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PREVENTIVE BEHAVIOR TOWARDS MAYA INDEX AT DHF ENDEMIC AREA

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Abstract

Introduction: Primary health care Putat Jaya is an area with the highest number of DHF cases out of the three primary health care in Sawahan District, Surabaya City. The number of breeding sites for mosquitoes and the density of larvae can be the risk factors that affect mosquitoes' spread. Maya Index is an indicator to measure the number of water reservoirs used as breeding grounds for mosquitoes. This study aims to analyze behavioral factors towards virtual index in dengue-endemic areas in the Primary health care Putat Jaya Surabaya. *Methods:* The research used observational type with a cross-sectional design. The population of this study was all houses in the highest endemic. The sample consisted of 100 houses taken randomly, with research variables including mosquito nests eradication behavior and Maya Index status. Data collection used questionnaires and direct observation. The data were presented in the form of distribution tables and statistically analyzed with the chi-square test. *Results and Discussion:* The results showed the Maya Index of 74 houses in the high category. There was a significant relationship between the respondent's behavior (knowledge, attitude, action) and the Maya Index. Analysis of the relationship between respondents' knowledge and Maya Index showed that the p-value = 0.00. Analysis of the relationship between respondents' attitudes with the Maya Index shows that p-value = 0.02. Furthermore, there was a significant relationship between the respondent's actions and the Maya Index with a p-value = 0.03. *Conclusion:* Based on the results of research, community behavior (Knowledge, Attitude, Action) has a significant relationship with the Maya Index level, and the high virtual index affects the risk level of DHF transmission. Knowledge was the most potential factor that affected the Maya Index. It is suggested that the community will often strive to eradicate mosquito nests independently and regularly as well as increase community knowledge with the help of community health center officers regarding the eradication of mosquito nets.

INTRODUCTION

Vector-borne diseases account for more than 17% of all infectious diseases and cause more than 700,000 deaths annually. More than 3.9 billion people in 128 countries are at risk of contracting dengue fever, with an estimated 96 million cases per year (1). One of the diseases due to vectors is Dengue Hemorrhagic Fever (DHF). DHF is a disease caused by the dengue virus, which belongs to the Arthropod-Borne Virus, the genus Flavivirus, and the Flaviviridae family. DHF is transmitted through mosquitoes' bite from the genus Aedes, mainly *Aedes aegypti* or *Aedes albopictus*. Dengue is a zoonosis disease transmitted by the *Aedes Sp* mosquito, the fastest growing mosquito globally, which causes nearly 390 million people to be infected every year (2).

DHF can occur throughout the year and can affect all age groups. This disease is related to environmental conditions and community behavior. The incidence of dengue has increased 30-fold over the past 50 years. Up to 50-100 million infections are now estimated to occur annually in more than 100 endemic countries, putting nearly half the population at risk (3). Dengue fever in Southeast Asia is reported to be 2.4 million, with a Case Fatality Rate of <1%, and around 1.3 billion populations are at risk (4). Southeast Asia has become endemic to dengue fever with periodic reports since 2010, with a record of 355,525 cases and 1982 deaths. In 2012, there were 257,204 cases and 1,229 deaths (5). In 2014 the number of DHF cases in Indonesia were 100,347 cases with an Incidence rate (IR) of 39.80 / 100,000 and case fatality rate (CFR) of 0.90%. DHF cases occur in almost all provinces in Indonesia (6).

In Indonesia, Dengue Fever was first discovered in Surabaya in 1968, whereas many as 58 people were infected, and 24 of them died (Mortality Rate = 41.3%). Moreover, since then, the disease has spread throughout Indonesia (7). Dengue Hemorrhagic Fever (DHF) cases in Indonesia, with several 68,407 cases in 2017, experienced a significant decrease from 2016 as many as 204,171 cases. Provinces with the highest number of cases occurred in 3 (three) Provinces in Java Island, each West Java with 10,016 cases, East Java with 7,838 cases, and Central Java 7,400 cases. Meanwhile, the lowest number of cases occurred in North Maluku Province, with 37 cases. (8). In 2018, the incidence rate was reported to still reach 51.53 per 100,000 population with a death rate of 919 people (2).

East Java Province is one of the dengue-endemic provinces. In 2017, from 34 provinces in Indonesia, the number of dengue cases in East Java was second, with 7,254 cases, after Central Java, with 7,400 cases. DHF in East Java tends to increase concerning population density, population mobility, urbanization, economic growth, community behavior, climate change, environmental sanitation conditions, and clean water (2). The city of Surabaya is one of the dengue-endemic cities in East Java. Sawahan District, which is a suburban settlement, is one of the dengue-endemic districts located in the city of Surabaya. In the last four years starting from 2015-2018, the number of dengue cases in Sawahan District was the highest of 31 other district in the Surabaya area. Primary health care Putat Jaya is one of the dengue-endemic areas in the Sawahan District (8).

