



Analysis of the Distribution Pattern Environmental Risk Factors with the Incidence Dengue Hemorrhagic Fever in South Binjai District, Binjai City

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<p>Track Record Article</p> <p>Accepted: 20 October 2023 Revised: 2 December 2023 Published: 11 December 2023</p> <p>How to cite : Rusli, M., Marganda, S., Manalu, H., & Syaputri, D. (2023). Analysis of the Distribution Pattern Environmental Risk Factors with the Incidence Dengue Hemorrhagic Fever in South Binjai District, Binjai City. Contagion :Scientific Periodical of Public Health and Coastal Health, 5(4), 1205-1215.</p>	<p style="text-align: center;">Abstract</p> <p><i>Environmental conditions have a big influence on the incidence of dengue hemorrhagic fever, because a bad environment can increase the breeding and reproduction of the Aedes aegypti mosquito. Research Objectives: To determine environmental risk factors and distribution patterns of dengue hemorrhagic fever in South Binjai District, Binjai City. The type of research used was analytical observational research with a cross sectional design and an ecological approach. The population in this study was 54.422 people and a sample of 100 people. Analysis of research data with bivariate using Chi square test. And mapping analysis of the distribution of cases of Dengue Hemorrhagic Fever using the Geographic Information System application to describe the distribution pattern of Dengue Hemorrhagic Fever in Binjai City. The results of the study showed that there was a relationship between the presence of larvae and cases of dengue hemorrhagic fever (p-value=0.000), there was a significant relationship between the presence of larvae and cases of dengue hemorrhagic fever (p-value=0.000), there was a significant relationship between the habit of hanging clothes with cases of dengue hemorrhagic fever (p-value=0.000), there is a significant relationship between the frequency of draining the bathtub and cases of dengue hemorrhagic fever (p-value=0.004), there is no significant relationship between the frequency of support from health workers and cases of dengue hemorrhagic fever (p-value = 0.359), and there is no significant relationship between the frequency of experience of receiving health education and cases of dengue hemorrhagic fever (p-value = 0.359). The distribution of dengue fever cases is not spread throughout the sub-district, but only in several adjacent areas. Based on research results, the highest number of cases occurred in mixed plantation areas. It is recommended that health workers compile a more specific distribution pattern map regarding the factors causing Dengue Hemorrhagic Fever.</i></p> <p>Keywords: Dengue hemorrhagic fever, Distribution pattern, Environmental, Risk factors</p>
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INTRODUCTION

Dengue hemorrhagic fever is a disease that causes death, known for >200 years, becoming a health problem in the world, especially developing countries. The disease became endemic in 100 countries, infecting from 500-100 million people. 500,000 cases of dengue hemorrhagic fever require hospitalization and 22.000 deaths each year (WHO, 2021).

In 2021, the number of dengue hemorrhagic fever sufferers in 34 provinces in Indonesia was 73,518 cases with a morbidity rate of 27/100,000 population and death rate of 0.96%. The number of dengue hemorrhagic fever cases in North Sumatra province in 2021 was 19.51/100,000 population and the mortality rate was 0.48% (Kemenkes RI, 2020).

Binjai City is one of the cities in North Sumatra that has a fairly high incidence of dengue hemorrhagic fever. Based on data from the central statistics agency of Binjai city, in

2018 there were 279 cases of dengue hemorrhagic fever and South Binjai District with the highest cases of 103 cases (BPS, 2023).

Environmental factors provide habitat for the *Aedes aegypti* mosquito to develop, such as puddles of clean water that are not in direct contact with the ground and not exposed to direct sunlight, the presence of used goods such as free tires, bottles, plastic and other items that can hold water are possible means. for mosquito breeding sites, the more used items that can hold water, the more places there will be for mosquitoes to lay eggs and breed, thereby increasing the risk of dengue fever (Ferdiansyah, 2016).

Community behavior also has a big relationship because community behavior can provide environmental support for the development of mosquitoes. Life habits of maintaining environmental cleanliness and health such as 3M+ (Draining, Burying and Closing water reservoirs + Abate) as an effort to prevent an outbreak of Dengue Hemorrhagic Fever (Cania et al., 2022).

Environmental conditions have a major influence on the incidence of dengue hemorrhagic fever, because a poor environment can increase the breeding and brooding of *aedes aegypti* mosquitoes (Srifati, 2020). Physical environment such as air temperature, air humidity, altitude, wind, sunlight, rain, water currents. Chemical environment such as the degree of acidity of water (Satoto et al., 2020; Nurmayanti et al., 2023).

