

# THE RELATIONSHIP BETWEEN ENVIRONMENTAL SANITATION AND THE RISK OF DENGUE HEMORRHAGIC FEVER IN BATAM, RIAU ISLAND

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## ABSTRACT

**Background:** Dengue haemorrhagic fever cases in Indonesia in 2019 amounted to 65,602 cases, with a death toll of 467 people. In 2020, dengue cases in Indonesia reached 71,633 cases. The number of DHF cases at Sei Pancur Community Health Center reached 53 cases in 2019. There was an increased incidence in 2020 as many as 116 cases. This study aimed to determine the relationship between environmental sanitation and the risk of dengue haemorrhagic fever.

**Subjects and Method:** This was a cross-sectional study conducted at Sei Pancur Community Health Center, Batam, Riau, Indonesia, from December 2020 to March 2021. A sample of 104 out of 140 people visiting the Community Health Center was selected at random. The dependent variable was dengue haemorrhagic fever. The independent variable was the environmental sanitation, including the presence of used goods, lighting, and the presence of larvae. The data were collected using questionnaires. The data were analyzed by odds ratio and chi-square.

**Results:** The risk of dengue haemorrhagic fever increased with poor environmental sanitation, including the presence of used goods around the house (OR= 5.25; 95% CI= 2.08 to 13.24; p= 0.001), poor house lighting (OR= 6.32; 95% CI= 2.31 to 17.30; p< 0.001), and the presence of larvae (OR= 2.85; 95% CI= 1.11 to 7.29; p= 0.045).

**Conclusion:** The risk of dengue haemorrhagic fever increases with poor environmental sanitation, including the presence of used goods around the house, poor house lighting, and the presence of larvae.

**Keywords:** house environment, dengue haemorrhagic fever

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## BACKGROUND

Dengue haemorrhagic fever cases in Indonesia in 2019 amounted to 65,602 cases, with a death toll of 467 people. In 2020, dengue cases in Indonesia reached 71,633 cases (Kementrian Kesehatan RI, 2020). Dengue Hemorrhagic Fever (DHF) is caused

by the Dengue virus which is transmitted from one person to another through the bite of the *Aedes Aegypti* mosquito which is the main vector, but other species such as *Aedes albopictus* can also be a vector of transmission (Kemenkes RI, 2017). In recent times, this infection has increasingly serious clinical symptoms and occurs

repeatedly with a very wide area of impact. Indonesia is a country with a dense population of 261 million people. However, dengue fever is mostly found in metropolitan areas, even spreading to areas far from urban areas, namely in remote villages (Pratiwi, 2018).

Sanitation is closely related to the relationship between the maintenance and development of mosquitoes, poor natural environmental hygiene can cause disease, one of which is Dengue Hemorrhagic Fever (DHF) which is caused by the dengue virus (Kemenkes RI, 2017). The transmission of DHF occurs because there are patients who are infected with the dengue virus (Muller, Depelsenaire and Young, 2017). In addition, the occurrence of DHF can be influenced by causative factors such as a poorly managed environment, science, financial condition, and information (Sintorini *et al.*, 2020). Furthermore, climate plays an important role in circulating the existence of vector life forms of ecologically based infections. In addition to the condition of the house also affects the spread of dengue hemorrhagic fever (Fidayanto *et al.*, 2013).

Conditions that affect the house such as ventilation, humidity and lighting. This is corroborated by study that has been carried out in the Kalasan Health Center, showing that there is a relationship between ventilation (OR= 0.07; 95% CI= 0.01 to 0.85; p= 0.039), stickiness (OR= 0.35; 95% CI= 0.04 to 3.37; p= 0.642) and lighting (OR = 0.072; 95% CI= 0.01 to 0.85; p= 0.039) with the incidence of dengue hemorrhagic fever in the

Kalasan Health Center, Sleman (Wijirahayu and Sukesi, 2019).