The rapid transmission of DHF can occur due to an increase in population and mosquito vectors. The population's density will facilitate the transmission of the dengue virus because of thr vector of (multiple bitting). The density of mosquito vectors increases due to a large number of mosquito breeding potential places, causing high larvae density. High larvae density increases the transmission of the dengue virus from human, causing high cases of DHF. The density of the dengue vector population can be measured using entomological indicators consisting of the House index (HI), Container Index (CI), Breteau Index (BI), which can be used to determine the level of DHF transmission (9)

Aedes sp mosquito larvae's potential breeding site is a clean place but has lot of openend stagnant water because *Aedes sp* mosquito larvae cannot breed in dirty water. The spread of the dengue virus does not occur directly from person to person, but occurs when a mosquito bite a host infected with the dengue virus so that the mosquito becomes infected (10).

DHF transmission does not only occur due to changing and developing vector populations, but environmental sanitation and settlements also support the incidence of DHF. The *Aedes aegypti* mosquito is related to human blood as food and containers around human habitation, where containers are used as mosquito breeding grounds. Control and elimination of *Aedes aegypti* mosquitoes are challenging because of high adaptation to the environment or the ability to return to its original condition after disturbing natural phenomena (e.g., drought). *Aedes aegypti* continuously responds and adapts to environmental changes (11). Maya index (MI) is an indicator used to identify an area at risk of mosquito breeding site. Cleanliness status of the Hygiene risk indicator (HRI) environment and the availability of places that might potentially serve as breeding risks for mosquitoes Breeding Risk Indicators (BRI) in an area (12).

In the period 2011-2016, the incidence of dengue fever in Surabaya's city always fluctuated (13). The incidence of dengue cases in four years (2015-

2018) tends to fluctuate, so early vigilance is needed in a significant handling effort to prevent transmission of dengue disease in the community (2). One way to help tackle dengue cases is to analyze high-risk breeding places through the Maya Index analysis. In Indonesia, various efforts have been made to prevent DHF, such as eradication progam, health education, and the use of fogging and abrasive insecticides. However, there are still many mosquito breeding places in the environment that are not monitored, such as used cans, used tires, new drums, tree holes, and others, which result in suboptimal control results indicated by the discovery of dengue cases from year to year (2).

Maya Index (MI) is used to identify whether an area is at high risk as a breeding site for *Aedes sp.* based on the environmental cleanliness status of the HRI and the availability of places that may have potential as breeding sites for the BRI mosquitoes (14), knowing the Maya Index of an area is expected to provide precise and accurate information in the prevention of dengue cases in Indonesia, especially in the working area of Primary Health Care of Putat Jaya Surabaya, so that the community can do preventive behavior.

METHODS

This study was an observational study with a cross-sectional design and conducted in dengue-endemic areas in Primary Health Care of Putat Jaya, Sawahan District, Surabaya City. The study population was all houses in the highest endemic neighborhood at 15 hamlet, Putat Jaya Sub-District, Surabaya. Samples were taken randomly as many as 100 houses, which all population members have the same opportunity to be sampled. Sampling was done by drawing the member of population (lottery technique). Criteria for research subjects were housewives or someone responsible for cleanliness of the house.

The data collected included preventive behavior (Knowledge, Attitudes, and Actions), the types and number of containers inside and outside the home. Maya Index is done by categorizing the observed containers into Controllable Sites and Disposable Sites. From these two container categories, the BRI and the HRI can be calculated for each house examined, categorized into three categories. The categories were; high, medium, low, which was then formed a 3x3 table. The categorization of the two indicators in the detailed table, Maya Index, was also categorized into three, namely low, medium, and high. The technique of collecting data was interviews and field observations and did not rule out secondary data in registers of dengue cases in the 2015-2018 period and January - February 2019. Data processing

used a descriptive analysis to provide an overview (description) of Mosquito Nests Eradication behavior in the study area. This research has been approved by the Health Research Ethics Commission of the Faculty of Dentistry, Airlangga University, through a certificate of ethical eligibility No. 508 / HRECC.FODM / VII / 2019.

