The Existence of Mosquito Vectors in the Hospital Environment

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ABSTRACT

Background: Indonesia has a tropical climate favorable for insect populations. Vector-borne diseases pose a significant threat. Mosquitoes are a major vector in the transmission of dengue fever, malaria, and Zika through their bites. This study aims to determine the presence of mosquito larvae in the hospital environment, considering physical factors and breeding characteristics as a preventive measure against the spread of vector-borne diseases. **Methods**: A descriptive cross-sectional design was chosen for this study. A purposive sample was taken at a hospital in Klaten Regency, Central Java Province. The observations were conducted from July to August 2025. Data obtained through observation, interviews, and laboratory tests are used to identify mosquito larvae. **Results**: The existence of mosquito larvae in the hospital was 28.6% of the observation sites, with adult mosquitoes found at all observation points. Physical and chemical vector control measures were implemented at all sites, while biological control measures were only implemented at one observation site. **Conclusion**: The existence of mosquito larvae in hospitals is high, more frequently found in locations with substandard temperature and lighting conditions, in cement containers, made from cement, with dark gray interior walls, and in containers without lids.

Keywords: mosquito larvae, mosquitoes, hospital vectors, mosquito breeding sites

INTRODUCTION

Indonesia has a tropical climate, so it is home to many diverse animal species, some of which can transmit, move, or become sources of disease, known as vectors (1). Vectors are a group of insects that carry and transmit microorganisms that cause vector-borne diseases that have the potential to cause epidemics (2).

Mosquitoes are the primary vectors of diseases such as dengue fever, malaria, and Zika, spreading viruses and parasites through their bites (3,4). Aedes aegypti and Aedes albopictus mosquitoes are the primary causes of dengue fever (5). Environmental factors strongly influence dengue fever transmission. The more open water reservoirs, such as bathtubs, can increase the population of larvae that develop into mosquitoes, so the presence of water reservoirs in the home environment can affect larval density (6).

One of the factors that greatly influences the emergence of disease is the environment. As long as conditions are favorable, the cause and spread of disease will continue. Vector control methods must consider various factors, including physical, biological, and chemical environmental factors, as well as socio-cultural factors in the community. Physical environment factors include weather, temperature, humidity, altitude, sanitation, wind influences, and breeding habitats. Chemical factors include the use of mosquito repellent in the community. Biological factors include the use of animals that prey on mosquitoes and larvae. Socio-cultural factors include community knowledge, attitudes, behavior, and actions. Another aspect that cannot be ignored is the vector itself with all its characteristics (7).

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Vector control is a preventative measure to prevent the presence of disease vectors in the hospital environment (8). Vector control in hospitals involves chemical control, traps and baits, and maintaining regular sanitation of the hospital environment (9). Vector control in the hospital environment is very important because it can pose a risk to the health of patients, staff, and visitors. Transmitted infections, damage to medical equipment, and decreased comfort are some of the problems that can arise if vector control is not carried out effectively (10).

METHOD

This study employed a descriptive cross-sectional design. The sample was determined purposively at a hospital in Klaten Regency, Central Java Province. Observations were conducted between July and August 2025. Data were collected through observation, interviews, and laboratory tests to identify mosquito larvae. Fourteen observation points were located in hospital areas with water reservoirs or standing water, both indoors and outdoors. The instruments used were questionnaires and observation sheets. Univariate analysis was conducted to explore the characteristics of each observation variable, while bivariate analysis was conducted to examine the relationship between the study variables. Categorical variables were demonstrated using the chi-square test with a 5% error rate.

RESULTS

Adult mosquitoes were found at all observation sites, while larvae were found at 28.6% of sampling sites. The type of mosquito found in both the larval and adult stages is *Culex sp* (Figure 1). The number of larvae found ranged from 1 to 12 at each site (Table 1).

