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Relationship between Ventilation, Light Intensity and Conditions for Water Reservoirs in the House with the Occurrence of Dengue Hemorrhagic Fever in Medan City in 2019

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Abstract:
Dengue hemorrhagic fever is an infectious disease caused by dengue virus and is transmitted through the bite of the Aedes aegypti or Aedes albopictus mosquito. Ventilation and light intensity are physical controls to reduce the risk of outbreaks of DHF. Medan is one of the cities that is endemic for DHF, so DHF cases continue to occur and even increase every year. In 2018 cases of dengue hemorrhagic fever have increased as many as 1490 cases with a death rate of 13 people. This study aims to analyze the relationship between ventilation, light intensity and water storage conditions with the incidence of DHF. This type of research is descriptive, with case control design. The study population was 98 households, the study sample consisted of 49 cases and 49 controls. Data collection through observation and measurement. Data analysis methods include univariate analysis, bivariate analysis using chi square. The univariate analysis results demonstrated that the dengue hemorrhagic fever cases had higher prevalence rate in August (41%) and had dominant attack on 3-14 year old people (39%) as well as on females (59%). The bivariate analysis results indicated that lighting (OR= 9.474), ventilation (OR= 5.949) and condition of water reservoirs (OR= 4.769) were correlated with prevalence of dengue hemorrhagic fever. It was suggested to the public to pay attention to the intensity of light inside the house and install a wire mesh on the ventilation if the home environment contained a lot of DHF vectors and closed water reservoirs.
Keywords:
ventilation; light intensity; dengue hemorrhagic fever

I. Introduction

Dengue hemorrhagic fever (DHF) is an vector-based infectious disease caused by dengue virus and transmitted through mosquitoes. Mosquitoes that can transmit dengue fever are Aedes aegypti and Aedes albopictus.

Dengue virus is a virus that causes DHF from the genus Flavivirus, family Flaviviridae. Transmission of dengue fever to humans through the bite of Aedes aegypti mosquitoes infected with dengue virus. Dengue virus has four types of serotypes, namely DEN-1, DEN-2, DEN-3, DEN-4 which can cause dengue fever or DD which can cause the transfer of fluid from the blood vessels to outside blood vessels which results in rupture of blood vessels and can cause death if not treated immediately.

DHF is a type of infectious disease caused by a virus transmitted through mosquitoes that often arises in tropical countries like Indonesia. WHO data in 2004 and 2010 stated that 75% of the burden of dengue in the Asia Pacific which ranked first in the world and Indonesia ranked second in the world with the highest DHF cases among 30 endemic countries, after Thailand from 1968 to 2009 (MOH RI, 2010). North Sumatra ranks fourth with the highest incidence of DHF in Indonesia with 5327 cases with 29 deaths.

Based on the 2016 North Sumatra Health Profile data, there were 8,715 DHF cases in North Sumatra with IR, out of 100,000 population there were 63.3 cases and CFR of 0.69 percent. In 2016, the IR figure increased from the previous year, from 100,000 population there were 21.9 cases. However, there was a decrease in mortality (CFR) in 2016 to 0.69% from 2015 which was 0.79%. The highest number of cases occurred in Medan City with 1,784 cases with CFR 0.62%, Deli Serdang Regency with 1,144 cases with CFR 0.17% and Simalungun with 1,071 cases with CFR 0%.

There was a decrease in the number of dengue cases in Medan in 2017 which was 1214 cases with 11 deaths, but in 2018 there was an increase of 1490 cases with 13 deaths. The incidence of DHF is influenced by several factors, namely the host (human) is a factor of vulnerability or the human immune system, the agent (mosquito) is influenced by the population density of Aedes aegypti larvae and the environment (environment) such as ventilation using wire mesh or not and the intensity of light that meets the requirements.

Installation of wire mesh on each vent can reduce the number of mosquitoes or the spread of disease by mosquitoes in the house because ventilation serves as a way out and into the house for mosquitoes. Light can affect the flight distance of mosquitoes, mosquito resting places, where mosquitoes like in dark places (<60 lux) coupled with high humidity and larvae are found more in dark vessels than large or bright vessels.

