The density of Aedes spp. in Public Areas: Analysis of Factors of Janitors Practices and Characteristics of Containers

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Abstract. Dengue Hemorrhagic Fever (DHF) is an endemic disease in Semarang city that reported cases of DBD every year in Mijen District. This study aims to analyze the relationship of container characteristics and behavior of eradicating mosquito nests janitors to the density of larvae of Aedes spp In Public Places In Mijen District, Semarang City. This research used an analytical observational method with a cross-sectional design. Survey of larvae using the single method. The samples used were 100 public places and 100 janitors at public places. Data were processed using chi-square test with a 95% confidence level. The results of the study obtained that each variable has a different p-value that is, container type (p value=0.043), container location (p value=0.030), container cap condition (p value=0.000), container color (p value=0.309), container base material (p value=0.254), knowledge (p value=0.001), attitude (p value=0.006), and practice (p value=0.035). House Index (HI), Container Index (CI), and Bretau Index (BI) results in public places in Mijen District were 54%, 26.47%, and 63% in high-density categories, respectively. The Larva-free index is 46%, still very far from the national target of ≥95%. This study concludes that there is a relationship between the type, location, condition of container cap, knowledge, attitude, and practice of janitors related to eradicating mosquito nests, and there is no relationship between the color and basic material of containers with the density of larvae of Aedes spp in public places in Mijen District.

Keywords: Density, Aedes sp, Public Area.

1 Introduction

Dengue Hemorrhagic Fever (DHF) is a disease transmitted to humans through the bite of Aedes aegypti and Aedes albopictus vectors that carry the Dengue virus.[1] DHF is still one of the global public health problems and can potentially cause death, especially in tropical and sub-tropical countries. In urban areas or rural areas, dengue

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cases have spread widely, causing high cases in the last decade, requiring hospitalization, and causing deaths in children. [2]

DHF cases in Indonesia in 2019 were recorded as 138,127 cases. This number has increased compared to 2018 of 65,602 cases. Deaths due to dengue in 2019 also increased compared to 2018, from 467 to 919 deaths. [3] Semarang City is one of the dengue-endemic areas in Central Java Province. The number of DHF sufferers in 2017-2019 fluctuated, IR 17.01 100,000 population in 2017 and decreased by 5.43 per 100,000 population in 2018 then increased by 24.3 per 100,000 population in 2019. [4] Mijen District is one of the districts in Semarang, which is one of the dengue endemic areas in Central Java where there are always reported cases and experiencing fluctuations in cases every year.

The behavior of the dengue vector that bites repeatedly results in the disease being contagious and spreading rapidly, causing an outbreak. The density of dengue vectors has a role in the occurrence of dengue disease outbreaks. The higher the vector density figure will increase the risk of dengue transmission. Public places are one of the potential places for dengue transmission, where people from various regions gather. Examples of public places include schools, hospitals, markets, places of worship, tourist attractions, and others. [5]

Aryanta (2018) shows a significant relationship between the existence of places of worship and the presence of DHF vectors. People who ignore existing containers in places of worship cause these containers to become potential places to develop dengue vectors. [6] The relatively large water reservoir size is quite challenging to clean, especially in public areas that do not pay attention to cleanliness; this can cause mosquitoes to breed rapidly.

2 Method

Data collection was carried out in March 2021 in public places in Mijen District. This research used an observational analytic research design with quantitative methods. The study design used in this study was cross-sectional. The sample of this research was taken by sampling technique using nonprobability sampling technique with purposive sampling approach for 100 public places. At the same time, the sample of cleaning workers was 100 with an accidental sampling approach.

The larvae survey was conducted using the single larva method, where each container found by larvae only needs to take one. Data collection was carried out by interview and observation. The independent variables in this study were the type, location, color, basic materials and conditions of the container cover, and the knowledge, attitudes, and practices of cleaning staff related to eradicating mosquito nets. The dependent variable in this study was the density of Aedes spp larvae. in public places. Statistical analysis was performed using the Chi-Square correlation test with a confidence level of 95% and an error tolerance of 5%.

