ORIGINAL ARTICLE

Factors Related To The Presence of *Aedes Aegypti* Larvae and their Density in Elementary School Environments

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Abstract

Background: Dengue fever in Indonesia is still high, and Bandung ranked the highest in the 33rd week of 2023. *Dengue* fever is a neglected tropical disease transmitted through the bite of *Aedes aegypti*. The school environment is at risk of DHF transmission because the biting time of *Aedes aegypti* coincides with student learning hours. The aim of this study was to determine the presence of *Aedes aegypti* larvae and their density in the elementary school environment.
Methods: This study is a quantitative study with a cross-sectional design. The population of this study was all elementary schools in Bandung City, with 59 samples based on Slovin. The sample was determination using random number generation.
Results: Environmental conditions of elementary schools are associated with the presence of larvae, with a P-value of 0.016. Observation results showed that 23 (39%) elementary schools found *Aedes aegypti* larvae. The House Index (HI) calculation was 39% and it was categorized at level 6 in the Fluke Index table. This indicates a high density of larvae. Breeding sites with larvae were in flower vases and water reservoirs in dispensers.
Conclusion: Overall, our research findings indicate that the environment is a factor related to the discovery of Aedes aegypti larvae in elementary schools. With a high density of mosquito larvae, the school environment has the potential to spread dengue fever quickly.

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Introduction

*D*engue, or dengue fever, is transmitted to humans through the bite of *Aedes aegypti* mosquitoes carrying the *dengue* virus. The incidence of Dengue Fever (DHF) in Indonesia remains high, with 143,266 reported cases in 2022. West Java recorded the highest number of cases at 36,594, followed by East Java and Central Java provinces. The total number of deaths amounted to 1237 cases, with 58% of dengue-related deaths concentrated in West Java, East Java, and Central Java, respectively.[1] In 2022, Bandung City ranked first with 5205 DHF cases, and by the 33rd week of 2023, it still held the highest position with 1281 DHF cases.[2]

As one of the Neglected Tropical Diseases (NTD), DHF requires continued attention, especially in preventive and promotive efforts. Community participation, which considers environmental conditions, must be prioritized, as both environment and behavior closely correlate with DHF incidence. The tropical climate and temperature in Indonesia provide ideal conditions for *Aedes aegypti* breeding. Density,

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food availability, temperature, and interactions among these variables significantly influence the larval stage development of *Aedes Aegypti*, from hatching to adulthood. Temperature without density or diet influenced larval mortality.[3] In sub-tropical climates, the presence of both *Aedes aegypti* and Aedes albopictus is also observed. Research conducted in Texas reveals variations in the distribution of Aedes aegypti and Aedes albopictus based on longitude in residential areas, where Aedes albopictus is more commonly found near the coast, and *Aedes aegypti* is more prevalent inland.[4]tire shops, and cemeteries

Aedes aegypti mosquitoes prefer clean water reservoirs that are not directly exposed to the ground for laying their eggs. Female Aedes aegypti mosquitoes prefer to bite humans rather than animals. Human blood serves for egg maturation. They may bite and suck blood multiple times, making this behavior highly effective in the virus transmission process. *Aedes aegypti* females typically bite during the morning and evening hours, specifically between 09:00 -10:00 a.m. and 16:00 -17:00 p.m. After biting, they seek rest in dark and humid places, both indoors and outdoors. *Aedes aegypti* lays its eggs on the surface of water, often adhering them to the sides of water reservoirs. These eggs can remain viable for 6 - 8 months in dry and cold environmental conditions. The school environment, like the residential environment, poses a potential risk factor for *Aedes aegypti* mosquito breeding sites. Schools represent important sources of arboviruses.[5]

Considering the school environment, there are similarities between the active hours of students and those of *Aedes aegypti*. The biting hours of *Aedes aegypti* coincide with the student's study activities in the schools, occurring a few hours after sunrise and before sunset. This condition puts elementary school students at risk of contracting DHF. Bandung City, being an endemic area, has the potential for dengue transmission, including within the school environment. Consequently, elementary school students are vulnerable to DHF. Based on the above conditions, researchers are interested in knowing the risk of *Aedes aegypti* transmission based on environmental variations, containers, and larval density in elementary schools in Bandung City.

