Dengue Fever Control and Determinants of Dengue Incidence at Huta Rakyat Public Health Center 2024

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Abstract

Dengue Hemorrhagic Fever (DHF) remains a major public health concern in Indonesia, where it is endemic and frequently leads to outbreaks. Dairi Regency, particularly the Huta Rakyat Public Health Center area, has experienced a marked increase in DHF cases over the past two years. This study aims to analyze the implementation of the dengue control program and identify factors associated with DHF incidence.This research used a sequential explanatory mixed-methods design, beginning with a quantitative phase followed by a qualitative phase to explain and enrich the quantitative findings. The quantitative component employed a cross-sectional survey of 100 respondents, analyzed using logistic regression. The qualitative phase involved 10 in-depth interviews, field observations, and document reviews, with data analyzed through thematic analysis.Quantitative findings indicated that DHF incidence was significantly associated with the waste disposal system (OR = 5.67; 95% CI: 1.773 17.479), attitude (OR = 3.316; 95% CI: 1.032 10.656), and knowledge (OR = 3.057; 95% CI: 1.016 9.198). Poor waste management emerged as the dominant factor, increasing the risk of DHF by 5.67 times. Qualitative findings supported these results, revealing persistent challenges in dengue control, including limited human resources, weak cross-sectoral coordination, irregular community engagement in 3M Plus activities, and a reactive approach that prioritizes fogging only after cases appear. The study recommends strengthening community-based prevention activities, improving waste management through stronger cross-sectoral collaboration, and implementing routine environmental surveillance to inform sustainable intervention planning. These efforts are expected to enhance the effectiveness and long-term sustainability of dengue control in the Huta Rakyat Public Health Center area.

Keywords: Dengue Hemorrhagic Fever, Risk Factors, Control, Public Health Center.

INTRODUCTION

Dengue Hemorrhagic Fever (DHF) remains a persistent public health challenge in Indonesia, where environmental and climatic conditions support year-round transmission (Ashar, 2022). Although various DHF control programs have been implemented nationally, the number of cases continues to fluctuate and periodically triggers outbreaks in many regions (Masturoh et al., 2021). North Sumatra is among the provinces with a consistently high DHF burden, and Dairi Regency has shown a concerning upward trend in recent years (Saragih et al., 2019). In Dairi, reported DHF cases increased from 99 cases in 2023 to 168 cases in 2024, with the highest incidence occurring in the working areas of Huta Rakyat, Batang Beruh, and Sitinjo Public Health Centers. Despite ongoing interventions including health education, Clean and Healthy Living Behavior (PHBS) promotion, Mosquito Breeding Site Eradication (PSN),

fogging, and epidemiological investigation DHF incidence in Dairi continues to rise (Halid, 2022). Environmental conditions, particularly high rainfall and inadequate household waste management, contribute significantly to the proliferation of Aedes mosquito breeding sites (Barek et al., 2020). Low community participation in PSN, limited awareness of PHBS, and irregular implementation of waste management practices further hinder effective dengue prevention efforts (Espiana et al., 2022). These challenges underscore the need for strengthened and more integrated dengue control strategies at the community level (Malinda, 2024). However, previous studies in Dairi and similar regions have primarily focused on descriptive trends or general program evaluations and have not comprehensively examined the specific behavioral and environmental factors contributing to DHF incidence at the local level (Asnel et al., 2022). There is also limited evidence regarding how existing control programs are implemented in practice and the barriers faced by health workers and communities (Fretes & H., 2020). This gap indicates a lack of detailed, context-specific analysis needed to guide more effective and sustainable dengue prevention efforts (Malinda, 2024). Therefore, this study aims to analyze the dengue control program and identify factors influencing DHF incidence in the working area of the Huta Rakyat Public Health Center in 2024. The findings are expected to provide evidence-based recommendations to enhance dengue control strategies in Dairi Regency and support the development of more sustainable public health policies (Saragih et al., 2019; Umbara & Raviola, 2020).