3 Result and Discussion

Table 1. Distribution of Types of Public Places Survey Sites Larvae Aedes spp. in Mijen District, Semarang City, 2020

Types of Public Places	Larvae Status				Total	%
	Positive	%	Negative	%		
School	15	71.4	6	28.6	21	100
Gas Station	0	0	2	100	2	100
Worship place	14	60.9	9	39.1	23	100
Government agencies	12	66.7	6	33.3	18	100
Terminal	1	100	0	0	1	100
Tourist attraction	3	75	1	25	4	100
Public health center	0	0	3	100	3	100
Restaurant	2	100	0	0	2	100
Market	2	22.2	7	77.8	9	100
Garden	1	33.3	2	66.7	3	100
Bank	0	0	3	100	3	100
Islamic boarding school	4	44.4	5	55.6	9	100
Clinic	0	0	2	100	2	100

From Table 1, it is known that the most common public places found in Mijen District are 15 schools (71.4%), 14 places of worship (60.9%), and 12 government agencies (66.7%). The three public places with the highest percentage found Aedes spp larvae, namely schools and places of worship. The school's finding many larvae is due to the lack of supervision and periodic larva checks by the school's building manager or cleaning staff. This is in line with the results of research, which states that in offices (36.36%) and schools (30%), larvae are found because the leadership of the institution or school is less concerned with monitoring environmental hygiene. [7]

Apart from schools, there are also many places of worship in Mijen District where DHF vector larvae are found, especially in places of ablution where there are ponds or puddles because of the cleaners' lack of knowledge about the pool or puddle can be a potential place for dengue vector to reproduce. Aryana's research shows that places of worship are related to dengue fever vectors' presence. People who ignore existing containers in places of worship and final shelters make these places a potential location for the development of dengue vectors. [8]

The research results conducted by Malonda (2015) show that public places such as schools, places of worship, government agencies show a density figure of 5-6. [7] Seeing the situation at the time of carrying out the research, Mijen District was still in a pandemic state of Covid-19, so that the community rarely visited public places, and their cleanliness was neglected. There are many containers such as drums or buckets filled with water for washing hands that are not maintained and become breeding places for mosquitoes.

Table 2. Relationship between Container Type and Density of Aedes Sp. Larvae In public places in Mijen District, Semarang City, 2020

Variable	Larvae Existence				Total	%	p-value
	Positive	%	Negative	%			
Bathtub	9	19,6	37	80,4	46	100	
Bucket	37	33,3	74	66,7	111	100	
Drum	2	9,5	19	90,5	21	100	
Vase	3	30	7	70	10	100	
Used tires	0	0	7	100	7	100	0,043
Dispenser	2	11,1	16	88,9	18	100	
Watet tower	2	66,7	1	33,3	3	100	
Indentation of trees	0	0	1	100	1	100	
Ablution place	8	38,1	13	61,9	21	100	

From Table 2, it can be seen that the type of container most larvae found was buckets (33.3%) with p-value = 0.043. This result shows a relationship between the type of container and the presence of larvae. Buckets are the most widely used containers because they are easy to clean and they save space. This research is in line with research conducted in Central Sulawesi Province and Pesisir Selatan Regency that the most common type of container is found as a breeding ground for *Ae. aegypti* mosquito larvae is a bucket. [9] Buckets are widely used to hold water temporarily and often leave little water that has the potential for mosquitoes to lay their eggs in the bucket. The surface of the container, either slippery like a bucket or rough, does not affect Aedes mosquitoes to lay eggs. Cleaners rarely clean these bucket-type containers. In addition, other factors cause larvae to be found in buckets, including the location of the container, the closed condition, and the draining habit. Cleaners have a habit of just spilling water in the bucket without brushing it, so the mosquito eggs may still stick to the bucket walls.

Table 3. Cross Tabulation Relationship between container location and larval density of Aedes sp. in public places in Mijen District, Semarang City, 2020

Container Location	Larval Density				Total	%	p-value
	Positive	%	Negative	%			
Inside	39	22,4	135	77,6	174	100	0,030
Outside	24	37,5	40	62,5	64	100	

Table 3 shows that the container's location with the most larvae found was 39 (22.4%) with a p-value = 0.030, which means that there is a relationship between the location of the container and the density of Aedes spp larvae in a public place. The condition of containers in low light buildings can support Aedes mosquitoes to lay eggs. The study results in South Sumatra Province found a significant relationship between the location, material, color, and volume of containers with the density of

pre-adult mosquitoes. [10] Similar research by Nidar (2016) shows 76 (90.5%) containers in public places with *Ae. aegypti* 62 larvae and Ae. albopictus 14 larvae. [6] There are containers in public places, but no larvae are found because the containers were clean and bright at the time of observation.

