



RESEARCH ARTICLE

Association of PSN implementation frequency with mosquito larvae presence in Kwala Bekala, Medan

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ABSTRACT

Background: Household-level dengue prevention depends on regular mosquito breeding-site eradication (PSN), yet evidence from Kwala Bekala remains limited. This study examined the association between PSN frequency and the presence of mosquito larvae.

Methods: We conducted a cross-sectional analysis using complete observation records from 59 houses in Kwala Bekala collected on April 29–30, 2026. PSN was classified as routine when performed at least once per week and as non-routine when performed monthly or at irregular intervals. A house was considered larva-positive if larvae were detected in at least one inspected water-holding container. Data were analyzed using frequency distributions and Pearson chi-square test.

Results: Larvae were detected in 12 houses (20.3%), whereas 47 houses (79.7%) were larva-negative. Routine PSN was reported in 34 houses (57.6%) and non-routine PSN in 25 houses (42.4%). Larvae were present in 17.6% of houses with routine PSN and in 24.0% of houses with non-routine PSN. The association was not statistically significant ($p = 0.549$; OR = 1.47; 95% CI, 0.41 to 5.26).

Conclusion: PSN should be implemented comprehensively and accompanied by regular inspection of all potential water-holding containers.

Keywords: mosquito larvae, mosquito breeding-site eradication, frequency, household

Introduction

Dengue hemorrhagic fever (DHF) is a vector-borne disease that remains a public health problem in tropical and subtropical regions. The World Health Organization reports that dengue transmission continues to increase, putting billions of people globally at risk of infection.¹ In Indonesia, the Ministry of Health of the Republic of Indonesia recorded more than 257,000 cases and over 1,400 deaths due to dengue throughout 2024. These figures underscore the continued need for household-based vector control as part of dengue prevention efforts.^{2,3} Mosquitoes, which act as dengue vectors, utilize various water-filled containers inside and around homes as breeding grounds. Eggs hatch into larvae that live in the water, then develop into pupae and adult mosquitoes.^{4,5} The life cycle from egg to adult mosquito can last approximately 7 to 10 days under favorable conditions. Accordingly, the presence of larvae in household water containers indicates ongoing potential for mosquito breeding.^{6–8}

PSN is an environmental management measure aimed at eliminating or reducing mosquito breeding sites. Implementation extends beyond draining bathtubs to include inspecting and managing drums, buckets, used containers, and other water-holding items. This approach is important because container characteristics,

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location, and condition can influence the likelihood of detecting larvae.^{9,10} The frequency of PSN implementation is a key aspect of mosquito larval control. Cleaning at least once per week aligns with the mosquito developmental period from egg to adult, which can last 7 to 10 days. Thus, weekly activities can interrupt the mosquito development cycle before adults emerge.¹¹

Mosquito nest eradication (PSN) through the 3M Plus movement is a vector control strategy that emphasizes draining and cleaning water reservoirs, covering water containers, and recycling items that can hold water. These activities must be performed regularly because unmanaged containers can quickly become productive mosquito breeding sites. The Indonesian Ministry of Health recommends cleaning water reservoirs at least once a week.^{12,13}

Kwala Bekala village is a residential area in Medan with a variety of water reservoirs within the neighborhood. Monitoring PSN frequency and larval presence is necessary to characterize household-level implementation of mosquito nest control. However, evidence on the relationship between PSN frequency and larval presence in Kwala Bekala village remains limited. Against this background, this study aimed to analyze the relationship between the frequency of mosquito larvae control (PSN) and the presence of mosquito larvae in houses inspected in Kwala Bekala village, Medan. The specific aim was to determine whether higher PSN frequency is associated with a lower likelihood of detecting mosquito larvae at the household level.

Method

This study employed an observational analytic design with a cross-sectional approach. Analysis was restricted to data from household inspections conducted in Kwala Bekala Village, Medan City, on April 29–30, 2026. The unit of analysis was the household. All 59 household records coded KW-R1 through KW-R59 that contained complete data on PSN frequency and larval inspection results were included in the analysis. Inspection records from other villages present in the source file were excluded.

Data were obtained from the Mosquito Larval Inspection Form. PSN frequency was recorded for each household. Larval presence was determined by inspecting water-holding containers inside and outside the home, including drums, bathtubs, buckets, other artificial containers, and natural containers. For each container type, the number of water-filled containers and the presence or absence of larvae were recorded. Analysis used only the household code, inspection date, PSN frequency, and larval inspection result; head of household names and addresses were not displayed in the analytical output.