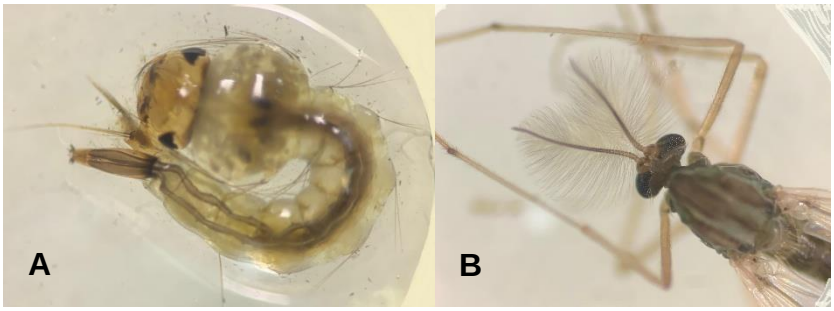

Figure 1. The finding of Culex sp larvae (A) and male adult (B)

Table 1. Breeding place characteristics in sampling sites

Variable		Frequency	Percentage (%)
Sampling site			
	Outdoor	5	35.7
	Indoor	9	64.3
Temperature (°C)			
	Not qualify	5	35.7
	Qualify	9	64.3
Air humidity			
	Not qualify	2	14.3
	Qualify	12	85.7

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Lighting			
	Not qualify	5	35.7
	Qualify	9	64.3
Adult mosquitoes existing			
	Yes	14	100
Container type			
	Cement tub	4	28.6
	Dispenser	6	42.9
	Plastic bucket	2	14.3
	Gutter	1	7.1
	Sink	1	7.1
Container material			
	Concrete	1	7.1
	Plastic	8	57.1
	Cement	4	28.6
	Stainless Steel	1	7.1
Interior wall color			
	Dark grey	5	35.7
	Light grey	1	7.1
	Bright blue	5	35.7
	Bright green	3	21.4
Container cover existence			
	No	6	42.9
	Yes	8	57.1
Breeding place existence			
	Yes	14	100
Physical control			
	Yes	14	100
Biology control			
	No	13	92.9

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	Yes	1	7.1
Chemical control			
	Yes	14	100
Mosquito-nest eradication			
	Yes	14	100
Abatization			
	No	14	100
Keeping predatory fish			
	No	14	100
Mosquito larvae presence			
	Yes	4	28.6
	No	10	71.4
Number of larvae			
	0	10	71.4
	1	1	7.1
	2	1	7.1
	6	1	7.1
	12	1	7.1
Vector control frequency			
	Monthly	5	35.7
	Weekly	8	57.1
	Daily	1	7.1

Environmental conditions that do not meet the requirements, whether in terms of temperature, humidity, or lighting, will be more favorable for the development of mosquito larvae (Table 2).

Table 2. Presence of mosquito larvae and characteristics of physical factors

Variable		Larvae existence	
		Yes	No
Temperature			
	Not qualify	4	1
	Qualify	0	9
Air humidity			

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	Not qualify	0	2
	Qualify	4	8
Lighting			
	Not qualify	1	7
	Qualify	3	3

Based on container type, larvae were most commonly found in cement tanks. Based on the container material, larvae were found in concrete and cement. In terms of interior wall color, larvae were more frequently found in dark gray containers and those without lids (Table 3).

Table 3. Presence of larvae and characteristics of broodstock

Variable		Larvae existence	
		Yes	No
Container type			
	Cement tub	3	1
	Dispenser	0	6
	Plastic bucket	0	2
	Gutter	1	0
	Sink	0	1
Container material			
	Concrete	1	0
	Plastic	0	8
	Cement	3	1
	Stainless Steel	0	1
Interior wall colour			
	Dark grey	4	1
	Light grey	0	1
	Bright blue	0	5
	Bright green	0	3
Container cover existence			
	No	3	3
	Yes	1	7

The only sampling location that used a biological vector control system found mosquito larvae (Figure 2).