Methods

Study Variables

The independent variables in this study were experience in DHF prevention, information exposure through socialization, school conditions, DHF information media, and the presence of Jumantik. The dependent variable in this study was the presence of *larvae*. Research variables, such as experience in dengue prevention, exposure to information through socialization, and presence of Jumantik, were measured through the a checklistthat was filled out by the School Health Officer. Meanwhile, data on school conditions, DHF information media, presence of larvae, and types of water storage containers that have the potential to become breeding grounds for *Aedes aegypti larvae* were collected through direct observation, which was then recorded on an observation sheet.

Study Design, Setting, and Sampling

This cross-sectional study was conducted in primary schools in Bandung City from August to September 2023. The population in this study was School Health Officers in elementary schools, both private elementary schools and state elementary schools, totaling 476 elementary schools. Slovin's formula was used to calculate the sample size with an error tolerance of 10% (0.1), resulting in a sample size of 58.91, which was rounded to 59. The sampling method was carried out using a simple random technique using a random number generator tool from 476 to get 59 Elementary School Health Officers as the research sample.

Participants

This descriptive quantitative study used school health officers from elementary schools in Bandung City as the research sample. This study received a good response from the Bandung City Education Office and Health Office. The population in this study consisted of 476 school health officers in Bandung City. The elementary schools in the research sample were willing to become respondents by providing access to researchers to easily collect primary data from the officers. A total of 59 school health officers who became respondents filled out a checklist sheet to collect the data related to DHF prevention experience in elementary schools, exposure to dengue information through socialization, and the presence of Jumantik. Meanwhile, for DHF information media, school conditions, types of water containers, and the presence of larvae were observed and recorded in the observation sheet.

Data Collection

This descriptive study aims to provide a comprehensive understanding, including health aspects, of a particular population. This study used an observational approach, focusing on observing the presence of *Aedes aegypti larvae* in the elementary school environment. All data collected were sourced from officers or teachers in charge of school health through filling out the checklist sheets. Data were collected in the form of prevention experience, exposure to information through socialization, and the presence of Jumantik from School Health Officers who represented the schools that were the sample of the study. School conditions, DHF information media, types of water containers, and the presence of larvae were obtained through direct observation. Data were obtained from filling out the checklist sheet by the School Health Officer, and observation data were recorded in the checklist sheet.

The identification step for *Aedes aegypti larvae* is to check water reservoirs. We took the larvae with a spoon and placed them in a separate clean and transparent container (can be a glass or a glass container). We observed the larvae with the help of a flashlight and a magnifying glass if needed. Aedes aegypti larvae are cylindrical and about 3-4 mm long when mature with two long antennae on a relatively large triangular head with setae (fine hairs) on its surface. The larval body at the abdomen is "S" shaped. The respiratory organs of the larvae are pipe-shaped at the back of the body. We recorded the number of larvae and the type of water reservoir.

In this study, larvae were identified by observing special characteristics of *Aedes aegypti larvae* and larval movements. *Aedes aegypti larvae* move up and down to find food or breathe by circling so that they seem more active. *Aedes aegypti larvae* also move in a tilted or upright position when swimming, but, when stationary, the position is slightly tilted downward with the head lower than the back of the body and floating, close to the surface of the water.

Ethical Considerations

This research received ethical approval, with the reference number 98/09.KEPK/UBK/VII/2023; it was obtained from the Ethics Committee of Bhakti Kencana University.

Statistical Analysis

In addition to descriptive analysis, data were tested for significant relationships between the variables of experience in dengue prevention, exposure to information through socialization, school conditions, presence of Jumantik, dengue information media, and the variable of larval presence using the Chi-Square test, with a significance level of 5%. House index (HI) was calculated as the percentage of houses where *Aedes aegypti* mosquito *larvae* were found, divided by the number of houses inspected, multiplied by 100, as a measure of larval density. Furthermore, HI values were categorized to determine the level of larval density in elementary schools in Bandung City.

Results

The city of Bandung is endemic for Dengue Hemorrhagic Fever. However, efforts to prevent dengue fever often overlook the school environment, which is integral to the community setting. School environments are commonly situated within residential areas and share similar potential risks as other community environments. It is worth noting that *Aedes aegypti* mosquitoes can fly distances ranging from 50 to 200 meters horizontally and 15 to 20 meters vertically. This condition can pose a threat to students, so it needs to be analyzed through research variables as listed in the analysis results below.