Based on data from the Indonesian Health Profile in 2019, there were 138,127 cases of dengue fever, this number increased compared to 2018 of 69,602 cases. Deaths due to DHF in 2019 also increased compared to 2018 from 467 to 919 deaths. Illness and death can be described using the Incident Rate (IR) indicators per 100,000 population and case fatality rate (CFR). The incidence rate of DHF in 2019 was 51.48 per 100,000 population, while CFR showed a slight decrease from the previous year, from 0.71% in 2018 to 0.67% in 2019 (*Profil Kesehatan Indonesia Tahun 2019*, 2020).

DHF cases in the Riau Islands Province in 2019 amounted to 1,873 cases, with the number of deaths as many as 11 people. The highest number of DHF cases by regency/city was in Batam City at 729 cases and the lowest in Anambas Regency at 39 cases. The morbidity rate of DHF in Riau Islands is 83.6 per 100,000 population, has not reached the target of < 49 per 100,000 population, while CFR of 0.6% has reached the national target of <1% (*Profil Kesehatan Provinsi Kepulauan Riau Tahun 2019*, 2020).

Data from the Batam City Health Office of DHF in 2019 was 729 cases with a death rate of 2 people and increased in 2020, namely 763 cases with a death rate of 4 people, while the latest data until early March 2021 were 104 cases, while for Sungai Beduk District which is located from twelve sub-districts in the Batam City Region and is the work area of the Sei Pancur

Puskesmas UPT there are 53 cases in 2019 and an increase in cases in 2020 as many as 116 cases while the data from 2021 to early March were 44 cases (Data P2P Dinas Kesehatan Kota Batam, 2021).

Based on that background above, the factors for the occurrence of DHF at Sei Pancur health center which experienced fluctuating events were due to a lack of awareness and participation from the community about the importance of creating a healthy environment and taking steps to prevent dengue disease by increasing PSN (Eradication of Mosquito Nests). If people do not have awareness about the importance of creating a healthy environment, what will happen will make it easier for environmental-based diseases to breed, one of which is dengue hemorrhagic fever (Profil Puskesmas Sei Pancur).

The purpose of this study was to determine the relationship between environmental sanitation, namely the presence of used goods, lighting, and the presence of larvae with the incidence of dengue hemorrhagic fever at Sei Pancur health center.

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## **SUBJECTS AND METHOD**

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### **1. Study Design**

This was a cross-sectional study carried out at the Sei Pancur Health Center, from March to June 2021.

### **2. Population and Sample**

The study population was adult. A sample of 140 study subjects was selected by simple random sampling.

### **3. Operational Definition of Variables**

Dengue hemorrhagic fever was defined as an infectious disease caused

by the dengue virus through the bite of the *Aedes aegypti* mosquito by taking secondary data from examination results from the medical records of the Sei Pancur community health center. The existence of used goods around the house is the existence of goods that are not used (used) and can accommodate rainwater outside the house so that it becomes a breeding ground for *Aedes* which was observed directly by researchers. Home lighting is sufficient light to illuminate the room in the house, which is a health need measured by using a lux meter with a cut off point of 60 lux. The presence of larvae is defined as the presence of larvae inside and outside the house that affects the incidence of DHF which is also directly observed by the researcher.

### **4. Study Variables**

This study looks at the relationship between the dependent variable, namely the incidence of dengue fever, and the independent variable, namely the home environment, including the presence of used goods, lighting, and the presence of larvae.

### **5. Study Instruments**

The measurement tools for some variables (presence of goods and presence of larvae) are used checklist with observation and direct measurement for lighting. For dependent variable, the incidence of dengue fever, using secondary data form Sei Beduk Health Centre.

### **6. Data Analysis**

The data obtained were analyzed by univariate and bivariate with chi-square analysis.

### **7. Research Ethics**

This study considers which research ethics by giving informed consent to the respondents. If they are not willing to sign, they are removed from the sample or replaced with another sample.

## RESULTS

Based on the analysis of the characteristics of the respondents seen from

**Table 1. Sample characteristics (categorical data)**

Characteristics	Category	Frequency	Percentage
<b>Age</b>	20-40 years old	46	44.2%
	41-60 years old	55	52.8%
	>60 years old	3	3.0%
<b>Sex</b>	Male	33	31.7%
	Female	71	68.3%
<b>Education Level</b>	Elementary School	2	1.9%
	Junior High School	9	8.7%
	Senior High School	81	77.9%
	Bachelor	12	11.5%
<b>Occupation</b>	Entrepreneur	29	27.9%
	Private employees	29	27.9%
	Government employees	1	1.0%
	Does not work	45	43.2%

the variables of age, sex, education level and occupation. From table 1, it can be seen that most of the respondents were 41-60 years old, namely 55 people (52.8%). A total of 71 respondents (68.3%) were female. 81 people have completed senior high school (77.9%) and as many as 45 (43.2%) were unemployed.