Biological environments such as mangroves, lichens, algae that can block sunlight. Dengue hemorrhagic fever data in South Binjai District has not been in the form of a geographic information system. Mapping the spread of cases has not been carried out. This causes the picture of the distribution of dengue hemorrhagic fever cases by area in South Binjai District is not known with certainty

Identification and analysis of environmental risk factors associated with the incidence of dengue hemorrhagic fever in South Binjai District is needed, so that control efforts become more optimal. It is necessary to conduct research analysis of the distribution pattern of environmental risk factors with the incidence of dengue hemorrhagic fever in South Binjai District, Binjai City. With spatial analysis, it can carry out a mapping process to determine the distribution of potential disease risks geographically and their relationship with existing environmental risk factors.

METHOD

This type of research is an analytical observational study with a *case control design* and ecological approach, aimed at obtaining an overview of the distribution pattern of dengue hemorrhagic fever and environmental factors using geographic information system applications. This research was conducted in South Binjai District, Binjai City, which was carried out from April to July 2023.

The population in this study is the entire population in South Binjai District, as many as 54.422 people. This research sampling technique is based on certain considerations such as characteristics or population traits that have been known before. Sampling using the slovin formula is calculated based on the formula, so the number of samples is obtained as many as 100 consisting of 50 case samples and 50 control samples.

The variables in this study were the presence of larvae in the house, the presence of larvae outside the house, the habit of hanging clothes, the frequency of draining tubs, the support of health workers and the experience of receiving health counseling. Data collection in this study using questionnaires in the form of interviews and by making direct observations at the research location.

Analysis of research data with bivariate using Chi square test with a confidence level of 95%. The decision taken from this analysis test by looking at the value of $p < 0.05$ and Odds Ratio to determine the dominant risk factor for the incidence of dengue hemorrhagic fever in the form of crosstab with the help of a computerized software device Statistical Package for the Social Sciences (SPSS) version 20. And mapping analysis of the distribution of cases of Dengue Hemorrhagic Fever using the Geographic Information System (GIS) application to describe the distribution pattern of Dengue Hemorrhagic Fever in Binjai City.

RESULT

Risk factors studied with dengue incidence in Karo Regency can be seen in the table below:

Table 1. Risk Factors for Dengue Hemorrhagic Fever in South Binjai Village, Binjai City

Variable	Dengue Hemorrhagic Fever				Total		Odds ratio	CI 95%	p-value
	Case		Control		n	%			
	n	%	n	%					
Presence of Larvae (In the House)									
Yes	48	84,2	9	15,8	57	57,0	0.009	0,002-0,045	0,000
Nothing	2	4,7	41	95,3	43	43,0			
Presence of Larvae (Outside the Home)									
Yes	50	73,5	18	26,5	68	68,0	3.778	2.543-5,614	0,000
Nothing	0	0	32	100	32	32,0			
Habit of Hanging Clothes									
Yes	41	65,1	22	34,9	63	63,0	0.172	0.069-0.429	0,000
No	9	24,3	28	75,7	37	37,0			
Frequency of Draining Tub									
Yes	27	67,5	13	32,5	40	40,0	0.229	0.129-0.695	0,004
No	23	38,3	37	61,7	60	60,0			
Health Worker Support									
Yes	4	80,0	1	20,0	5	5,0	0.235	0.025-2,579	0,359
No	46	48,4	49	51,6	95	95,0			
Experience Receiving Health Education									
Yes	4	80	1	20,0	5	5,0	0.235	0.025-2.178	0,359
No	46	48,4	49	51,6	95	95,0			

From the description in the table above shows that out of 100 respondents who suffered from dengue hemorrhagic fever as many as 50 respondents, while those who did not suffer from dengue hemorrhagic fever there were 50 respondents. In containers in the house in the case there were 48 (84.2%) houses that had the presence of larvae, and 2 (4.7%) houses that did not have the presence of larvae. While in the control there were 9 (15.8%) houses, and 41 (95.3%) houses without larvae. Based on the results of statistical tests, the results of the analysis show value = 0.000 or $p < 0.005$, thus it can be concluded that there is a significant relationship between the presence of larvae and cases of dengue hemorrhagic fever.