Research Overview

The data collected included data on the independent variables, namely experience in preventing DHF, exposure to information through socialization, presence of Jumantik, school conditions, DHF information media, and the dependent variable, namely the presence of *larvae*. Data were obtained through filling out a checklist sheet and observation.

Most elementary schools had no experience in DHF prevention (69.5%), and the school environment was in poor condition (64.4%). Almost all elementary schools were not exposed to information through socialization (89.8%), did not have Jumantik (96.6%), and there were no DHF information media available in the school environment (98.3%). Almost all primary schools had mosquito *larvae* (39.0%). The results of the data collection can be seen in the Table below (Table 1).

Based on the results of the chi-squared analysis, the variable associated with the presence of larvae in the school environment is the condition of the school environment itself. P=0.016 with a CI value of 0.220 (0.070-0.686)means that good environmental conditions will be a factor that can prevent mosquitoes from breeding. The variables of experience in preventing DHF, exposure to information through socialization, the existence of Jumantik, and the availability of DHF information media were not associated with the presence of larvae in the school environment (Table 2).

Water reservoirs or containers serve as water containers, often being large and shaded, conditions conducive to *Aedes aegypti* breeding. Therefore, these water reservoirs or water containers become potential breeding grounds for mosquitoes. In school settings, containers may include water tanks in bathrooms and water closets, flower vases, fish ponds, wastewater dispensers, plastic waste, or any used items capable of holding water. The findings of the conducted research are described in the sections below.

Most of the elementary schools in Bandung City (61%), totaling 36 schools, had no larvae present during the inspection. However, nearly all inspected elementary schools were found to have *Aedes aegypti larvae*. Given that Bandung City is a DHF-endemic area, *Aedes aegypti* will easily breed in favorable environments, including the school environment.

Table 1: Characteristics of the research variables for the presence of larvae

Research Variables	n	%
Experience in DHF prevention		
Yes	18	30.5
No	41	69.5
Information exposure through socialization		
Ever	6	10.2
Never	53	89.8
School conditions		
Good	21	35.6
Not good	38	64.4
The presence of Jumantik		
None	2	3.4
Available	57	96.6
DHF Information Media		
Available	1	1.7
No	58	98.3
The presence of larvae		
None	36	61.0
Available	23	39.0

Table 2: Variables related to the presence of larvae

Risk Factors	The presence of larvae				Total		P value	95% CI
	None		Available					
	N	%	n	%	n	%		
Experience in DHF prevention							0,779	0,721 (0,234-2,224)
Yes	10	55,6	8	44,4	18	100		
No	26	63,4	15	36,5	41	100		
Information exposure through socialization							0,072	1,767 (1,396-2,236)
Ever	6	100	0	0,0	6	100		
Never	30	56,6	23	43,4	53	100		
School conditions							0,016	0,220 (0,070-0,686)
Good	8	38,1	13	61,9	21	100		
Not good	28	73,7	10	26,3	38	100		
The presence of Jumantik							0,516	1,676 (1.354-2,076)
None	2	100	0	0,0	2	100		
Available	34	59,6	23	40,4	57	100		
DHF Information Media							0,820	2,636 (1,897-3,664)
Available	0	0,0	1	100	1	100		
No	36	62,1	22	37,9	58	100		

Containers or water reservoirs with high volumes of water pose potential breeding sites and risk factors for increased pupal abundance.[6]

Aedes aegypti can breed in water reservoirs that are not routinely checked and cleaned. Water quality plays a crucial role, as female mosquitoes prefer to lay eggs and breed in specific conditions. *Aedes Aegypti* thrives in alkaline waters with pH levels between 7.5 and 8.5, low turbidity, and TDS ranging from 250 to 350 ppm. *Aedes aegypti* can breed in water with an average dissolved oxygen level of 6.9±0.7 mg/L.[7] Moreover, *Aedes aegypti larvae* can be found in water reservoirs both indoors and outdoors. They prefer breeding in clean, quiet, stagnant water that is not directly exposed to the ground. *Aedes aegypti* mosquitoes were predominantly found indoors (74.19%), compared to those found in the neighborhood (25.81%). The rainy season sustains *Aedes aegypti*'s high density by providing ample breeding sites in water reservoirs and households.[8] Rainfall positively correlates with the number of female *Aedes aegypti* mosquitoes, while high humidity positively correlates with the presence of 4th instar larvae and pupae.[9]