**Table 2. The Risk of House Environment on Dengue Hemorrhagic Fever**

Independent Variables	DHF				OR	p
	Yes		No			
	N	%	N	%		
<b>The Presence of Used</b>						
Not eligible	42	60.9	27	39.1	5.25	0.001
Eligible	8	22.9	27	77.1		
<b>Home Lighting</b>						
Not eligible	44	60.3	29	39.7	6.32	0.000
Eligible	6	19.4	25	80.6		
<b>The presence of larvae</b>						
Not eligible	42	54.5	35	45.5	2.85	0.045
Eligible	8	29.6	19	70.4		

Based on the table above, it is known that the frequency of DHF incidence is more in the category of the group with DHF than in the non-DHF group. Where the existence of used goods around the house with criteria that do not meet the requirements as many as 42 (60.9%) in patients with

DHF. From the results of statistical tests that there is a significant relationship between the presence of used goods and the incidence of DHF in the Work Area of the UPT Puskesmas Sei Pancur.

From table 2 above, the incidence of dengue hemorrhagic fever is

more in the group of DHF patients than in the non-DHF patient group with the results of lighting measurements not meeting the requirements in the group of patients as many as 44 (60.3%) and 29 (39.7%) in the group of patients with dengue hemorrhagic fever. the non-DHF patient group. The results of statistical tests using chi square is a significant relationship between house lighting and the incidence of dengue hemorrhagic fever in the UPT work area Sei Pancur Health Center.

Based on table above, it is known that the number of larvae that do not meet the requirements in the group of DHF patients is more, namely 42 (54.5%) compared to the group of non-DHF sufferers with a total of 35 (45.5%). Where the results of statistical tests is a significant relationship between the presence of larvae and the incidence of dengue hemorrhagic fever in the working area of UPT Puskesmas Sei Pancur.

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## DISCUSSION

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### **1. The relationship between the existence of used goods and the incidence of dengue hemorrhagic fever**

Considering that this bivariate analysis used the Chi-Square test to determine the relationship between the presence of used goods around the house and the incidence of dengue hemorrhagic fever, the  $p= 0.001$ , means that there is a significant relationship between the presence of used goods around the house and the incidence of dengue hemorrhagic fever at Sei Pancur health center.

Based on the theory, places that become breeding grounds for *Aedes aegypti* mosquitoes are water reservoirs (TPA) for daily needs both inside and outside the home, including buckets, drums, jars, bathtubs, and others. Daily needs, including bird drinking places, water media flower vases, used goods, gutters, and so on. Natural landfills, such as tree holes, banana leaf midribs, coconut shells, flowers and so on (Kementerian Kesehatan RI, 2013).

This is in line with Winarsih (2012) with the results that there was a relationship between the presence of ornamental plants ( $p= 0.349$ ), the presence of used goods (OR= 4.55;  $p= 0.005$ ), house ventilation area (OR= 4.26;  $p= 0.020$ ), house humidity ( $p= 0.005$ ), draining the landfill (OR= 3.87;  $p= 0.004$ ), closing the landfill ( $p= 0.070$ ), burying used goods (OR= 4.75;  $p= 0.004$ ) and sow abate (OR= 6.23;  $p= 0.001$ ) (Winarsih, 2012)

Based on the above discussion, it is expected that the participation of the community in carrying out mosquito nest eradication with draining water reservoirs, closing water reservoirs, recycling used goods, monitoring once a week, planting mosquito repellent plants and keeping larvae-eating fish in home and environment.

### **2. The relationship between house lighting and dengue hemorrhagic fever**

The results of a bivariate study using chi square to determine the relationship between house lighting and the incidence of dengue hemorrhagic fever, with  $p < 0.001$ . It explains that there is a significant relationship between house lighting and the

incidence of dengue hemorrhagic fever at Sei Pancur Health Center.

