berdarah Dengue," *J. Pegguruang Conf. Ser.*, vol. 4, no. 2, p. 817, Nov. 2022, doi: 10.35329/jp.v4i2.3412.
- [11] H. Pebrianti, Ilham, and U. Kalsum, "Hubungan Faktor Lingkungan Fisik, Perilaku Pemberantasan Sarang Nyamuk (PSN) 3M Plus dan Keberadaan Vektor Terhadap Kejadian Demam Berdarah Dengue (DBD)," *Syntax Lit.*, vol. 6, no. 11, pp. 5639–5656, 2021, [Online]. Available: <http://dx.doi.org/10.36418/>
- [12] M. Y. Oroh, O. R. Pinontoan, and J. B. S. Tuda, "Faktor Lingkungan, Manusia dan Pelayanan Kesehatan yang Berhubungan dengan Kejadian Demam Berdarah Dengue," *Indones. J. Public Heal. Community Med.*, vol. 1, no. 3, pp. 35–46, 2020.
- [13] R. M. Arsyad, E. Nabuasa, and E. M. Ndoen, "Hubungan antara Perilaku Sanitasi Lingkungan dengan Kejadian Demam Berdarah Dengue (DBD) di Wilayah Kerja Puskesmas Tarus," *Media Kesehat. Masy.*, vol. 2, no. 2, pp. 15–23, Oct. 2020, doi: 10.35508/mkm.v2i2.2498.
- [14] A. Hamid, A. Lestari, and I. Maliga, "Analisis Perbandingan Faktor Lingkungan Terkait Dengan Prevalensi Kejadian Demam Berdarah Dengue (DBD) Pada Daerah Sporadis Dan Daerah Endemis," *J. Kesehat. Lingkung. Indones.*, vol. 22, no. 1, pp. 13–20, Feb. 2023, doi: 10.14710/jkli.22.1.13-20.
- [15] P. R. Kartini, S. Martini, and S. R. Devy, "Pengaruh Lingkungan Sosial Terhadap Kejadian DBD di SD Kota Madiun Tahun 2016," *Pharmed J. Pharm. Sci. Med. Res.*, vol. 5, no. 1, pp. 33–41, 2022, [Online]. Available: <http://e-journal.unipma.ac.id/index.php/pharmed/article/view/12514>