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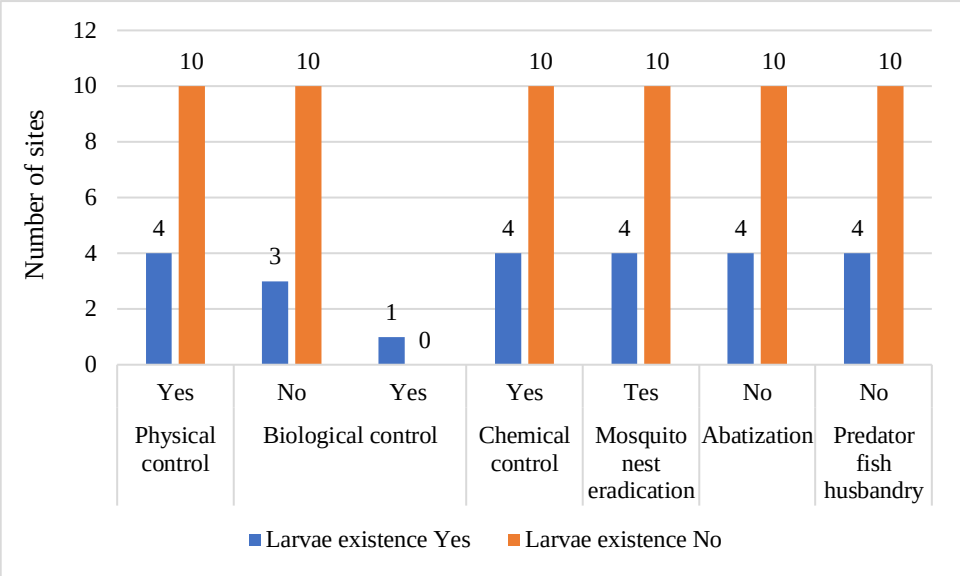

Figure 2. Existence of larvae based on vector control location

Breeding areas inspected more than once a week are at high risk of finding mosquito larvae. Findings indicate that monthly inspections of certain areas lead to the discovery of mosquito larvae (Figure 3).

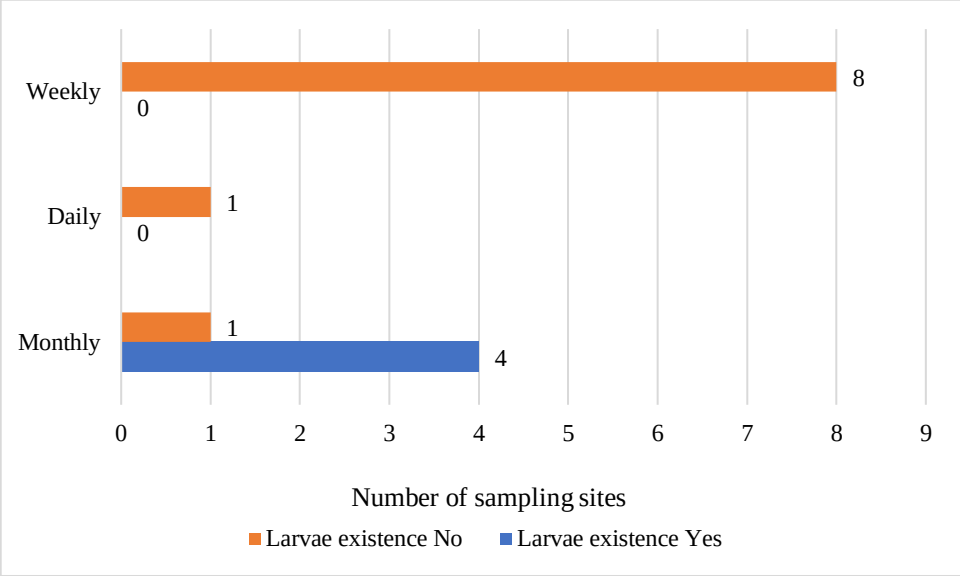

Figure 3. Existence of larvae based on vector control frequencies

The results showed that mosquito larvae were more prevalent in locations that did not implement biological control, did not use abatement, and did not raise predatory fish. In terms of control frequency, locations that implemented weekly controls proved most effective, as no larvae were found in all sites.