The independent variable was PSN frequency. Frequency was categorized as routine if PSN was performed at least once per week, including daily, once, twice, or three times weekly. Frequency was categorized as non-routine if PSN was performed once per month or at irregular intervals. The one-week threshold follows the recommendation for cleaning water storage containers issued by the Ministry of Health of the Republic of Indonesia. The dependent variable was the presence of mosquito larvae, categorized as positive if larvae were found in at least one inspected container and negative if no larvae were detected in any container.

Univariate analysis is presented as frequencies and percentages. The association between the two variables was assessed using the Pearson chi-square test with a significance level of 5%. The magnitude of association is reported as the odds ratio (OR) comparing the non-routine PSN group with the routine PSN group, along with the 95% confidence interval.

Results

Data collection and field inspection were conducted over two consecutive days on April 29–30, 2026, covering 59 sampled households in the Kwala Bekala neighborhood. All data obtained through mosquito larval observation instruments and questionnaires on the frequency of Mosquito Nest Eradication (Pemberantasan Sarang Nyamuk, PSN) implementation underwent data cleaning, coding, editing, and statistical processing. The findings are presented in two main sections: univariate analysis to describe the frequency distribution of each variable separately, and bivariate analysis to examine and test the association between the frequency of PSN activities as the independent variable and the presence of mosquito larvae as the dependent variable.

Mosquito larval presence was assessed using visual larval survey methods across all water storage containers and receptacles located inside and outside the sampled households in Kwala Bekala. A household was classified as larva-positive if at least one mosquito larva was found in any inspected container.

Conversely, a household was classified as larva-negative if no larvae were detected in any water storage containers examined.

Table 1. Distribution of Mosquito Larvae Presence in Kwala Bekala

Larvae Presence	Number of Houses (n)	Percentage (%)
Larvae present	12	20.3
No larvae	47	79.7
Total	59	100.0

As shown in Table 1, field inspections revealed that mosquito larvae were detected in 12 of the 59 households examined (20.3 percent). The remaining 47 households (79.7 percent) showed no larvae in any containers inspected. From these data, two key epidemiological and entomological indicators were calculated: the House Index and the Free Larvae Rate (Angka Bebas Jentik). The House Index in Kwala Bekala was 20.3 percent, representing the proportion of households infested with mosquito larvae. The Free Larvae Rate was 79.7 percent. This rate falls below the national target of 95 percent or higher established by the government, indicating that water storage container hygiene in the study area requires improvement. Approximately one in five households in the study location remains a potential breeding site for dengue fever vectors.

The frequency of PSN implementation was measured through structured interviews with respondents representing each of the 59 sampled households. PSN activities were categorized into two groups: routine and non-routine. The routine group comprised households that consistently performed water container draining, covering, and disposal of discarded items at least once per week. The non-routine group included households that conducted these activities less than once per week or not on a scheduled basis.

Table 2. Distribution of PSN Frequency in Kwala Bekala

PSN Frequency	Number of Houses (n)	Percentage (%)
Routine (at least once per week)	34	57.6
Non-routine	25	42.4
Total	59	100.0

As shown in Table 2, the majority of residents in Kwala Bekala reported conducting PSN activities routinely. A total of 34 households (57.6 percent) performed these preventive measures at least once per week. However, 25 households (42.4 percent) were classified as non-routine. This substantial proportion indicates that many residents have not incorporated mosquito nest cleaning into a consistent weekly schedule, potentially creating opportunities for *Aedes aegypti* breeding.

Bivariate analysis was conducted to evaluate the association between PSN frequency (independent variable) and mosquito larvae presence (dependent variable). The cross-tabulation of these variables and the results of statistical hypothesis testing are presented in Table 3.

Table 3. Association Between PSN Frequency and Mosquito Larvae Presence in Kwala Bekala

PSN Frequency	Larvae Present (n, %)	No Larvae (n, %)	Total Houses (n, %)
Routine	6 (17.6%)	28 (82.4%)	34 (100.0%)
Non-routine	6 (24.0%)	19 (76.0%)	25 (100.0%)
Total	12 (20.3%)	47 (79.7%)	59 (100.0%)

Table 3 shows that among the 34 households performing PSN routinely, 6 (17.6 percent) were larva-positive, while 28 (82.4 percent) were larva-negative. Among the 25 households performing PSN non-routinely, 6 (24.0 percent) were larva-positive and 19 (76.0 percent) were larva-negative. Descriptively, the proportion of larva-positive households was higher in the non-routine group (24.0 percent) than in the routine group (17.6 percent), representing a 6.4 percentage point difference.