RESULTS

Primary Health Care of Putat Jaya Surabaya located in Kupang Gunung Timur, Putat Jaya, Sawahan District, Surabaya City, East Java. The working area of Primary Health Care of Putat Jaya was 439,640 km^2 and served one sub-district, consisting of 13,329 households. Putat Jaya sub-district had the highest number of dengue cases for two years in 2015 and 2017. The number of dengue cases in 2015 were 7 cases; in 2017, there were 7 cases.

Table 1. Recapitulation of DHF Case Data of Primary Health Care of Putat Jaya in the 2015-2018

Location (Hamlet)	Number of DHF Cases (n)			
	Year 2015	Year 2016	Year 2017	Year 2018
1	2	0	0	0
2	7	2	7	1
3	4	5	1	9
4	7	2	0	3
5	3	1	0	2
6	3	2	2	2
7	2	3	4	1
8	3	4	3	7
9	1	5	3	2
10	6	1	0	1
11	1	2	0	0
12	1	1	0	1
13	1	3	4	0
14	0	6	3	3
15	1	2	1	1
Total	**42**	**40**	**28**	**33**

Some innovations from the Primary Health Care of Putat Jaya related to dengue prevention were: 1.) The Great "Jumantik" Competition began in 2017 until now; 2.) Mosquito Nest Eradication parade (Kirab) was held in the form of a parade to eradicate mosquito nests while distributing leaflets and abate; 3.) Gangserkus (Simultaneous Mosquito Nest Eradication Movement Focus Neighborhood - Hamlet), started in February 2019; 4.) Refiners (mobile counseling on the eradication of mosquito nests) was carried out once a week, in the form of mobile counseling activities about eradicating mosquito nests complied into one with Gangserkus activities. In the intervening of providing counseling

while distributing leaflets, posters, abate and posting of posters and banners.

Based on the results of interviews with sanitation officers at the Primary Health Care of Putat Jaya. Some of the obstacles to health centers in preventing DHF included: 1.) the lack of public mindset in participating in health activities; 2.) the lack of influence of "jumantik" in socializing to the community regarding the importance of larva surveys; 3.) the lack of community participation in the implementation of health programs. Not every neighborhood had "jumantik" cadre.

Maya Index Status in the Primary Health Care of Putat Jaya

The results of observations on the types of water reservoirs in the Controllable Sites and Disposables Sites categories in the field were obtained as follows:

Table 2. Distribution of Positive Larvae Containers Based on Categories in Putat Jaya Sub-District

Container Type	Amount (n)	Percentage (%)
Controllable Sites		
Bucket	97	26.50
Gallon	74	20.22
Bathtub	101	27.60
Glass	15	4.10
Bar / drum	58	15.85
Bottle	5	1.37
Bird drinking place	1	0.27
Water filter	1	0.27
Tandon	7	1.91
Thermos	4	1.09
Basin	3	0.82
Dispossable Sites		
Used Buckets	87	27.80
Used Pot	44	14.06
Used bottles	100	31.95
Used glass	27	8.63
Used tires	1	0.32
Used drum	38	12.14
Used pot	2	0.64
Used gallons	2	0.64
Used cans	7	2.24
Toddler bike basket	1	0.32
Used baby bath	1	0.32
Used scoop	1	0.32
Used aquarium	2	0.64
Un Controllable Sites		
Aquarium	4	100

Table 2. showed that 600 water reservoirs or containers examined in Putat Jaya sub-district, 100 of the containers were positive for larvae. The proportion of Controllable Sites were 366 containers with 57 positive containers. The type of Controllable Sites with the highest number and the most positive larvae was a bathtub with 101 and positive 25. The lowest number for

Controllable Sites was bird drinking places and water filters. The proportion of Disposable Sites was lower than Controllable Sites, 313 containers with 18 containers positive for larvae. The type of Disposable Sites with the highest number of used bottles and the highest number of positives was in used buckets. The lowest number of Disposable Sites was used tires, used baby baths, toddler bicycle baskets and used scoops.

Maya Index Analysis at Primary Health Care of Putat Jaya Surabaya

Table 3. was an assessment of Maya Index status based on the results of observations in the Putat Jaya sub-district.

Table 3. Calculation of Breeding Risk Index (BRI), Hygiene Risk Index (HRI), and Maya Index in Putat Jaya Sub-District

Category	Low BRI	Medium BRI	BRI High
Low HRI	Low	Low	Low
Medium HRI	Low	Medium (26)	High (47)
High HRI	Moderate	High (10)	High (17)

Table 3. showed 100 houses were examined; 26 houses with medium BRI category HRI medium, 10 houses with high BRI category HRI high, 47 houses with high BRI category HRI medium, 17 houses with high BRI category HRI high. Preventive behavior (knowledge, attitudes, and actions) of the community towards eradicating mosquito nests. The research used a questionnaire. 44% of respondents had sufficient knowledge, and based on the chi-square test results, there was a significant relationship (p-value 0.00) between the respondent's knowledge and Maya Index.