Based on the presence of *Aedes aegypti larvae* found in flower vases, dispenser containers, plastic or used items holding water, and Water Closet (WC) tubs, it is evident that water reservoirs or containers serve as productive breeding sites for *Aedes aegypti*. These breeding grounds can be found indoors and within the school premises. (Figure 1) Additionally, discarded small or large containers in the surrounding environment strongly contribute to larval and pupal production.[10] The research findings indicate larvae presence in various indoor locations such as flower vases, dispenser containers, bathtubs, and Water Closet (WC) tubs, as well as in outdoor plastic or used items.

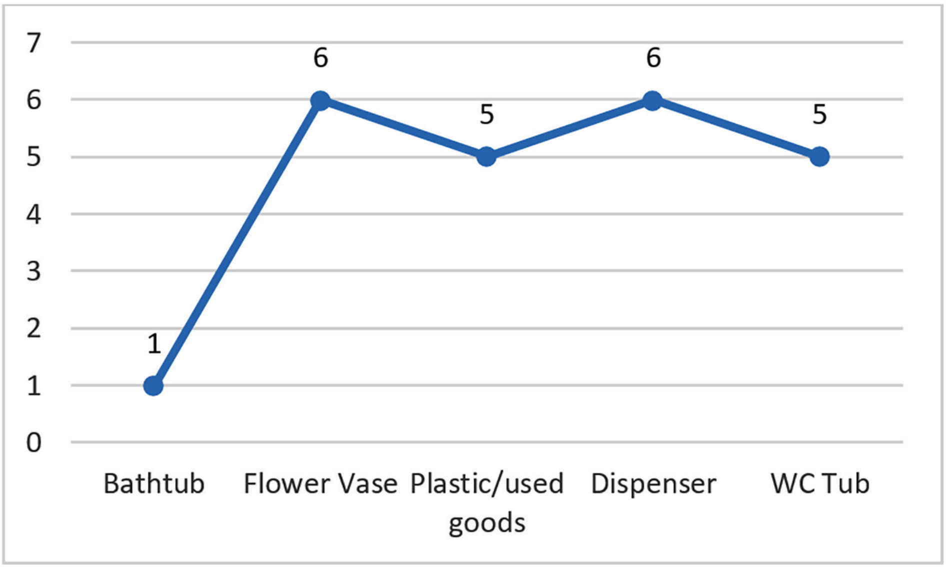

Figure 1: The Presence of *Aedes Aegypti Larvae*

Table 3: *Aedes aegypti larvae* Density

Elementary School	*Aedes aegypti larvae*		*House Index*
	Number of Elementary Schools with larvae	Number of Elementary Schools checked	
59	23	36	39%

Various types of used items, as water reservoirs containing organic matter, are significantly associated with the presence of adult mosquitoes, given their potential as breeding sites due to being uncovered and surrounded by vegetation.[11]

Aedes Aegypti Larvae Density

Mosquito density serves as an environmental and behavioral indicator supporting the breeding of the *Aedes aegypti* mosquitoes. Based on research conducted in 59 elementary school neighborhoods, the House Index (HI) was found to be 39% (Table 3).

The House Index (HI) of 39% indicates a Density Figure (DF) category of 6, signifying high mosquito density. High mosquito density conditions pose a heightened risk of mosquito-borne disease transmission, thereby exacerbating the spread of dengue disease. The density of mosquito larvae in an environment indicates environmental conditions supporting mosquito breeding. The school environment closely resembles the home environment in terms of breeding and resting places favored by the *Aedes aegypti* mosquito. An environment receiving sufficient sunlight intensity and having proper ventilation is less favorable to *Aedes aegypti*. However, it should also be noted that other environmental factors play a role. Adequate sunlight intensity illuminates rooms in both houses and schools, reducing humidity. Sunlit areas deter mosquitoes from resting, favoring environments that are dark and shielded from sunlight.

Table 4: Index larva table

Density Figure (DF)	House Index (HI)
1	1– 3
2	4 – 7
3	8 – 17
4	18 – 28
5	29 – 37
6	38 – 49
7	50 – 59
8	60 – 76
9	>77 >76

Air ventilation serving as a supply of air circulation has the potential to be a pathway for mosquitoes to enter the house (Table 4).