Despite the ongoing control efforts, the continuous rise of DHF cases in the Huta Rakyat Public Health Center area suggests that existing interventions have not adequately addressed the multidimensional determinants of dengue transmission. Previous studies across Indonesia consistently highlight that environmental sanitation such as waste disposal systems, household waste segregation, drainage conditions, and mismanaged water storage plays a pivotal role in creating Aedes breeding sites and thus increasing the risk of DHF at the household level (Mawaddah et al., 2022). These environmental vulnerabilities are further exacerbated in communities where waste collection services are irregular, discarded containers accumulate during the rainy season, and households lack the capacity or motivation to maintain clean surroundings. Evidence shows that areas with inadequate waste management experience significantly higher dengue incidence compared to those with structured sanitation systems, demonstrating the importance of environmental interventions as a core strategy in dengue prevention. Beyond environmental risk factors, the role of knowledge and attitudes in shaping dengue-preventive behavior has been repeatedly documented. Individuals with limited understanding of DHF transmission mechanisms tend to be less consistent in carrying out

Mosquito Breeding Site Eradication (PSN) activities, while those with more favorable attitudes toward prevention demonstrate stronger adherence to routine 3M Plus measures, including covering, draining, and burying potential breeding containers (Espiana et al., 2022). However, recent findings indicate that knowledge alone does not guarantee preventive practice, especially when environmental and social barriers such as lack of community support, insufficient environmental facilities, and weak mobilization of health cadres are not simultaneously addressed (Rochmawati et al., 2021). This highlights the need for comprehensive and context-sensitive behavioral interventions.

Programmatic challenges also hinder dengue control effectiveness. Evaluations of dengue programs across Indonesia reveal systemic limitations, including insufficient human resources, gaps in technical training, poor cross-sectoral coordination, and limited capacity for regular environmental surveillance at the primary care level (Umbara & Raviola, 2020). A recurrent issue is the overreliance on fogging as a reactive measure when cases arise, rather than proactive environmental management that addresses root causes of transmission. Such reactive strategies are widely criticized because they fail to disrupt the mosquito life cycle and often provide only temporary reductions in adult mosquito populations (Madhe et al., 2021). Program evaluations further indicate discrepancies between policy expectations and field implementation, particularly related to larval surveillance, documentation accuracy, and follow-up of epidemiological investigations (Safira & Devy, 2023). These structural inconsistencies weaken program effectiveness and reduce the capacity of health centers to respond efficiently to rising DHF cases.

From a behavioral science perspective, the PRECEDE PROCEED model underscores that long-term behavior change requires alignment between predisposing factors (knowledge and attitudes), enabling factors (infrastructure, environmental resources), and reinforcing factors (community support, cadre involvement, and health worker engagement) (Malinda, 2024; Notoatmodjo, 2010). Many dengue interventions in Indonesia emphasize educational activities but fail to address enabling conditions such as waste infrastructure, access to clean water, and household environmental safety. Without these environmental supports, communities may understand the importance of PSN but remain unable to implement preventive behaviors consistently (Halid, 2022). This mismatch between knowledge and practice is repeatedly highlighted in dengue literature, revealing a complex interplay between behavior, environment, and structural context (Yuliandari et al., 2022).

Taken together, the rising DHF burden in the Huta Rakyat Public Health Center area reflects the interplay of three primary domains: environmental risk factors, household-level

behavioral determinants, and programmatic constraints. The convergence of these issues indicates a pressing need for research capable of integrating multiple dimensions of dengue transmission within a single analytic framework. Although numerous studies have examined environmental sanitation or knowledge attitude practice relationships, and others have assessed program inputs and outputs, very few investigations have combined these perspectives using a mixed-methods design that can capture both the statistical associations and the contextual operational challenges shaping dengue control outcomes (Aprianto et al., 2025). This represents a clear research gap: the absence of comprehensive, context-specific evidence linking household determinants with program implementation in a puskesmas catchment area.

METHODS

This study employed a sequential explanatory mixed-methods design, consisting of two distinct phases. The quantitative phase was conducted first to identify statistical associations between environmental and behavioral factors and DHF incidence. The qualitative phase followed to explain, contextualize, and deepen the quantitative findings. Integration of both datasets was carried out during the interpretation stage through connecting (using quantitative results to guide qualitative inquiry) and merging (comparing and synthesizing findings) to generate comprehensive conclusions. The study was conducted in the working area of the Huta Rakyat Public Health Center, Dairi Regency, North Sumatra, from February to April 2025. The quantitative population consisted of all 25,695 residents in the area. The sample size of 99 respondents was determined based on analytical study requirements and resource considerations, and respondents were selected using simple random sampling to ensure representativeness. The qualitative phase involved eight informants selected through purposive sampling based on predetermined criteria: (1) directly involved in DHF program implementation (environmental health officer, epidemiological surveillance officer, DHF program manager), and (2) individuals with recent DHF experience (five DHF patients) who could provide insights regarding environmental conditions, prevention practices, and community behavior. Primary data were collected using structured questionnaires for the quantitative component and semi-structured in-depth interviews for the qualitative component. Interviews were conducted with the aid of audio recorders after obtaining written informed consent. Environmental assessments were performed through direct field observations using a standardized checklist, covering water storage conditions, waste disposal practices, presence of breeding sites, and overall household sanitation. Secondary data were obtained from health center profiles, district health office reports, and relevant literature. Quantitative data were