Table 4. Chi Square Test Results

Category	Knowledge		Attitude		Action	
	n	%	n	%	n	%
Well	13	13	8	8	1	1
Enough	44	44	63	63	25	25
Less	43	43	29	29	74	74
p-value (<0.05)	0.00		0.02		0.03	

Respondents' attitude towards eradicating mosquito nests, respondents in the moderate category, amounted to 63%. Moreover, Chi-square test results showed a significant relationship (p-value 0.02) between attitudes and Maya Index. The Mosquito Nests Eradication action shows that 71% of respondents have never done Mosquito Nests Eradication activities, and the chi-square test results showed a significant relationship between the respondent's actions and Maya Index with a p-value (0.03) <0.05.

DISCUSSION

Maya Index

In 100 houses, there were 74 houses with a high Maya Index and 26 houses with a moderate Maya Index. Most of the Maya Index status in the Putat Jaya sub-district was mostly in the high-risk category of being a place for the *Aedes aegypti* mosquito to develop. The research study results were in line with the research in South Denpasar, which found the high category. High Maya Index increases the incidence of dengue infection transmission in an area (15). Maya Index in Putat Jaya was obtained by calculating two indicators, the Breeding Risk Index (BRI) and the Hygiene Risk Index (HRI) indicators, which was categorized into high, medium and low levels of risk. The two indicators were combined to find out the Maya Index value.

The Breeding Risk Index indicator can be seen from the use of container types in daily life. The use of containers is 683 variations, of which 366 containers are Controllable Sites. From 366 containers, 57 containers were found positive for larvae. The results of the Breeding Risk Index were included in the high category. Putat Jaya had a high risk of larval breeding. The type of most positive container for *Aedes aegypti* larvae was the bathtub.

This result was different from research in South Tangerang City, where the dominant positive for Aedes aegypti larvae was bucket (16). People in Putat Jaya still used many bathtubs for bathing and collecting water. However, the community had lack to control over the condition of the containers in their homes, so that during the survey, there were still many tubs with positive *Aedes aegypti* larvae. Research conducted in Aceh stated that the risk of dengue fever in respondents whose home environment had a Breeding Place was 3.8 times greater than that of respondents whose household had no Breeding Place (17)

The Hygiene Risk Index indicator can be seen from the Disposable Sites, which indicated the cleanliness of the environment around the house. Most of the disposable sites at Putat Jaya used bottles. The most container positive for larvae was the used bucket. Research in a village in South Minahasa found the used buckets was a potential place for mosquito breeding (18). This study's results related to the habits of the community in their environment so that if left unchecked, it will cause rainwater to be caught in it and become a breeding ground for mosquitoes. The container is a potential breeding ground for *Aedes aegypti*. It was supported by data in the field, which showed that *Aedes aegypti*

larvae mostly found the container. The Disposable Sites category container is an indicator of the HRI and mostly in the medium category.

Some of the results of previous research, conducted in the work area of Primary Health Care of Ngawi, Ngawi Regency, found that there was a relationship between potential breeding places in the house, the existence of resting places in the house, the practice of draining water reservoirs, the practice of closing landfills, and recycling used goods. Moreover, the practice of avoiding contact with *Aedes* with dengue incidence (19). Then, research on the relationship between water reservoirs' characteristics to the incidence of dengue fever in the working area of Primary Health Care of Gianyar I, Gianyar Regency. The study results said that there was a relationship between the frequency of draining the landfill and the incidence of dengue. This study also found a relationship between the number of water reservoirs and the volume of water reservoirs with the incidence of dengue (20).

Similar research conducted in South Tangerang City, Banten, showed that HRI was mostly in the medium category with used buckets Disposable Sitess (17). This result was consistent with the conditions in Banjar City in 2012, where most *Aedes aegypti* was found in the controlled container (Controllable Container), equal to 94.29% (21). The dominant controllable containers found in South Tangerang City were buckets and bathtubs (22). While in Denpasar and Banjar City, the dominant ones were water tanks and dispensers (23).

From the results, the higher the HRI value, the dirtier the house or settlement. This means that the community of Hamlet 2, Putat Jaya Village needs to pay attention to and understand environmental cleanliness related to waste management and minimize the presence of used goods that have the potential to become a nest for *Aedes aegypti* mosquitoes.