DISCUSSION

Presence of Mosquito Larvae in the Hospital

Of the 14 containers examined at various locations in the hospital, four tested positive for larvae and 10 tested negative. The larvae and adult mosquitoes found were Culex sp. Assuming the hospital complex is a residential community, with each sampling location representing each building, the Container Index value is 28.57%, far exceeding the WHO tolerance threshold of 5%. Therefore, these findings indicate the hospital is at high risk of becoming a vector-borne disease transmission medium. According to Indonesian national standards, the habitat index for Culex sp. larvae is less than 5, while the findings from the four sampling locations ranged from 1 to 12 larvae.

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Mosquitoes larvae existence and physical factors

Five locations, representing 35.7% of the sample sizes, experienced substandard room temperatures (Table 1). Mosquito larvae were found in four of the five sampling locations. These results align with previous research that found a significant relationship between room temperature and dengue fever cases triggered by the presence of mosquito vectors ($p = 0.0001$) (11). An interesting phenomenon was discovered, where no mosquito larvae were found in rooms with suboptimal humidity, while mosquito larvae were found in rooms with adequate humidity. This finding aligns with previous research, which found that locations with optimal humidity have the potential to harbor more mosquito larvae (74.2%), compared to houses with no humidity (66.7%) (12). Lighting at five sampling locations (5.7%) did not meet standards. Mosquito larvae were more prevalent in the lit area. While lighting levels are not directly related to the transmission of vector-borne diseases, they do provide a different environment for the vectors to live in. A research report also stated that there was no correlation between lighting and the incidence of dengue fever in Pontianak City ($p > 0.05$) (13).

The presence of mosquito larvae and characteristics of breeding sites

The larvae were found in cement tubs and gutters. Culex sp larvae prefer to live in stagnant water that is directly connected to the ground or in containers that have been neglected for a long time, resulting in the water being dirtier and mixed with soil particles. This condition can be found in several places with contaminated groundwater, such as gutters, clogged drains, septic tanks, shallow ponds, tree holes, and dirty water reservoirs (14). Mosquito larvae were found in concrete and cement containers, but not in plastic and stainless steel containers. While this is somewhat difficult to explain, similar findings have been reported (14). The most common container wall colors were dark gray and light blue. The dark gray interior walls were the color of containers where mosquito larvae were found. Generally, mosquitoes prefer dark colors as egg-laying sites over light colors. There was a significant correlation between container color and the presence of mosquito larvae in an area ($p= 0.047$) (14). Containers without lids will become breeding grounds for adult mosquitoes, increasing the chance of finding mosquito larvae. This aligns with the mosquito development cycle, which requires water for egg hatching and the larval and pupal stages. The role of the cover on this water reservoir is crucial, as it will impact its role as a breeding ground for mosquito larvae (14).

Mosquito larvae control efforts in hospitals

Mosquito larvae were more frequently found at sampling locations where biological control, abatement, and the use of predatory fish were not implemented. This was evident in all sampling locations where larvae were found, where none of these three methods were implemented. In terms of control frequency, locations that conducted weekly controls proved most effective, as no larvae were found in all of them. The gonotrophic cycle of Culex sp. is approximately 1-2 weeks (15), so checking containers once a week is the best option (16). This means that before the mosquito eggs hatch, the containers are cleaned again, preventing larvae from being found and interrupting the mosquito gonotrophic cycle (17).

CONCLUSION

Mosquito larvae in hospitals remain at a relatively high level, necessitating increased weekly monitoring efforts. Sampling locations with physical, biological, and chemical conditions conducive to mosquito vector breeding in hospital areas requires increased attention. Integrated vector control must be implemented as a comprehensive effort to minimize mosquito populations in hospital areas.

Conflict of Interests

The authors declare that they have no conflict of interest.

Ethics approval

Released by the Ethics Committee for Health Research of the Faculty of Public Health, Universitas Muhammadiyah Semarang, number 0089/KEPK-FKM/UNIMUS/2025.

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Author contributions

Varissa Salsabila designed the research concept, collected data, analyzed data, and wrote the draft report. Mifbakhuddin assisted with the concept design and report writing. Didik Sumanto designed the research concept, analyzed the data, and wrote the published article. Sayono reviewed the research concept and published article. All authors reviewed the manuscript and approved the final draft.

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