analyzed using descriptive statistics and logistic regression. Qualitative data were transcribed verbatim and analyzed using thematic analysis, which included open coding, axial coding, and theme development. Credibility was ensured through data triangulation (interviews, observations, and documents) and member checking.

RESULT

Univariate Analysis

Table 1. Distribution of Respondents' Characteristics and Factors Influencing the Incidence of Dengue Hemorrhagic Fever (DHF) in the Working Area of Huta Rakyat Public Health Center 2024

Variable	Category	Number (n)	Percentage (%)
Age (Years)	< 24 Years	31	31.3
	≥ 24 Years	68	68.7
	Total	99	100
Sex	Male	65	65.7
	Female	34	34.3
	Total	99	100
Education Level	Low (No Schooling, Elementary, Junior High School)	30	30.3
	High (Senior High School, Higher Education)	69	69.7
	Total	99	100
Occupation	Unemployed	27	27.3
	Employed	72	72.7
	Total	**99**	**100**
History of DHF Incidence	Never	74	74.7
	Ever	25	25.3
	Total	**99**	**100**
Condition of Water Storage Facilities	Poor	65	65.7
	Good	34	34.3
	Total	**99**	**100**
Waste Disposal System	Poor	54	54.5
	Good	45	45.5
	Total	**99**	**100**
Knowledge Level	Poor	58	58.6
	Good	41	41.4
	Total	**99**	**100**
Attitude	Poor	74	74.7
	Good	25	25.3
	Total	**99**	**100**

Based on Table 1, the majority of respondents were aged over 24 years (68.7%), male (65.7%), had a high level of education (69.7%), and were employed (72.7%). In terms of environmental and behavioral factors, most respondents had poor water storage conditions (65.7%), inadequate waste disposal systems (54.5%), and poor knowledge (58.6%) as well as poor attitudes (74.7%) regarding dengue prevention. In addition, 25.3% of respondents had previously experienced DHF, indicating that dengue fever remains a significant public health problem within the working area of Huta Rakyat Public Health Center.

Bivariate Analysis

Table 2. Relationship Between the Condition of Water Storage Facilities and the Incidence of Dengue Hemorrhagic Fever (DHF) at Huta Rakyat Public Health Center

Water Storage Condition	DHF Incidence				Total	OR (95% CI)	p-value
	Ever	%	Never	%	N	%	
Good	15	8.6	19	25.4	34	34.3	4.342 (1.671–11.285)
Poor	10	16.4	55	48.6	65	65.7	
Total	**25**	**25.0**	**74**	**74.0**	**99**	**100.0**	

The significant association between TPA condition and DHF incidence (p = 0.002) indicates that structural and maintenance problems in water storage facilities contribute directly to vector proliferation. Respondents with poorly maintained TPA had a 4.3-fold higher risk of contracting DHF (OR = 4.342; 95% CI: 1.671–11.285). This finding suggests that water containers especially those left uncovered, cracked, or rarely cleaned serve as ideal breeding sites for *Aedes aegypti*. The elevated risk reflects not only environmental vulnerability but also the community's limited adherence to routine cleaning practices such as draining and brushing water containers weekly. Thus, interventions must prioritize household-level improvements in TPA maintenance, accompanied by targeted education on eliminating mosquito breeding sites.