Table 4. Relationship between Container Color and Density of Larvae Aedes spp. in Public Places in Mijen District, Semarang City in 2020

Container Color	Density of Larvae				Total	%	p-value
	Positive	%	Negative	%			
Black	5	21,7	18	78,3	23	100	
Blue	24	29,6	57	70,4	81	100	
Red	8	18,6	35	81,4	43	100	
Yellow	1	9,1	10	90,9	11	100	
Green	6	31,6	13	68,4	19	100	0,309
White	7	38,9	11	61,1	18	100	
Grey	8	22,9	27	71,1	35	100	
Orange	4	57,1	3	42,9	7	100	
Brown	0	0	1	100	1	100	

Based on table 4, it is known that the container color found by the most larvae in blue containers is 24 (29.6%) with a p-value = 0.309, which means there is no relationship between container color and the density of *Aedes spp.* in a public place. The results of this study are in line with Suryaningtyas 2017, which shows that there is no significant relationship between container color and the presence of larvae. Other studies have shown results in dark and light landfill colors where Aedes mosquito larvae were found. [10] The color of the landfills has no relationship with the presence of *Aedes spp* larvae. This is because other factors influence such as lighting, draining habits, tightly closed containers, and the schedule of cleaning the mosquito nests by cleaners.

Table 5. Relationship of Container Base Material With Larvae Density of Aedes spp. in a Public Place In Mijen District, Semarang City

Container Color	Density of Larvae				Total	%	p-value
	Positive	%	Negative	%			
Cement	4	40	6	50	10	100	
Plastic	44	26,2	124	51.4	168	100	
Ceramic	15	30,6	34	21.1	49	100	
Soil	0	0	0	0	0	0	0,309
Metal/Iron	0	0	0	0	0	0	
Rubber	0	0	10	100	10	100	
Alumunm	0	0	0	0	0	0	

Wood	0	0	1	100	1	100

Based on table 5, the basic material for containers most commonly found in larvae is 44 (26.2%) plastic-based containers with a p-value = 0.254, which means that there is no relationship between the container base material and the density of *Aedes spp* larvae in a public place. This result is related to the type of container that is often found in plastic buckets because it is a common and practical type of container used by people in Mijen District. This research is supported by Tusy (2020), who obtained the p-value for container material of 0.639, which means that there is no significant relationship between the container material and the presence of *Ae. Aegypti* larvae. [11]

In contrast to Nidar's (2016) study, it was found that the basic material for containers with the most positive larvae was ceramic as much as 37 (34.9%). [6] Container size, length of use, and infrequent draining habits can create mildew and scale on the walls of the container. This condition makes it easier for mosquitoes to attach eggs and get food from the walls of the container.

Table 6. Cross Tabulation Relationship between Container Cover Conditions and Density of Aedes spp. Larvae in public places in Mijen District, Semarang City in 2020

Container Cover Conditions	Larvae Density				Total	%	p-value
	Positive	%	Negative	%			
Closed	9	11,4	70	88,6	79	100	0,000
Open	54	34	105	66	159	100	

Based on the results of the study, it is known that the containers found by larvae in closed conditions were 9 containers (11.4%) and open containers were 54 containers (34%) with a p-value = 0.000, which means that there is a significant relationship between the closed condition density of *Aedes spp.* larvae in a public place. Closed containers will make it difficult for mosquitoes to find breeding places. In line with the research by Santoso et al. (2018), 126 (18.3%) and 18 (6.9%). [12] Similar research by Junus Widjaja (2012) shows that there is a relationship between the container cover and the presence of *Aedes spp.* Larvae. [13] Open containers are the most common places for larvae to find because mosquitoes can easily find a water source that will serve as a place to lay their eggs. Types of water reservoirs are such as bathtubs, toilets, and buckets which rarely have a cover. The reason is that the size of the tub is too large or the bucket is too small. In addition, many containers were not closed because it was considered difficult to collect water.

