ORIGINAL ARTICLE

Risk factors associated with dengue hemorrhagic fever incidence in the Belawan II Community Health Center

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ABSTRACT

Dengue Hemorrhagic Fever (DHF) remains a major public health concern in tropical regions such as Indonesia, where environmental and behavioural factors play crucial roles in its transmission. This study aimed to analyse the factors associated with the incidence of DHF in the working area of the Belawan II Community Health Centre in Medan. A quantitative approach with a cross-sectional design was employed. A sample of 110 housewives was selected via purposive sampling from a population of 150 housewives in the area. Data were collected through questionnaires and observation, then analysed using univariate, bivariate (Chi-Square test), and multivariate (logistic regression) methods. Bivariate analysis revealed significant associations between DHF incidence and the following factors: education level (p=0.001), housewives' knowledge (p=0.000), 3M Plus behaviour (p=0.000), health promotion services (p=0.000), and the presence of mosquito larvae (p=0.000). In contrast, variables for age (p=0.161) and occupation (p=0.898) showed no significant association. Multivariate analysis identified health promotion services as the dominant factor associated with DHF incidence (OR=0.029; 95% CI=0.010-0.084; p=0.000), with housewives' knowledge serving as a supporting factor. In conclusion, DHF prevention efforts in the Belawan II area should prioritise enhancing the quality and coverage of effective health promotion services, complemented by improving household-level knowledge and preventive practices, alongside sustainable control of mosquito breeding sites.

Keywords: dengue hemorrhagic fever, 3M Plus behaviour, mosquito larvae

Introduction

Dengue Hemorrhagic Fever (DHF) is an infectious disease caused by the dengue virus and transmitted through the bites of Aedes aegypti and Aedes albopictus mosquitoes. The disease is endemic in over 100 countries, primarily in tropical and subtropical regions, with an estimated 390 million infections occurring globally each year. Approximately 96 million of these manifest clinically, with symptoms ranging from mild fever to potentially fatal dengue shock syndrome.[1] In Southeast Asia, including Indonesia, the burden of DHF is substantial and poses a serious threat to public health and socio-economic development.[2] The World Health Organisation (WHO) has established a global target to reduce the Case Fatality Rate (CFR) of DHF to below 0.5% by 2030, which requires comprehensive, evidence-based control strategies.[3]

Nationally, Indonesia is among the countries with the highest number of DHF cases in Asia. Data from the Indonesian Ministry of Health indicate a significant fluctuation in case numbers annually. In early 2024, over 53,000 cases with hundreds of deaths were reported, indicating that DHF transmission is not yet optimally controlled.[4] Factors such as rapid urbanisation, climate change, population mobility, and limited

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resources for vector control contribute to the complexity of DHF management.[5] At the provincial level in North Sumatra, and specifically in Medan City, DHF is also a priority health concern. Medan City, characterised by densely populated areas, varied environmental sanitation conditions, and high rainfall, creates an ideal environment for *Aedes mosquito* breeding.[6]

The study locality, the working area of the Belawan II Community Health Centre in Medan Belawan District, is a coastal region with dense settlements and geographical conditions prone to water pooling. Data from the Belawan Community Health Centre recorded 100 DHF cases from January to November 2024, indicating this area as endemic with active transmission.[7] Previous studies have identified that behavioural and environmental factors play key roles in DHF incidence. Community knowledge and attitudes, particularly among housewives as the primary managers of the domestic environment, towards DHF prevention are often inadequate.[8] Furthermore, the implementation of Mosquito Nest Eradication (PSN) using the 3M Plus method (draining, covering, recycling, plus other preventive actions) is not consistently practised.[9] The effectiveness of health promotion programmes from healthcare facilities is also a determining factor in shaping community preventive behaviour.[10] Concurrently, the presence of mosquito larvae in water containers in and around houses remains a strong environmental indicator of transmission risk.[11]

Based on the above, a gap exists between planned DHF control efforts and the actual situation on the ground, particularly in endemic areas such as Belawan II. This study is important for identifying the specific factors most influential on DHF incidence in the area, so that interventions can be more targeted, effective, and efficient. The general objective of this study was to analyse the factors associated with the incidence of DHF in the working area of the Belawan II Community Health Centre. Specifically, this study aimed to analyse the association between housewives' knowledge, 3M Plus behaviour, health promotion services, and the presence of mosquito larvae with the incidence of DHF.

Method

This study employed a quantitative method with a cross-sectional study design to observe the relationship between independent and dependent variables at a single point in time. The research was conducted in the working area of the Belawan II Community Health Centre, Belawan II Village, Medan Belawan District, Medan City, North Sumatra Province, in May 2025. The target population comprised all housewives residing in the area, totalling 150 individuals. The study sample was drawn from this population using a non-probability sampling technique, specifically purposive sampling. The sample size was calculated using the Slovin formula with a 5% margin of error (e), resulting in a minimum sample size of 110 housewives. Inclusion criteria were housewives willing to participate as respondents, having resided in the research area for at least six months, and able to communicate effectively.