The density figure (DF) categories are as follows:
a. DF=1, meaning that the density of larvae is low
b. DF=2-5, meaning the density of larvae is medium.
c. DF=6-9, meaning high larval density.

Discussion

School Conditions

School conditions are associated with the presence of mosquito larvae. The presence of *Aedes aegypti,* the primary vector of DHF, indicates a high potential for arbovirus transmission in the study area.[12] *Aedes aegypti* likes water reservoirs that are not directly in contact with the ground. *Aedes aegypti* is known as a mosquito that likes clean places. School conditions that support both breeding and resting places triggered the discovery of *Aedes aegypti* larvae during the observation, especially as a resting place because *Aedes aegypti* likes a dark place not exposed to the sun directly, humid with low wind speed, so as not to be disturbed when it is resting. A classroom is a place that is filled with many teaching tools, such as cupboards, tables, and chairs that are too many according to the number of students per class, lockers, and other learning media that have the potential to become a place for resting places. These water reservoirs pose a risk of becoming breeding grounds for *Aedes aegypti* due to infrequent checks and cleaning. Live flower vases are seldom inspected unless the water used as a growing medium remains stagnant or the plant begins to decay. In contrast, WC tubs are often overlooked in cleaning compared to bathroom tubs. Most primary schools use buckets for water storage, considering them effective and easy to maintain.

The limited land area of primary schools, typically situated amidst residential areas, influences the design of bathrooms without tubs. This presents an advantage in promoting Clean and Healthy Living Behavior (PHBS) within the school setting, particularly in eradicating *Aedes aegypti larvae* buckets, being easier to clean, are employed as water reservoirs, even necessitating daily cleaning. This aligns with maintaining cleanliness in the school environment, creating a clean, beautiful, and comfortable environment while addressing the eradication of *Aedes aegypti* larvae in PHBS school settings. Notably, there exists a significant interactive effect between fluctuations in larval density and temperature on larval growth and mortality rates.[13] Therefore, efforts at DHF prevention should pay attention to monitoring larval density, larval interactions in low-volume containers, and temperature fluctuations. The rate of development of *Aedes aegypti*, primarily determined by temperature, stands as the most important ecological determinant.[14]

Problems arise when water reservoirs are not routinely checked or replaced. According to the study findings, flower vases and water reservoirs in dispensers were identified as locations where *Aedes aegypti* larvae were present. Flower vases and water reservoirs are rarely overlooked because they are perceived to contain small amounts of water. However, it is crucial to understand that *Aedes aegypt*i mosquitoes thrive in clean, stagnant water that is shielded from direct sunlight and not directly in contact with the ground. Flower vases and water reservoirs in dispensers provide ideal breeding grounds for *Aedes aegypti* mosquitoes. These mosquitoes lay their eggs on the walls of water reservoirs, particularly those with dark-colored, rough-textured surfaces that absorb water, facilitating egg adherence. Eggs can survive up to six months in dry conditions. Likewise, other puddles of clean water, both indoors and outdoors, contribute to *Aedes aegypti* breeding, including bathtubs or water reservoirs or WC tubs, bird drinking places, and plastic or used items capable of holding water. The increased density of *Aedes aegypti* habitats results from the heightened productivity of containers for larval development.[15] Particularly, super-large containers serve as highly productive breeding sites and have the potential to affect the adaptation of dengue viruses to mosquitoes.[16]we developed an agent-based transmission model of the dengue transmission cycle across houses in 16 dengue- endemic urban 'patches' (1–3 city blocks each Draining water reservoirs can break the breeding cycle of Aedes aegypti in the larval phase.[17]

Experience in DHF Prevention

The school environment shares similarities with the home environment, featuring similar structures and fixtures, including water reservoirs or containers. Common breeding sites for *Aedes adapt larvae* include discarded containers, decorative containers, plates/flowerpot trays, plants, and rooftops/water gutters. Residential containers are among the most frequently encountered breeding sites, along with those found in public places, particularly during the warmer temperature season. Urban neighborhoods experience seasonal fluctuations in *Aedes*-positive containers, which can contribute to *dengue* fever transmission reduction.[18] Adult female *Aedes aegypti* mosquitoes have been observed in classrooms, with breeding sites including containers (such as cans) and water storage containers. The rainy season is characterized by heightened *Aedes aegypti* infestation rates.[19] Additionally, the effects of larva development, adult body size, and larval survival are influenced by density-dependent factors, which can be estimated based on water, food, and natural larval availability.[20]