Table 7. The relationship between the Cleaners' Knowledge Regarding the Eradication of Mosquito Nests and the Presence of Larvae Aedes spp in Public Temps in Mijen District

Knowledge	Presence of Larvae				Total	%	p-value
	Positive	%	Negative	%			
Good	18	37.5	30	62.5	48	100	0,001
Poor	36	69.2	16	30.8	52	100	

The table above shows that the proportion of both respondents' knowledge and positive larvae 18 (37.5%) and low and positive knowledge larvae 36 (69.2%). After testing the hypothesis using the chi-square test, it was found that the p-value was 0.001, indicating that there was a relationship between the cleaning staff's knowledge regarding the eradication of mosquito nests and the density of larvae *Aedes spp.* in public places. These results are in line with Nur Aisah (2013) research, which shows that there is a significant relationship between knowledge about the eradication of Aedes aegypti mosquito nests and the presence of larvae. [14] Research conducted by Nani (2017) shows a relationship between knowledge of mosquito nest eradication and Aedes aegypti larvae in the port. [15] According to Riyadi, knowledge is influenced by two factors, namely internal factors, including education, occupation, and age, while environment and socio-culture are external factors. A good practice is the result of good knowledge. [16] This result is in line with Waris L's (2013) research that the principal capital is good knowledge. [17] The results of this study indicate that the knowledge of cleaners regarding the eradication of mosquito nests in public places is not good; this is due to the lack of activity of cleaning officers in seeking information related to eradicating mosquito nests in public places. In addition, there is a lack of information regarding the eradication of mosquito nests, both from building managers, authorities, the mass media, and health workers.

Table 8. Cross-tabulation of the Relationship between the Attitudes of Cleaning Officers Regarding the Eradication of Mosquito Nests and the Existence of Larvae Aedes spp. in a public place

Attitudes	Existence of Larvae				Total	%	p-value
	Positive	%	Negative	%			
Good	17	38.6	27	61.4	44	100	0,006
Poor	37	66.1	19	33.9	56	100	

From table 8 it can be seen that the proportion of good and positive attitude of respondents to larvae is 17 (38.6.5%) and low and positive attitude of larvae is 37 (66.1%). After testing the hypothesis using the chi-square test, the value of p = 0.006 shows a relationship between the attitude of the cleaners regarding PSN and the density of *Aedes spp* larvae in public places. This research is also supported by research by Puguh (2016), which shows significant results with a value of p = 0.0001 (p <0.05) (95% CI 0.385-0.521). This means that respondents who have an unsupportive attitude are likely to behave less well in eradicating mosquito nests. [16] Thus the atti-

tude significantly affects the behavior of the eradication of mosquito nets. According to Nugrahaningsih's (2010) research, the same results show a relationship between attitudes and the presence of *Aedes aegypti* larvae in the respondent's house in the work area of Puskesmas Kuta Utara in 2010 with a p-value of 0.001. [18] In this study, there was a lack of good attitude among cleaning staff towards eradicating mosquito nests in public places, lack of knowledge regarding the risk of dengue transmission in public places, and lack of knowledge regarding proper and correct eradication of mosquito nets. There is a need for the participation of the government, managers of public places, and health workers to increase the knowledge of cleaners so that cleaners believe so that they tend to increase the behavior of eradicating mosquito nests in public places in Mijen District.

Table 9. Cross Tabulation of The Relationship Between Cleaning Staff Practices Related to the Eradication of Mosquito Nests and The Presence of Aedes Spp. Larvae. In Public Place

Practice	Existence of Larvae				Total	%	p-value
	Positive	%	Negative	%			
Good	17	40.5	25	59.5	42	100	0,035
Poor	37	63.8	21	36.2	58	100	