Respondent Behavior
Knowledge

Knowledge is related to the motivation and outlook on the life of each individual in responding to information. If the individual does not see the benefit of information, the information will be forgotten (11). The knowledge of respondents assessed was about dengue fever and the eradication of mosquito nests with seven questions. Knowledge is categorized into good, adequate, and insufficient categories. Based on the results of the research on the knowledge level of 100 respondents about DHF and Mosquito Nests Eradication, it was known

that the knowledge level was in a sufficient category. As many as 69% of respondents could not answer correctly about preventing transmission of dengue disease. The low knowledge level can be affected by economy and education factors.

According to research conducted in South Kalimantan, stated that good knowledge cannot guarantee someone to be free from dengue because people with good knowledge will take actions that are contrary to the knowledge they have (15). Good knowledge should be based on a high sense of awareness to act according to the knowledge they have. Human behavior is formed from predisposing factors , enabling factors, and reinforcing factors. Someone will act to do something caused by thoughts and feelings in the form of knowledge, perceptions, attitudes, beliefs, and judgments about an object. Knowledge is one of the predisposing factors (predisposing factors), so it will shape a person's behavior. This behavior will encourage someone to take action (24).

Early vigilance is needed by someone so that DHF cases do not spread widely. Special attention from the government is also very necessary to tackle dengue fever cases, which are always endemic every year in various regions, to prevent transmission to other areas so that the incidence of dengue can be minimized as early as possible.

Attitude

The attitude assessment results stated that the respondents with insufficient attitude level category were insufficient category were 67%. Respondents stated that draining the water reservoir could prevent dengue transmission. Draining of water reservoirs needs to be done regularly, at least once a week, so that mosquitoes cannot breed in and grow into adult mosquitoes. The draining implementation is still not good, such as only disposing of dirty water and then immediately replacing it without brushing the water reservoir, causing *Aedes aegypti* mosquito eggs stick to the container walls and develop into *Aedes aegypti* larvae. These results by research in Makassar found a relationship between draining the place and the presence of *Aedes aegypti* larvae; draining the water reservoir at least once a week can reduce the breeding ground for *Aedes aegypti* larvae (25).

Action

Based on the research results, most of the community Mosquito Nests Eradication actions were not good enough. A person will take action in advance to communicate the stimulus he received with his inner state and feelings. The inner state in question are knowledge, beliefs, and attitudes. This communication is a mental process that will encourage someone to take specific actions (26). Adoption of acceptance of new actions based on positive knowledge and awareness will be long-lasting to encourage people to take action according to their knowledge (27).

The level of action carried out on 100 respondents showed that 76% of the respondents' actions have never used recycled goods. Many respondents collected used goods and then sell them to scavengers. Most of the larvae in the Controllable Sites category were found in the bathtub, while the Disposable Sites category was mostly found in used buckets. This finding was in line with research in Palu City that bathtubs were the most common container for larvae (28). It was due to the people's habit of Putat Jaya Surabaya, which prefer to take a bath using a dipper instead of using the shower. Also, the bath was used as water storage for daily needs. Putat Jaya district is an area with a busy population, and the need for clean water is relatively high, causing residents to rarely clean bathtubs, worried about their water supply will decrease.

Knowledge is the most potential factor in influencing the Maya Index. Knowledge becomes the basis for behavior change where a person performs a behavior based on the knowledge that will be more sustainable than without based on knowledge (29). Knowledge is an important aspect in the formation of behavior so that if knowledge increases, participation will increase in controlling mosquito nests (30). Good knowledge of mosquito nests eradication is 2.8 times higher for a person to have good behavior in eradicating mosquito nests (31). Knowledge is indeed a very important thing for behavior change (13). Research conducted in the Andalas Village in 2018 stated that every respondent who did not carry out the mosquito nests eradication behavior properly was at risk of developing Dengue Hemoraghic Fever 5.842 times than the respondent who did the mosquito nests eradication behavior as well. The three levels of behavior (knowledge, attitude, action) related to eradicating mosquito nests, knowledge has a very strong relationship with the Maya Index (32).

CONCLUSION

The research found significant relationship between the behavior (knowledge, attitudes, actions) and the Maya Index. Most of the respondents' actions and attitudes related to insufficient categories of mosquito nests eradication. Knowledge influences two other aspects, especially respondent's actions related to mosquito nests eradication actions such as; Never

use recycle goods, never monitor larvae in their home and surroundings once a week, and do not cover water reservoirs.

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