Data collection was conducted in two ways: primary and secondary data. Primary data were obtained through guided interviews using a structured questionnaire that had been tested for validity and reliability. The questionnaire consisted of several sections measuring the research variables: (1) respondent characteristics (age, education, occupation), (2) housewives' knowledge about DHF (6 questions with a Guttman scale), (3) 3M Plus behavioural practices (6 questions with a Guttman scale), (4) perception of health promotion services from the Community Health Centre (6 questions with a Guttman scale), (5) presence of mosquito larvae in the home (1 observation/interview question), and (6) history of DHF incidence in the family within the last 3 months (1 question). Secondary data were obtained from archives and reports of the Belawan II Community Health Centre related to the area's health profile and DHF case data.

The operational definitions and variable measurements were as follows. The dependent variable, DHF incidence, was measured based on respondents' reports of whether a family member had been diagnosed with DHF by a health worker in the last 3 months, categorised as "ever infected" and "never infected". Independent variables included: (1) housewives' knowledge, measured from the score of answers to 6 questions, categorised as "good" (score 6-9) and "poor" (score 10-12); (2) 3M Plus behaviour, measured from the score of 6 preventive practices, categorised as "good" (score 6-9) and "poor" (score 10-12); (3) health promotion services, measured from the score of perception of 6 service aspects from the Community Health Centre, categorised as "good" (score 6-9) and "poor" (score 10-12); (4) presence of mosquito larvae, based on respondent report/observation, categorised as "present" and "absent"; (5) age, categorised as "<35 years" and "≥35 years"; (6) education, categorised as "low & intermediate" (Primary-High School) and "high" (Diploma/Bachelor's degree); (7) occupation, categorised as "working" and "not working".

Collected data were processed through the stages of editing, coding, entry, cleaning, and tabulating using software. Data analysis was conducted in stages. Univariate analysis was used to describe the characteristics of each variable in frequency distribution and percentage. Bivariate analysis used the Chi-Square test (or Fisher's Exact Test if a cell had an expected frequency <5) to test the association between each independent variable and DHF incidence, with a significance level of α=0.05. Variables with a p-value < 0.25 in the bivariate analysis were then entered into a multivariate analysis model using multiple logistic regression with a backward method to identify the dominant factors influencing DHF incidence while controlling for other variables. The logistic regression results are presented in the form of an adjusted Odds Ratio (OR) with a 95% confidence interval.

Results

The majority of respondents were under 35 years old (85.5%), had low to intermediate education (90%), and did not work outside the home (80.9%). Some 65.5% of respondents had good knowledge about DHF, but only 40% exhibited good 3M Plus behaviour. A total of 53.6% of respondents rated the health promotion services from the Community Health Centre as poor. A concerning finding was that mosquito larvae were found in 88.2% of respondents' homes. More than half of the respondents (53.6%) reported a family member having contracted DHF within the last 3 months.

The results of the bivariate test showed a statistically significant association between DHF incidence and the variables of education (p=0.001), housewives' knowledge (p=0.000), 3M Plus behaviour (p=0.000), health promotion services (p=0.000), and the presence of mosquito larvae (p=0.000). The variables of age (p=0.161) and occupation (p=0.898) showed no significant association with DHF incidence. Complete results are presented in Table 1.

Table 1. Results of bivariate analysis

Variable	DHF Incidence (n, %)		p-value
	Infected (n=59)	Not Infected (n=51)	
Age			
<35 years	53 (56.4%)	41 (43.6%)	0.161
≥35 years	6 (37.5%)	10 (62.5%)	
Education			
Low & Intermediate	58 (58.6%)	41 (41.4%)	0.001
High	1 (9.1%)	10 (90.9%)	
Occupation			
Not Working	48 (53.9%)	41 (46.1%)	0.898
Working	11 (52.4%)	10 (47.6%)	
Housewives' Knowledge			
Good	22 (30.6%)	50 (69.4%)	0.000
Poor	37 (97.4%)	1 (2.6%)	
3M Plus Behaviour			
Good	4 (9.1%)	40 (90.9%)	0.000
Poor	55 (83.3%)	11 (16.7%)	
Health Promotion Services			
Good	8 (15.7%)	43 (84.3%)	0.000
Poor	51 (86.4%)	8 (13.6%)	
Presence of Mosquito Larvae			
Present	59 (60.8%)	38 (39.2%)	0.000
Absent	0 (0.0%)	13 (100.0%)	

Multivariate analysis using logistic regression was performed on the five variables significant in the bivariate analysis (p<0.25). After a stepwise elimination process, the final model indicated that only one variable was statistically significant as the dominant factor: health promotion services. The logistic regression results are presented in Table 2. Housewives who perceived health promotion services from the Community Health Centre as poor had a 34.5 times higher risk (1/0.029) of experiencing a DHF case in their family compared to those who perceived the services as good, after controlling for other variables.