And in containers outside the house in the case of 50 (73.5%) houses there is the presence of larvae. And in the control there were 18 (26.5%) houses that had larvae and as many as 32 (100%) houses that did not have larvae. Based on the results of statistical tests, the results of the analysis show a value = 0.000 or $p < 0.005$, thus it can be concluded that there is a significant relationship between the presence of larvae and cases of dengue hemorrhagic fever.

Respondents who experienced cases of dengue hemorrhagic fever who had a habit of hanging clothes as many as 41 (65.1%) respondents, and as many as 9 (24.3%) respondents who did not have the habit of hanging clothes. And respondents who did not have dengue hemorrhagic fever or the control group who had a habit of hanging clothes as many as 22 (34.9%) respondents and as many as 28 (75.7%) respondents who did not have the habit of

hanging clothes. Based on the results of statistical tests, the results of the analysis show value $= 0.000$ or $p < 0.005$, thus it can be concluded that there is a significant relationship between the habit of hanging clothes with cases of dengue hemorrhagic fever.

Respondents who experienced cases of dengue hemorrhagic fever that drained the tub were 27 (67.5%) respondents and as many as 23 (38.3%) respondents who did not drain the tub. And in respondents who did not have dengue hemorrhagic fever or the control group who drained the tub as many as 13 (32.5%) respondents and respondents who did not drain the tub drain in the control group as much as 37 (61.7%). Based on the results of statistical tests, the results of the analysis showed a value of 0.004 or $p < 0.005$, thus it can be concluded that there is a significant relationship between the frequency of draining tubs with cases of dengue hemorrhagic fever.

Respondents who experienced dengue hemorrhagic fever cases who received the support of health workers were 4 (80%) respondents and as many as 46 (48.4%) respondents who did not receive the support of health workers. And in respondents who did not have dengue hemorrhagic fever or the control group who received health worker support as many as 1 (20%) respondents and respondents who did not get health worker support in the control group as many as 47 (51.6%). Based on the results of statistical tests, the results of the analysis showed a value of 0.359 or $p > 0.005$, thus it can be concluded that there is no significant relationship between the frequency of support of health workers and cases of dengue hemorrhagic fever.

There were 4 (80%) respondents who experienced cases of dengue hemorrhagic fever who had experience receiving health education and 46 (48.4) respondents who had no experience receiving health education. And in respondents who did not have dengue hemorrhagic fever or the control group who got experience getting health counseling as many as 1 (20%) respondents and respondents who did not get experience received health counseling in the control group as many as 47 (51.6%). Based on the results of statistical tests, the results of the analysis showed a value of 0.359 or $p > 0.005$, thus it can be concluded that there is no significant relationship between the frequency of experience receiving health counseling with cases of dengue hemorrhagic fever.

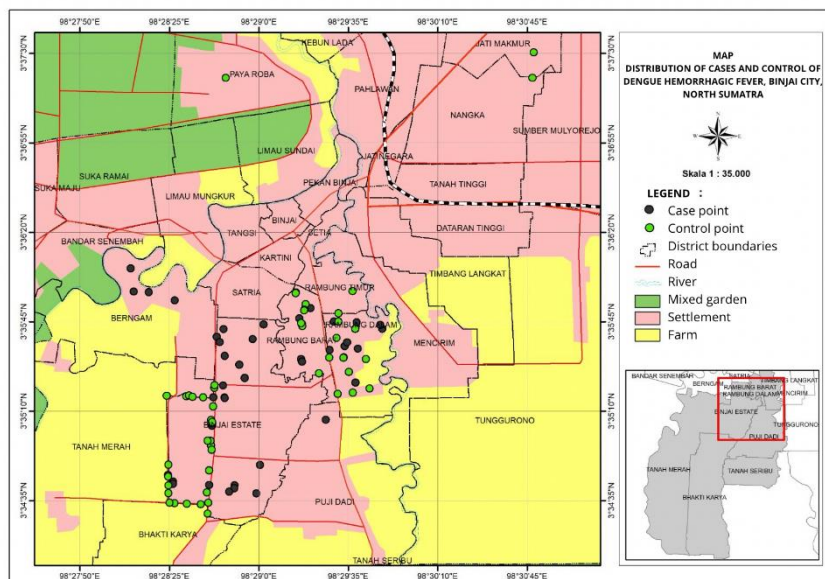


Figure 1. Map of the distribution of dengue hemorrhagic fever in South Binjai District, Binjai, North Sumatra City

The spread of dengue hemorrhagic fever cases is not in all areas in the sub-district, but only a few adjacent areas. Based on the results of the study, the most cases were in mixed plantation areas. With this map, the Public health center can find out which areas have high cases of dengue hemorrhagic fever so that the Public health center can take langkah in tackling dengue hemorrhagic fever cases in South Binjai District, Binjai Kota.