In addition, mosquito activity in biting humans is also influenced by the density of residents who occupy the house, so it can be estimated that the *Aedes aegypti* mosquito in homes with dense residents, bites humans more often than in houses that are not densely populated (Poinsignon *et al.*, 2019). Respondents' houses whose lighting did not meet the requirements in the group of non-DHF sufferers were 29 (39.7%) but had never experienced a DHF incident due to respondents who have a habit of opening windows with the aim of getting air circulation and getting maximum lighting. So that it will reduce the risk of mosquitoes to perch in a house with less lighting.

In accordance with the theory shown by Sukidjo (2011) a healthy house requires sufficient light, in the morning all rooms are expected to get enough sunlight (Notoatmodjo, 2011). Because the lack of light becomes a very good condition for mosquitoes, where the intensity of light is a very big factor in influencing the flying activity of mosquitoes. Mosquitoes fly at light intensities below 60 lux. Low light and high humidity are favorable conditions for mosquitoes to perch (Sapti, 2019).

This study showed that there was a relationship between ventilation (OR= 0.07; 95% CI= 0.01 to 0.85; p= 0.039), humidity (OR= 0.35; 95% CI= 0.04 to 3.37; p= 0.642) and lighting (OR= 0.07; 95% CI= 0.01 to 0.85; p= 0.039) with the frequency of dengue hemorrhagic fever in the working area of Kalasan Public Health Center,

Sleman Regency (Wijirahayu & Sukesni, 2019).

Thus, it is appealed to the public for homes that do not have lighting that does not meet the requirements in order to increase the habit of opening windows with the aim of helping maximize the entry of light into the house where houses with less light intensity are the most preferred places for mosquitoes to perch.

### **3. Relationship between the presence of larvae and the incidence of dengue hemorrhagic fever**

Based on the bivariate test using chi square to determine the relationship between the presence of larvae and the incidence of dengue hemorrhagic fever, with  $p= 0.045$ , showed that there was a significant relationship between the presence of larvae and the incidence of dengue hemorrhagic fever at Sei Pancur Public Health Center.

In accordance with the theory that the breeding place of the *aedes aegypti* mosquito greatly affects the density or density of larvae, the larval density has a very large influence on the incidence of dengue hemorrhagic fever cases (Carrington and Simmons, 2014). The main breeding places in the house are water reservoirs: bathtubs, jars, placemats for storing water dispensers, etc. (Kementarian Kesehatan RI, 2013).

A study by Anggraini (2018), reported that there is a relationship between the presence of larvae and the incidence of DHF ( $p < 0.001$ ) in the Kedukus Village (Anggraini, 2018). To reduce the risk of transmission of dengue disease, it is hoped that all levels of society will take an active role

in prevention efforts, namely by doing the program 1 House 1 Jumantik (G1R1J1) at home and in their respective environments. For its implementation, the role of jumantik cadres is very influential in this case as evidenced by the implementation of the home visit/ larva check method that is carried out so that it can provide motivation to the community to make efforts to prevent dengue disease through 3Mplus actions at their respective homes and the surrounding environment (Aji, 2018).

The conclusion of the research is that there is a relationship between environmental sanitation, namely the presence of used goods around the house, house lighting and the presence of larvae with the incidence of dengue hemorrhagic fever in the Work Area of Sei Pancur Public Health Center. As one of the efforts to prevent dengue, the community is expected to: Get used to the maintenance and reuse of used goods around the house, Get used to opening windows during the day to maximize the entry of light into the house and do the 3Mplus program, namely draining, closing and recycling used goods and the pluses monitoring once a week, keeping larvae-eating fish, planting mosquito repellent plants, and others at home and the surrounding environment.

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#### **AUTHOR CONTRIBUTION**

All authors have contributed to this research. The first author as well as the correspondent author as the main idea compiler of the research and the author of the final research report. The second author took on the role of data collector. The third author as data

analysis and making attachments. The fourth author as a quality control of the research instrument.

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#### **CONFLICT OF INTEREST**

There is no conflict of interest in this study.

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