Table 3 Relationship between Waste Disposal System and Dengue Fever Incidents at Huta Rakyat Community Health Center

Waste Disposal System	DHF Incidence				Total	OR (95% CI)	p-value
	Ever	%	Never	%	N	%	
Good	19	11.4	26	33.6	45	45.5	5.846 (2.078–16.449)
Poor	6	13.6	48	40.4	54	54.5	
Total	**25**	**25.0**	**74**	**74.0**	**99**	**100.0**	

The strong relationship between waste disposal practices and DHF incidence (p = 0.000) demonstrates the critical role of solid waste management in dengue transmission. Individuals with poor waste disposal systems were 5.8 times more likely to develop DHF (OR = 5.846; 95% CI: 2.078–16.449). This pattern is consistent with environmental observations that uncovered trash bins, irregular waste collection, and accumulation of plastic containers create abundant breeding sites for mosquitoes. The magnitude of the risk indicates that improving TPS conditions may offer one of the most impactful preventive strategies. It also highlights systemic issues such as inadequate waste services and insufficient community participation in waste segregation and regular disposal.

Table 4. Relationship between Knowledge and Dengue Fever Incidence at Huta Rakyat Community Health Center

Knowledge Level	DHF Incidence				Total	OR (95% CI)	p-value
	Never	%	Ever	%	n	%	
Good	24	30.6	17	10.4	41	41.4	4.427 (1.676–11.691)
Poor	50	43.4	8	14.6	58	58.6	
Total	**74**	**74.0**	**25**	**25.0**	**99**	**100.0**	

The association between knowledge and DHF incidence (p = 0.002) suggests that understanding dengue prevention principles plays a foundational role in shaping protective behaviors. Respondents with poor knowledge had a 4.4-fold increased risk of DHF (OR = 4.427). This implies that informational gaps such as lack of awareness regarding 3M Plus, early symptom recognition, and the importance of PSN translate into inadequate preventive practices. The finding underscores that knowledge is not merely cognitive but acts as a key enabling factor for behavioral change. Strengthening health education, particularly through school-based programs and community outreach, is therefore essential.

Table 5. Relationship between Attitude and Dengue Fever Incidence at Huta Rakyat Community Health Center

Attitude	DHF Incidence				Total	OR (95% CI)	p-value
	Ever	%	Never	%	N	%	
Good	12	6.3	13	18.7	25	25.3	4.331 (1.614–11.621)
Poor	13	18.7	61	55.3	74	74.7	
Total	**25**	**25.0**	**74**	**74.0**	**99**	**100.0**	

The significant link between attitude and DHF incidence (p = 0.004) highlights the behavioral dimension of dengue prevention. Respondents with unfavorable attitudes were 4.3 times more likely to contract DHF (OR = 4.331). This suggests that even when knowledge is present, a lack of positive perception or motivation such as believing PSN is time-consuming, feeling fogging alone is sufficient, or relying on external interventions reduces preventive action. A favorable attitude reflects a sense of personal responsibility and community awareness, which are crucial for sustained household-level interventions. Therefore, behavior-change communication strategies need to emphasize motivation, collective responsibility, and practical benefits of regular 3M Plus practices.

Multivariate Analysis

Table 6. Bivariate Selection Results

Variable	p-value
Water Storage Condition	0.002
Waste Disposal System	0.000
Knowledge	0.002
Attitude	0.004

The results of bivariate selection that produce a p-value < 0.25, the variable enters the multivariate stage, while variables that produce a p-value > 0.25 are not entered into the multivariate stage.

Table 7. Logistic Regression

		Variables in the Equation							
		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1a	**Water Reservoir Condition**	1.051	.567	3.438	1	.064	2.860	.942	8.686
	Waste Disposal System	1.717	.584	8.652	1	.003	5.567	1.773	17.479
	Knowledge	1.117	.562	3.952	1	.047	3.057	1.016	9.198
	Attitude	1.199	.596	4.052	1	.044	3.316	1.032	10.656
	Constant	-8.498	1.728	24.189	1	.000	.000		

a. Variable(s) entered on step 1: condition of water reservoirs, waste disposal systems, knowledge, attitudes.

The logistic regression output did not provide model-fit indicators such as the Nagelkerke R^2 or the Hosmer Lemeshow goodness-of-fit test, which are essential for evaluating how well the final model explains the variability of the outcome. During the analysis, one variable namely the condition of the water reservoir showed a p-value greater than 0.05, indicating that it did not have a statistically significant association with the dependent variable in the multivariate model. In accordance with standard modeling procedures, this variable was excluded from subsequent stages of analysis to improve the precision and parsimony of the model. After removing the non-significant variable and applying the same analytical steps, the following results were generated.:

Table 8. Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1a	**waste disposal system**	1.754	.573	9.363	1	.002	5.778	1.879	17.773
	Knowledge	1.279	.546	5.478	1	.019	3.593	1.231	10.484
	Attitude	1.388	.580	5.735	1	.017	4.007	1.287	12.479
	Constant	-7.561	1.580	22.890	1	.000	.001		

a. Variable(s) entered on step 1: waste disposal system, knowledge, attitude.