DISCUSSION

This research was carried out in South Binjai District, Binjai City, which consists of 8 sub-districts. With a sample size of 100 respondents consisting of 50 case group respondents and 50 control group respondents. The largest number of respondents were women, 54 (54%) respondents, while men were 46 (46.0%) respondents.

Based on the research results, it can be seen that people are less concerned about environmental conditions, where it is known that the presence of larvae in containers inside the house and containers outside the house has been proven to have an influence on the incidence of dengue hemorrhagic fever. The presence of larvae in containers in the house was mostly found in bathtubs, with 59% being positive for larvae. The presence of larvae in bathtubs is caused by people rarely draining bathtubs. To overcome the high incidence of dengue hemorrhagic fever, this can be done by draining and cleaning the bathtub at least once a week to minimize the presence of mosquito larvae in the bathtub. The factor that makes people rarely drain their bathtubs is because the volume of their bathtubs is quite large so it takes a lot of energy to clean them frequently.

Mosquito breeding places are often found in containers with cement walls, dark colors and container volumes >50 liters. Mosquitoes like cement-walled containers because they have low light reflection and also like large volume containers >50 liters because in large containers the water stays in them long enough so they are suitable for breeding places (Sari et al., 2020).

In the case group there were 48 respondents (84.2%) who were positive for larvae in containers in the house and in the control group there were 9 respondents (15.8%) who were positive for larvae. The Odds ratio (OR) results show that the homes of respondents who were positive for larvae had a 0.009 greater risk of suffering from dengue hemorrhagic fever than respondents who did not find mosquito larvae. Mosquito breeding places, apart from water reservoirs, are also in containers or used items that allow rainwater to stagnate that are not grounded, such as used cans, used tires, bottles, coconut shells, plastic, etc. that are thrown away in any place. Containers is a water reservoir or vessel used as a breeding place for the *Aedes aegypti* mosquito (Kinansi et al., 2020).

The breeding place variable is a risk factor for dengue fever where the presence of a breeding place has 10 times the risk of contracting dengue fever than those who do not have a breeding place. This research is in line with research Putri et al., (2020) and research Kabalu et al., (2023) explained that the presence of containers has a 7-9 times greater risk of contracting dengue fever, because containers can be a place for the *Aedes Aegypti* mosquito to place its eggs which can then develop into larvae and pupae until they become adults. In general, the eggs, larvae and pupae of the *Aedes aegypti* mosquito grow and thrive in water.

The results of this study are in line with Dompas (2020) which shows that there is a relationship between water reservoirs and the incidence of dengue fever with a p-value of 0.002 and an Odds Ratio (OR) value obtained of 6.417. This value shows that respondents who have water reservoirs that do not meet the requirements are at 6,417 times greater risk of contracting dengue fever.

Prevention of dengue fever can be done by controlling mosquito vectors, including by draining bathtubs or water reservoirs at least once a week; replace or drain flower vases and bird drinkers once a week; tightly close the water reservoir; burying used cans; used batteries and tires around the house; and home design improvements (Arfan, 2019; Afton, 2019).

The location of water reservoirs, both inside the house and outside the house, greatly influences the presence of mosquito larvae. These larvae are often found in reservoirs that are difficult to drain, one example is that mosquito larvae are often found in drums or in reservoirs located in outside and a bathtub for shelter inside. Therefore, it is important to always pay

attention to cleaning water reservoirs outside the house and inside the house so that mosquito breeding does not increase around our home environment (Shafira, 2021).

Existences such as used cans, pieces of bamboo, poles made from pipes or bathtubs outside the house that are hard to reach for cleanliness can become water reservoirs and can create breeding places for mosquitoes. The existence of a breeding place will create opportunities for mosquitoes to breed and increase larvae. This research is also in line with research Putri et al., (2020) explained that mosquitoes that breed around the house will find it easier to reach the host (human), thus the presence of larvae in containers around the house will increase the incidence of dengue fever.