According to the Ministry of Health of the Republic of Indonesia in 2016, an effective and efficient way to deal with dengue is by conducting a program to eradicate mosquito nests (PSN) namely 3M (draining cover, burying water reservoirs) and 3M plus which one of them is installing wire mesh on the ventilation and maintain the light intensity in the house to meet the requirements, so researchers are interested to know whether the ventilation factor and the light intensity is one of the factors that causes the high incidence of DHF in Medan because based on the observation of researchers there are many houses in Medan that do not install wire mesh the ventilation of the house, the low intensity of light entering the house and there are still many open water reservoirs both inside and outside the house.

II. Research Method

This research is an observational analytic study using case control design. The study population was 98 houses, the study sample consisted of 49 cases and 49 controls, taken using matching techniques. The number of cases was taken from June to August 2019. The collection of data through observation to see the presence or absence of wire mesh in ventilation, open or closed water reservoirs and measurement of light intensity using a lux meter. Data analysis methods include univariate analysis, bivariate analysis using chi square. This research was conducted in September 2019.

III. Discussion

a. Univariate Analysis

Table 1. Frequency Distribution of DHF Events by Month.

DHF Events	**Cases**		**Control**	
	n	**%**	**n**	**%**
Months				
June	20	41	20	41
July	15	31	15	31

August	14	29	14	29
Total	**49**	**100**	**49**	**100**
Age				
3-14 years old	19	39	19	39
15-26 years old	10	18	10	18
27-38 years old	11	24	11	24
39-50 years old	4	8	4	8
51-62 years old	3	6	3	6
63-74 years old	1	2	1	2
> 74 years old	1	2	1	2
Total	**49**	**100**	**49**	**100**
Gender				
Boy	20	41	20	41
Girl	29	59	29	59
Total	**49**	**100**	**49**	**100**

Based on Table 1 below, it is known that the incidence of DHF in June was 20 people (41%), in July 15 people (31%) and in August 14 people (29%), where this number increased from 2018 in 25 cases. DHF cases are more common in the age group 3-14 years, as many as 19 people (39%) and in the age group 63-74 years and the age group > 74 years, DHF cases do not occur very much or as many as 1 person (2%). The majority of respondents who contracted dengue disease are female sex as many as 29 people (59%), while the male sex as many as 20 people (41%). children and women are more predominantly infected with DHF caused by a factor of low immunity and more frequent contact with dengue mosquitoes, such as the playground, school or workplace.

Table 2. Ventilation Frequency Distribution

Ventilation	**Cases**		**Control**	
	n	**%**	**n**	**%**
There is wire mesh	9	18	31	63
There is not wire mesh	40	82	18	37
Total	**49**	**100**	**49**	**100**

Based on Table 2, it is known that the installation of gauze in ventilation is mostly done by the case group, with 31 houses (63%) compared to the control group with only 9 houses (18%).

Table 3. Frequency Distribution of Light Intensity

Light Intensity	**Cases**		**Control**	
	n	**%**	**n**	**%**
Qualifiy	9	18	28	57
Not Qualifiy	40	82	21	43
Total	**49**	**100**	**49**	**100**

Based on 4,able 3 above, it is known that the light intensity that meets the requirements (≥ 60%) is found in the control group houses, which is 28 houses (57%) than in the case group that only 9 houses (18%).

Table 4. Frequency Distribution of Conditions for Water Reservoirs

Light Intensity	Cases		Control	
	n	**%**	**N**	**%**
Closed	18	36,7	36	73,5
Open	31	63,3	13	26,5
Total	**49**	**100**	**49**	**100**

Based on table 4 above, is it known that the condition of water reservoirs in the control group was more closed, as many as 36 households (73,5%), while the water reservoirs in the case group were more open, as many as 31 households (63.3%).

b. Bivariate Analysis

Table 5. Relationship between Ventilation and DHF Events

Ventilation	***P***	**OR (95% CI)**
There is wire mesh There is not wire mesh	0,001	5,949 (2,449- 14,452)

The results of ventilation measurements in this study are there is a relationship between ventilation and the incidence of DHF p = 0.001 and the OR value is 5.949 (95% CI 2.449 - 14.452) which means that the ventilation variable has a risk of 5.949 times the occurrence of DHF to respondents whose ventilation does not use a wire gauze.