After the water reservoir condition variable was removed, we looked at the changes in the OR values for the waste disposal system variables, respondents' knowledge and attitudes regarding dengue fever incidents.

Table 9. Confounding Test

Variable	OR (Water Storage Condition Present)	OR (Water Storage Condition Absent)	Change in OR (%)
Water Storage Condition	2.860		0.0%
Waste Disposal System	5.567	5.778	3.7%
Knowledge	3.057	3.593	17.5%
Attitude	3.316	4.007	20.8%

It turns out that after the condition of the water reservoir was removed, the OR of the waste disposal system variable, respondents' knowledge and attitudes about the occurrence of

dengue fever changed by >10%, thus the variable of the condition of the water reservoir regarding dengue fever was re-entered into the model.

Table 10. Final Model

		Variables in the Equation							
		B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1a	**Water Reservoir Condition**	1.051	.567	3.438	1	.064	2.860	.942	8.686
	Waste Disposal System	1.717	.584	8.652	1	.003	5.567	1.773	17.479
	Knowledge	1.117	.562	3.952	1	.047	3.057	1.016	9.198
	Attitude	1.199	.596	4.052	1	.044	3.316	1.032	10.656
	Constant	-8.498	1.728	24.189	1	.000	.000		

a. Variable(s) entered on step 1: water_reservoir_condition, waste_disposal_system, knowledge, attitude.

Based on the results of the multivariate analysis, the variables significantly related to the incidence of Dengue Hemorrhagic Fever (DHF) are the waste disposal system, knowledge, and attitudes of respondents, while the condition of the water reservoir acts as a confounding variable. Of the three significant variables, the dominant variable is the waste disposal system with an Odds Ratio (OR) value of 5.567. This indicates that respondents who have a poor waste disposal system have a risk of contracting DHF 5.567 times higher than respondents who have a good waste disposal system after controlling for the condition of the water reservoir variable.

1. Implementation of Dengue Hemorrhagic Fever (DHF) Control

Informants described DHF control as a combination of preventive and responsive strategies, including Mosquito Nest Eradication (PSN), selective fogging, and epidemiological investigation. Fogging is not conducted routinely but is triggered by evidence of *Aedes aegypti* larvae or case clusters. Health workers highlighted that a multi-method approach - chemical, biological, and environmental was necessary to manage vector breeding sites. One staff member explained: "*We only carry out fogging when the survey shows larvae or when cases start to increase. It's not routine because we focus more on eliminating breeding sites*." Community education plays a central role, delivered through outreach activities and digital platforms. According to an environmental health officer: "*Our Facebook page helps a lot. People report faster when they see suspected symptoms or mosquitoes around their house*."These insights point to a blended strategy combining field action and digital engagement to strengthen early detection and reporting.

2. Challenges in Program Implementation

Limited human resources emerged as a major constraint. Informants emphasized that the number of health staff is insufficient to cover all intervention areas. Cross-sector collaboration with village authorities was also reported as weak, especially regarding support

for jumantik cadres. One informant stated: "*We don't have enough staff. Without support from the village to fund jumantik cadres, monitoring becomes very difficult*." Another noted the lack of involvement from community leaders: "*If local leaders don't actively support the program, community mobilization becomes slow. Advocacy doesn't run well."* These challenges reflect systemic barriers that affect the sustainability of DHF control efforts.

3. Surveillance and Case Monitoring

Surveillance activities rely on the SP2TP reporting system, followed by epidemiological screening and household assessments. Informants highlighted that geographic mapping based on recurrent case areas guides targeted interventions. As described by one surveillance officer:"*We map the places where cases often appear and compare them with environmental risks like drainage problems. That's where we focus our visits*." The findings suggest that surveillance is not only administrative but also strategic in directing limited resources to high-risk zones.

4. Environmental Conditions and Community Participation

Environmental conditions were consistently described as inadequate, particularly in areas near markets. Stagnant water, clogged drains, and waste accumulation contribute to mosquito breeding. Community participation remains reactive rather than preventive. One resident explained: "*People clean only after someone gets dengue. If there's no case, they think everything is fine*." Health workers also noted irregular participation in community cleanup activities: "*Fogging and education are appreciated, but the community often waits for us. They rarely take initiative unless cases appear*." This indicates a gap between awareness and sustained community action.