Table 2. Results of multivariate analysis

Variable	B	SE	Wald	p-value	Adjusted OR	95% CI for Adjusted OR	
						Lower	Upper
Health Promotion Services (Poor)	-3.534	0.541	42.648	0.000	0.029	0.01	0.084
Constant	5.216	0.859	36.882	0.000	184.178		

Discussion

The findings of this study reveal that the quality of health promotion services is the dominant factor associated with the incidence of DHF in the working area of the Belawan II Community Health Centre. This result aligns with research by Engkeng et al. (2023), which demonstrated that effective health promotion interventions can significantly increase community knowledge and preventive practices for DHF, ultimately reducing morbidity rates.[12] Effective health promotion involves not merely disseminating information, but also employing participatory, sustainable approaches appropriate to the local cultural context and education level.[13] In Belawan II, the majority of respondents (53.6%) rated health promotion services as poor, which may be attributed to monotonous counselling methods, infrequent sessions, non-applicable materials, or a lack of feedback. This ineffectiveness impacts the low level of community understanding and motivation to perform preventive actions consistently.

Although not the dominant factor in the final regression model, housewives' knowledge showed a very strong association in the bivariate analysis. Respondents with poor knowledge had a significantly higher risk of DHF infection. This finding is consistent with research by Kharismaka, Lestari & Prasida (2023), which stated that knowledge is the foundation for forming preventive attitudes and actions.[14] Good knowledge about the mosquito life cycle, breeding sites, and prevention methods encourages housewives to be more vigilant and proactive in maintaining environmental cleanliness. However, this study also indicates a gap between knowledge and practice, where 65.5% of respondents had good knowledge, but only 40% practised 3M Plus well. This reinforces the Health Belief Model theory that knowledge alone is insufficient; adequate perception of susceptibility, severity, benefits, and barriers is also required to trigger action.[15]

3M Plus behaviour also proved to have a significant association with DHF incidence. Respondents with poor behaviour had a higher risk of experiencing DHF. This is supported by a meta-analysis by Alfalakh (2023), which concluded that non-adherence to 3M Plus increased the risk of contracting DHF nearly six-fold.[16] Regular and meticulous 3M Plus practice is the frontline of community-based prevention as it directly targets vector breeding sites. The low practice of 3M Plus in Belawan II (only 40% good) can be influenced by various factors, such as busy schedules, lack of social support, or the perception that fogging is the primary solution, as found in research by Yebi Susanti Hambur et al. (2023).[17] Therefore, health promotion needs to emphasise that PSN 3M Plus is a more sustainable and effective preventive action than fogging.

The presence of mosquito larvae in 88.2% of respondents' homes is a clear indicator of the high risk of DHF transmission in the area. The analysis shows a highly significant association between larval presence and DHF incidence, consistent with research by Rama (2023) and Siregar et al. (2023).[18,19] The geographical conditions of Belawan II, which are flat and tend to be swampy, are prone to water pooling. Coupled with behaviours such as storing water or leaving used items that can collect rainwater, this creates an ideal habitat for *Aedes* mosquitoes. This finding underscores that controlling the physical and biological environment through regular larval monitoring (for instance, via the One House One Larvae Monitor/G1R1J programme) remains crucial.[20]

The formal education variable showed a significant association, with respondents having low-intermediate education at higher risk. Education influences an individual's ability to access, process, and apply health information, including about DHF.[21] Meanwhile, demographic variables such as the age and occupation of housewives in this study showed no significant association with DHF incidence. This may be due to the homogeneous characteristics of the sample (mostly young and not working) or because behavioural and environmental factors have a more direct influence than these demographic factors.

Conclusion

Study results confirm that DHF incidence in the Belawan II area is associated with education, knowledge, 3M Plus behaviour, health services, and larvae presence. The dominant risk factor is inadequate health promotion from the Community Health Centre. Families where housewives perceive these services as poor are at greatest risk. To address this, the Belawan II Health Centre must innovate its health promotion with engaging, sustainable, and locally relevant programs. Emphasis should shift to consistent PSN 3M Plus over fogging. Strengthening larval monitoring via the G1R1J program and cadres, plus partnering with local authorities for community clean-ups, is critical. Future research should use longitudinal or qualitative methods to better understand household-level preventive behaviour.

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