This research is in line with the research of Wahyono et al. year 2010 in the city of Depok regarding factors related to the incidence of DHF and efforts to overcome them showed that there was a relationship between ventilation and DHF events. , the amount of costs to be incurred and according to them the greater benefits of installing iron in each ventilation than installing a wire mesh. The respondents' lack of interest in the case group to install wire mesh can cause frequent contact between residents of the house with Aedes aegypti mosquitoes, because Physical control through the installation of mosquito netting is done to reduce the density of mosquitoes / larvae of Aedes aegypti and the rate of increase in dengue cases (WHO, 2001), so this study proves that the installation of wire mesh has a relationship with the occurrence of DHF.

Table 6. Relationship of Light Intensity with DHF Event

Light Intensity	***P***	**OR (95% CI)**
Qualify Not Qualify	0,001	9,474 (3,357 - 25,372)

Based on table 6 above, it is known that there is a relationship between lighting with DHF events p = 0.001 and the OR value is 9,474 (95% CI (3,357 - 25,372) which means that the lighting variable has a risk of 9,474 times for DHF events for respondents whose home lighting temperature does not meet condition.

This is in line with Purba's research (2012) in East Binjai Subdistrict, where there is a relationship of lighting to the incidence of DHF obtained p = 0.041 and OR = 2.33 (95% CI 1.027-5.3300).

Mosquito Aedes aegypti likes dark places or light intensity < 60 lux to rest, fly looking for prey and light can affect the distance of flying mosquitoes, where to put larvae. Lighting in the house comes from two sources namely natural sources such as sunlight and artificial sources such as lights. Low lighting in this study was found in a group of cases, where low lighting due to the respondents' habits that rarely opened the window in the morning or afternoon both in the living room and bedroom that can prevent natural lighting sources from entering the house and sources artificial lighting is only used or turned on at dusk or from evening to night. This low lighting causes many larvae or mosquitoes that breed in the respondent's home. Many people also do not know how light intensity can reduce the risk of contracting dengue. This research proves that lighting has a relationship with the occurrence of DHF.

Table 7. Relationship of Conditions for Water Reservoirs with DHF Event

Light Intensity	***P***	**OR (95% CI)**
Closed	0,001	4,769 (2,018 – 11,270)
Open		

Based on table 6 above, it is known that there is a relationship between the conditions of open water reservoirs with the incidence of DHF p = 0.001 and the OR value is 9,474 (95% CI (3,357 - 25,372) which means that the conditions of water reservoirs have a risk of 9,474 times for events DHF for respondents whose water reservoirs in their homes are open.

This study is in line with Zulfikar's research (2014) in the Work Area of Kebayaan Public Health Center in Central Aceh District in 2017 that there is a relationship between the conditions of closed and uncovered water reservoirs on the incidence of DHF with p value = 0.004 and OR value of 3.328.

A water reservoir is a medium for breeding Aedes aegypti mosquitoes. Based on field observations, water reservoirs were found more in the case group than in the control group and found more outside the house which was left open or reversed and was rare and some even never cleaned it because of the function which they said was only to water the plants, became a place garbage and not used for everyday purposes, such as bathing. This causes the number of larvae found at the water reservoir.

IV. Conclusion

From the above results it can be concluded that there is a relationship between ventilation, light intensity in the house and the conditions of the water reservoir with the incidence of DHF in Medan City in 2019. The case group in the study dominated more for the relationship with the incidence of DHF, so we can draw no conclusions there is a change in behavior to prevent the occurrence of dengue in the case group. Ventilation and light intensity have a contribution in preventing DHF as a physical control, so that the community must also be able to pay attention to ventilation conditions that have the potential to be a

pathway for mosquitoes to enter and enter the house and the light intensity in their homes. Health workers must also provide knowledge about the contribution of Ventilation and light intensity have a contribution in preventing DHF as a physical control, so that the community must also pay attention to the ventilation conditions that have the potential to be a pathway for mosquitoes to enter and enter the house and the light intensity in their homes and close the finished water reservoirs used mainly outside the home. Health workers must also provide knowledge about the contribution of the presence or absence of screen wire and light intensity in reducing mosquito density inside their homes and closing water reservoirs outside the home.

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