In the case group there were 41 respondents (65.1%) who had the habit of hanging clothes and in the control group there were 22 respondents (34.9%). The OR results show that the homes of respondents who have the habit of hanging clothes have a 0.172 greater risk of suffering from dengue hemorrhagic fever than respondents who do not have the habit of hanging clothes. In line with research Putri et al., (2020) explaining where the resting place is. In the case group there were 41 respondents (65.1%) who had the habit of hanging clothes and in the control group there were 22 respondents (34.9%). The OR results show that the homes of respondents who have the habit of hanging clothes have a 0.172 greater risk of suffering from dengue hemorrhagic fever than respondents who do not have the habit of hanging clothes. In line with research on mosquitoes in the house, one of them is clothes that have been used and hung up, because there are amino substances (odor) produced by human sweat and this is something that mosquitoes like and causes mosquitoes to come closer and land to rest.

This research is in line with research Lestari (2022), There is a relationship between the habit of hanging clothes and the incidence of dengue fever with a p value of 0.000. The habit of hanging clothes can increase the risk of dengue hemorrhagic fever because mosquitoes like to stick to hanging clothes because of the human scent on the clothes.

In the case group there were 23 respondents (38.3%) who did not drain the tank once a week and in the control group there were 37 respondents (61.7%) who did not drain the tank. The OR results showed that the homes of respondents who did not drain the tank at least once a week had 0.229 more cases of dengue hemorrhagic fever than respondents who drained the tank at least once a week. The community should drain the tanks at least once a week to prevent and overcome the incidence of dengue hemorrhagic fever because mosquitoes like to lay their eggs in tanks which are breeding places for mosquitoes.

People rarely drain their tanks usually because the tanks they use have large volumes (>50 liters) which can be quite draining if they drain frequently. The success rate of mosquitoes

breeding is greatly supported by the very large size of the container and place as well as the length of time the water is in it (Kinansi et al., 2020). The existence of *Aedes Aegypti* mosquitoes or larvae is more caused by the living habits of the community such as not cleaning containers in the house (Soerachman et al., 2023).

This research is in line with research Dewi et al., (2018), which states that the presence of *Aedes Aegypti* inside buildings is greater and these mosquitoes have a habit of resting outside buildings. This means that this is in accordance with the way of life and behavior of the *Aedes Aegypti* mosquito, which tends to choose dark, damp and hidden resting places, for example in buildings or inside houses, and also the feeding behavior of the *Aedes aegypti* mosquito is very anthropophilic. By draining, we have broken the mosquito life cycle so that the adult mosquito population will eventually run out.

In the case group there were 4 respondents (80%) and 46 respondents (48.4%) did not receive support from health workers. And of the respondents who did not experience dengue fever or the control group who received health workers, there was 1 respondent (20%) and 47 respondents (51.6%) who did not receive support from health workers. Based on these data, it was concluded that there was no significant relationship between the frequency of support from health workers and the incidence of dengue hemorrhagic fever. This research is also in line with research Nasution (2019) and research Suryani (2020) explained that there was no relationship between health worker support and the incidence of dengue fever. Thus, it can be concluded that the community can prevent and overcome the incidence of dengue hemorrhagic fever whether or not there is support from health workers.

CONCLUSION

The research results show that there is a significant relationship between the presence of larvae in containers in the house and the presence of larvae outside with the incidence of Dengue Hemorrhagic Fever in the South Binjai District area with chi square with a p-value of $0.000 < 0.005$. There is a relationship between the influence of the habit of hanging clothes with the incidence of Dengue Hemorrhagic Fever in the South Binjai sub-district area with the results of chi square p-value analysis of $0.000 < 0.005$ and with the value of $OR = 0.172$.

There is a relationship between the frequency of draining tubs with the incidence of dengue hemorrhagic fever in the South Binjai sub-district area with the results of chi square p-value analysis of $0.004 < 0.005$ and with the value of $OR = 0.229$. There is no relationship between Health Officer support and the incidence of Dengue Hemorrhagic Fever in the South Binjai sub-district area with the results of chi square analysis p-value $0.359 > 0.005$ and with

OR value = 0.235. and there is no relationship between the experience of receiving health counseling with the incidence of Dengue Hemorrhagic Fever in the South Binjai sub-district area with the results of chi square analysis p-value $0.359 > 0.005$ and with the value of OR = 0.235

It is hoped that Public health center officers can develop a distribution pattern map more specifically to recognize the factors that cause Dengue Hemorrhagic Fever and it is expected that the community will pay attention to environmental conditions such as water reservoirs or containers and the habit of hanging clothes, and routinely drain the tubs inside and outside the house to reduce the risk of Dengue Hemorrhagic Fever.

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