So far, the school has not made any special efforts to prevent dengue fever. Environmental cleanliness by throwing garbage in its place has not been able to break the cycle of dengue development. Some places in the school are potential breeding grounds and resting places for Aedes aegypti so that the environmental cleanliness carried out by the School has not been able to break the cycle of the spread of DHF, especially in the larval phase. A school environment in a residential neighborhood is similar to a home environment. The presence of water containers, poor ventilation, and lighting can be a good habitat for Aedes aegypti to breed. By disregarding the prevention of DHF, schools become risky places for the density of Aedes aegypti larvae.

Rrainwater channels prevent the formation of puddles that could serve as breeding grounds for *Aedes aegypti*. Astuti's research showed that light intensity, ventilation, and rainwater channels in the school environment were associated with the *Aedes aegypti larvae* density.[21] These mosquitoes have the potential to lay their eggs in puddles formed due to poorly functioning rainwater drains. Puddles not in direct contact with the ground and shielded from direct sunlight have the potential to be a breeding place for *Aedes aegypti*. Based on the results of the study, flower vases and water reservoirs in dispensers within schools represent potential breeding sites for *Aedes aegypti*.

The indoor and outdoor school environments closely resemble typical home environments. Water reservoirs, rooms with adequate sunlight exposure, and ventilation with wire mesh are implemented as an effort to prevent DHF. However, in reality, the school environment is often situated within residential areas, exposing them to the threat of *Aedes aegypti* mosquitoes, having flight distances of 100 - 400 meters. This means that there is no limit for mosquitoes to fly, breed, and rest both at home and in school environments, contributing to the potential for high mosquito density in the school environment. The absence of DHF prevention in schools is not related to the presence of larvae but may pose a risk to the surrounding environment, given the presence of schools among residential areas.

Information Exposure through Socialization

Previous studies suggest that the city center serves as a focal point for human contact with Aedes aegypti, increasing the risk of contracting DHF, while human contact with *Aedes albopictus* is more dispersed around the city limits. Aedes aegypti larvae have a higher frequency of contact than Aedes albopictus larvae in communities located near areas of high human activity.[22]Aedes aegypti L. and Aedes albopictus Skuse have been considered the main strategies for dengue prevention. Spatial targeting of dengue risk areas is the highest priority for implementing control measures. However, the frequency of human-Aedes mosquito contacts as human factors for assessing the risk of dengue has not been taken into account by past studies. The objective of this study is to clarify the geographic effects of crowd-gathering places on the frequency of dengue vector for assessing the spatial risk of exposure to dengue in Kaohsiung City, Taiwan. A geographic information system (GIS Human population density and the natural distribution patterns of *Aedes aegypti* show significant interactions in dengue transmission. Human density plays an important role in dengue transmission because there are many potential human contacts with *Aedes aegypti*, both inside and outside the house.[16]

The above conditions are the information that should be known by the community, including the school component. The school environment, as part of the community, must participate in preventing DHF. However, based on the results of the research, school components such as principals, teachers, school health workers, and students have never been exposed to socialization about dengue prevention. Knowing about the risk factors of DHF can be a stimulus in preventing DHF.

The reality is that the school environment is in the middle of a densely populated residential area in Bandung City. The risks of water reservoirs and poor lighting are often overlooked due to a lack of knowledge about the risks of these environmental conditions. Based on data from the Central Bureau of Statistics in mid-June 2023, the population density of Bandung City totaled 2,506,603 residents, covering an area of 167.67 km2. Thus, the population density of Bandung City stands at 150 people/km2. This population density is influenced by urbanization, which is prevalent in the city. Urbanization rates and average temperatures exceeding 18°C per year are associated with an increased risk of dengue fever in urban areas. Dengue transmission among vulnerable populations increased by 1.95-fold (from 3,966,173 to 7,748,267) for every 1°C rise in average monthly temperature, contributing to higher risks of dengue epidemics across the entire island of Taiwan. Predictions indicate a substantial increase in both population and geographic area at risk for dengue outbreaks.[23] By participating in the socialization, the risk factors for DHF and prevention efforts will be conveyed so that the experience of participating in socialization can be a stimulus in changing behavior in accordance with their respective roles at school.