From Table 9 it can be seen that the proportion of respondents' good practices and positive larvae is 17 (40.5%), and more minor and positive practices are 37 larvae (63.8%). After testing the hypothesis using the chi-square test, the p-value is 0.035, indicating that there is a relationship between the cleaning service practices related to PSN and the density of Aedes spp. Larvae. in public places. This research is also supported by Imawati, which shows that there is a significant relationship between the implementation of eradication of mosquito nets. The presence of larvae, with a PR value = 1.97 CI 1.53 - 2.55, means that respondents who do not have the habit of eradicating mosquito nests will have a 1.97 times greater risk than respondents who have the habit of eradicating mosquito nests. [16] Ayu Azlina's research (2016) shows that there is a significant relationship between the act of eradicating mosquito nests and the presence of dengue vector larvae in Lubuk Buaya village (p = 0.001). [17] Booroto's shows a relationship between eradicating mosquito nests and the presence of Aedes sp mosquito larvae in the first environment of Teling Atas Village, Wanea District, Manado City. Respondents with inadequate mosquito nest eradication measures had a 2.37 times greater chance of having Aedes sp mosquito larvae in their homes than respondents with suitable mosquito nest eradication measures who had an OR value of 2.37. [19] The practice of eradicating mosquito nests by cleaning workers shows the lack of awareness of cleaners in maintaining the cleanliness of public places and the environment around public places to prevent dengue disease. This is due to the lack of knowledge of the cleaning staff regarding eradicating mosquito nests, and the respondents only clean the water reservoirs that are accessible to other containers such as flower pots, dispensers, trash cans, used tires, and others. Considered not to be a nest for mosquitoes so that they are ignored and not subject to inspection.

Table 10. Density Level of Aedes Spp Larvae Based on HI, BI, CI and Larvae Free Index in Public Places in Mijen District

Σ Public Places	Σ Public Places (+) Larvae	Σ Public Places (-) Larvae	Σ Container	Σ Container (+) Larvae	Larva Density Level (%)			
					HI	CI	BI	Larvae Free Index
100	54	46	238	63	54	26,47	63	46

The observations show that public places in Mijen District have HI values of 54% with DF 7, CI 26.47% with DF 6, BI 63% with DF 6 all in the high-density category. HI figures illustrate the extent of the spread of mosquitoes in an area. The high number of HI, CI and BI in public places in Mijen District is due to the effective use of bucket-type containers containing water, but in small quantities, because they are rarely used or even unused, this has the potential for containers to become breeding grounds for Aedes spp. The large number of larvae found in plastic-based containers is due to the conditions around the container that support larval development. In the research of Suryadi et al., the factor that most influences the endemicity of DHF are the house index (HI). [20]

$$\textbf{Density Figure (DF)} = \frac{7+6+6}{3} = \textbf{6,3}$$

Based on the results of the calculation of DF, it can be seen that the value of DF in public places in Mijen District is included in areas with high vector-borne disease transmission, so it is necessary to control. The larvae-free index is 46%, still below the national standard, which is 95%, meaning that the density of mosquito larvae is still high, and there is a risk of rapid transmission in the area. One factor that causes larvae free index in public places in Mijen Subdistrict has not reached 95% because there is no routine larva inspection by cleaning officers in some public places. The density of mosquito larvae must be controlled by carrying out regular periodic larva checks by the sanitation officer in the public place.

4 Conclusion

There is a relationship between the type of container, the container's location, the condition of the container lid, the knowledge, attitudes, and practices of cleaners regarding eradicating mosquito nests in public places, and the density of Aedes spp. Larvae in public places in Mijen District with p-value < 0.05. There is no relationship between the color of the container and the base material of container with the density of Aedes spp. larvae in public places, Mijen District with p-value > 0.05. The number of HI = 54%, CI = 26.47%, and BI = 63% obtained a density figure of 6-9, which means that the density of larvae is high with a high risk of dengue infection caused by vectors. The Larvae Free Index of 46% shows that it is still far below the national

standard, namely Larvae Free Index of 95%. This study found factors in terms of container characteristics and behavior of mosquito nest eradication on the density of Aedes spp. larvae in public places. Further research can develop other factors such as environmental characteristics (temperature, humidity, light intensity, and others) and compare the density between endemic and non-endemic areas of DHF with mixed quantitative and qualitative methods to obtain complex and varied results.

5 Suggestion

For the local healt service it is necessary to evaluate and control the larvae of Aedes spp. with the formation of an agent that specializes in monitoring in public places and providing good and correct socialization related to the eradication of mosquito nests as well as knowledge of potential mosquito breeding places in public places in the form of posters, pamphlets, and others. Cleaners must be more responsive and care about the presence and cleanliness of containers around public places, whether they are used daily or not. Building managers need to have special regulations or a routine schedule to eradicate mosquito nests so that there are no more breeding places for mosquitoes so that the risk of transmission in public places is low.

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