Descriptively, the proportion of larva-positive households was higher in the non-routine group (24.0 percent) than in the routine group (17.6 percent), representing a 6.4 percentage point difference. To test the statistical significance of this association, Pearson's chi-square test of independence was performed at an alpha level of 0.05. The analysis yielded a chi-square value of 0.359 with 1 degree of freedom. The resulting p-value was 0.549. Because the p-value (0.549) exceeds the critical alpha threshold of 0.05, the null hypothesis was retained and the alternative hypothesis was rejected. These findings indicate no statistically

significant association between PSN frequency and mosquito larvae presence in Kwala Bekala at the 95 percent confidence level.

Measures of association and risk were assessed using the odds ratio (OR) with a 95 percent confidence interval (CI). The odds of larvae presence in the non-routine group were calculated as 6 positive households divided by 19 negative households, yielding an odds of 0.316. In the routine group, the odds were 6 positive households divided by 28 negative households, yielding an odds of 0.214. The odds ratio, calculated as the ratio of the non-routine group odds to the routine group odds, was 1.474. This point estimate suggests that households performing PSN non-routinely had 1.474 times higher odds of larvae presence compared with those performing PSN routinely. However, the 95 percent confidence interval for the odds ratio ranged from 0.413 to 5.262. Because this interval includes the null value of 1.0, the observed increase in odds is not statistically significant at the 95 percent confidence level.

Across all evaluated epidemiological parameters in the 59 sampled households, the larvae presence rate in Kwala Bekala warrants continued attention, as the Free Larvae Rate of 79.7 percent does not meet the ideal national criterion. Although households with non-routine PSN implementation showed a descriptively higher proportion of larvae positivity and an elevated odds ratio of 1.474, the absence of a statistically significant association suggests that PSN frequency alone may not be the sole determinant of larvae absence in residential settings. Other environmental, behavioral, or structural factors may contribute to larval breeding and should be considered in future investigations.

Discussion

This study detected mosquito larvae in 20.3% of inspected households in Kwala Bekala Village. The finding indicates that some households still maintain water containers that permit larval development. The presence of larvae warrants attention because water-holding containers inside and around homes can serve as mosquito breeding habitats, although this study did not identify the larval species detected.

A total of 57.6% of households reported conducting PSN (Mosquito Nest Eradication) routinely at least once per week. This frequency aligns with recommendations from the Indonesian Ministry of Health (2025) and is consistent with the approximately 7–10 day development cycle of *Aedes* mosquitoes (CDC, 2024). However, the recorded frequency does not automatically reflect the quality of PSN implementation, such as scrubbing container walls, covering containers, or inspecting all potential water-holding sites.¹⁴

Descriptively, households with non-routine PSN had a higher proportion of larval positivity than those with routine PSN. However, this difference was not statistically significant. An odds ratio of 1.474 indicates an association in the expected direction, but the wide 95% confidence interval crossing unity indicates imprecise estimation. The small number of larva-positive households ($n=12$) and the overall sample size ($n=59$) may have limited the analysis power to detect between-group differences.

These findings differ from Farma et al. (2024), who reported an association between PSN implementation and larval presence in the Meukek Community Health Center catchment area. Nurjana et al. (2023) similarly reported that weekly container emptying, along with container characteristics and location, was associated with the presence of *Aedes* larvae or pupae. Differences in results may be attributable to variations in sample size, operational definitions of PSN, inspection methods, container characteristics, and environmental conditions. In this study, the exposure variable captured only PSN frequency and did not encompass all components of the 3M Plus strategy.^{15,16}

The detection of larvae in households reporting routine PSN may occur if activities are limited to certain containers, do not include scrubbing, or if other containers outside the home are overlooked. Container characteristics and location also influence the likelihood of detecting larvae.¹⁷ Therefore, the implication of these findings is not that PSN lacks benefit, but rather that frequency must be accompanied by comprehensive implementation, inspection of all containers, and regular larval monitoring.

Conclusion

Of the 59 houses inspected in Kwala Bekala Village, 34 (57.6%) reported routine implementation of Mosquito Nest Eradication (PSN), and larvae were detected in 12 houses (20.3%). The proportion of houses positive for larvae was higher among households that did not perform PSN routinely compared with those that did; however, this association was not statistically significant ($p = 0.549$; odds ratio [OR] = 1.474; 95% confidence interval [CI]: 0.413–5.262). Accordingly, these data do not provide sufficient evidence to conclude that PSN frequency is associated with the presence of mosquito larvae. Households should continue

to implement the 3M Plus PSN measures at least once weekly in a thorough manner. This includes draining and scrubbing water containers, tightly covering water storage vessels, and inspecting containers both inside and outside the home. Cadre-based surveillance by jumantik (larvae hunters) should emphasize not only the frequency of PSN activities but also the completeness and quality of their implementation.

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