DHF Information Media

Information on dengue prevention should be easily accessible through socialization. The advancement of science and technology can be facilitated with various media as an effort to disseminate information about dengue prevention. The unavailability of dengue prevention media in schools is a challenge in prevention efforts. Media can be a powerful tool in stimulating knowledge. The school environment, much like the home environment, has the potential for transmitting DHF. High mosquito density encourages massive acceleration of transmission, impacting not only the school community but also the surrounding community, given the flight distance of Aedes aegypti.

This risk is particularly pronounced in school environments that do not make efforts to prevent DHF. In line with Rahmawati's research, it was found that 100% of the larvae obtained were *Aedes aegypti* larvae. The density of *Aedes aegypti* larvae, or House Index, in elementary schools within dengue-endemic and non-endemic areas stood at 85.7% and 60%, respectively.[24] The highest Aedes Container Index (CI) was found in densely populated areas, while the lowest proportion was found in less densely populated areas. Used tires were the most common breeding sites, followed by drums and cement tanks.[25]

Jumantik

The government program in the form of Jumantik (Lover Monitoring Officer) is intensively implemented in households. However, schools have not been exposed to specific jumantik programs or dengue prevention. The school environment is vulnerable to dengue transmission, as indicated by various factors including the house index, bateau index, ovitrap index, container index, presence of ventilation without wire mesh, humidity and temperature levels both indoors and outdoors, and the close distance between buildings, all of which have the potential to accelerate transmission.[26] Based on Mistica's research, the presence of *Aedes aegypti* in the school environment highlights the necessity for vector control efforts within these settings. Proactive measures targeting disease transmission by *Aedes aegypti* mosquitoes are especially crucial.[27] Litter-free rate, container index, breteau index, house index, and entomological parameters should be considered. The presence of larvae, virtual index, and breeding risk index can influence the high incidence of DHF.[28] Jumantik can be a breaker of the Aedes aegypti breeding cycle in the larval phase so that the density of Aedes aegypti larvae can be controlled.

The school environment, being part of the community environment, also needs attention, with interventions needed in every season to control vectors by targeting high-risk households and containers. Jumantik in schools can control the presence of Aede aegypti larvae in schools. Open water reservoirs serve as breeding grounds for *Aedes aegypti*. Thus, closing off water reservoirs such as water tanks and metal drums can effectively reduce the population density of adult female mosquitoes.[29] These intervention efforts play a significant role in alleviating the burden of DHF through vector control campaigns.[30] Mosquito larvae density can be effectively controlled if the school community adopts proper control behaviors. However, these behaviors must be accurately targeted. There were misconceptions about dengue transmission and dengue control practices. Half of the respondents (50.5%) had misconceptions about *Aedes aegypti* breeding in dirty water, while nearly half of the respondents (45.6%) believed that *Aedes aegypti* only bit at night.[31] The high density of mosquito larvae often stems from the condition of water reservoirs. Implementing Mosquito Nest Eradication measures, such as covering, draining, and recycling used materials, can be an effective control effort, including within the school environment. Moreover, employing the right strategy, such as intervention during the non-transmission season, is crucial. This intervention aimed to reduce the density *of Aedes aegypti* mosquitoes as dengue vectors, thereby helping to control dengue cases during the transmission season.[32] Considering that productive habitats of *Aedes aegypti* larvae can be found both outside and inside the house, efforts to curb transmission must focus on improving water reservoirs or productive containers, both indoors and outdoors.[33] Given the habitat of Aedes in schools, Jumantik must understand their responsibilities so that the school environment is free from Aedes larvae.

Conclusion

The school environment is related to the presence of mosquito larvae. Almost all elementary schools contained mosquito larvae (39%), yielding a House Index (HI) of 39%. Consequently, it falls into level 6 of the Larva Index table, indicating a high-density category. Common breeding sites for larvae included flower vases and water reservoirs in dispensers. The density of *Aedes aegypti* mosquitoes in elementary schools in Bandung City is high. High mosquito larva density can be a risk factor for increased transmission of *Aedes aegypti*, leading to DHF. Therefore, further in-depth studies of dengue control policies in endemic areas with population density characteristics are recommended.

Authors' Contribution

All authors contributed to the from research and final manuscript.

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