5. Community Knowledge and Behavior

Although most community members understand DHF transmission, consistent adoption of preventive behaviors particularly the 3M program remains weak. Knowledge does not necessarily translate into routine practice. A community informant remarked:"*We know about 3M, but honestly people don't always do it. They start caring only when someone close gets sick*." Another added: "*Sometimes we forget to check water containers. It's not that we don't know, but we don't do it regularly*." These findings underscore the need for continuous community empowerment and behavior reinforcement to ensure long-term preventio

DISCUSSION

This study demonstrates that both environmental and behavioral factors are significantly associated with the occurrence of Dengue Hemorrhagic Fever (DHF) in the working area of the Huta Rakyat Public Health Center. These findings support the epidemiological understanding that DHF transmission is not solely determined by vector presence but results from complex interactions between environmental conditions, human behavior, and public health control systems (Anggreyani et al., 2024; Asnel et al., 2022). The significant associations observed between water storage conditions, waste disposal systems, knowledge, attitudes, and DHF incidence highlight the multifactorial nature of dengue transmission.

The significant association between water storage container conditions and DHF incidence ($p = 0.002$) is consistent with previous studies conducted in dengue-endemic regions. Poorly managed water storage containers have been widely reported as primary breeding sites for Aedes aegypti, facilitating increased vector density and dengue transmission risk (Aprianto et al., 2025; Harbriyanto, 2024) From an environmental epidemiology perspective, stable and stagnant water provides optimal ecological conditions for the mosquito life cycle, increasing human vector contact (Octaviani & Wahyono, 2021). The present study contributes additional evidence by demonstrating that inadequate water storage practices remain a significant risk factor even in semi-rural settings, reinforcing the need for sustained household-level interventions beyond urban areas.

The waste disposal system was also strongly associated with DHF incidence ($p < 0.001$), supporting findings from earlier studies that identified unmanaged household waste as an important environmental determinant of dengue transmission (Lestari, 2024; Mawaddah et al., 2022). Discarded containers such as plastic bottles, cans, and other non-biodegradable waste can collect rainwater and create artificial breeding habitats for Aedes aegypti (Tansil et al., 2021). Unlike many previous studies that examined waste management as a single exposure, this study highlights the cumulative effect of poor waste disposal and inadequate water storage practices, suggesting that multiple environmental risk factors may interact synergistically to amplify DHF transmission risk.

Beyond environmental determinants, this study underscores the importance of behavioral factors, particularly community knowledge and attitudes. The significant association between knowledge level and DHF incidence ($p = 0.002$) aligns with the Knowledge Attitude Practice (KAP) framework, which posits that knowledge is a key predisposing factor influencing health behavior (Notoadmojo, 2018). Previous studies have

similarly reported that limited knowledge regarding dengue transmission and prevention is associated with higher DHF incidence (Wulandari et al., 2021; Yuniar et al., 2024). Inadequate knowledge may reduce community engagement in preventive practices such as source reduction and participation in vector control programs, thereby increasing susceptibility to dengue virus exposure (Putri Sapphira et al., 2022).

Community attitudes were also significantly associated with DHF incidence ($p = 0.004$), reinforcing evidence that attitudes play a critical role in shaping preventive behavior. Positive attitudes toward DHF prevention have been shown to encourage consistent participation in mosquito breeding site eradication activities, whereas negative attitudes may hinder preventive actions despite the availability of information and resources (Sunaryanti & Iswahyuni, 2020). From a behavioral epidemiology perspective, attitudes function as a mediating factor between knowledge and practice, influencing whether preventive behaviors are adopted and sustained (Putra & Miko, 2021).

The implications of these findings are substantial for public health policy and practice. Effective DHF control requires integrated interventions that simultaneously address environmental management and behavioral change. Programs focusing solely on vector control measures, such as fogging, without strengthening community knowledge and attitudes may have limited long-term effectiveness (WHO, 2024). Therefore, dengue prevention strategies should prioritize health promotion, community empowerment, and strengthened environmental surveillance, including the active involvement of larva monitoring cadres (jumantik) as key agents in source reduction efforts (Niksan et al., 2025).

Several limitations of this study should be acknowledged. First, the cross-sectional design limits the ability to establish causal relationships between the studied factors and DHF incidence. Second, data on knowledge, attitudes, and environmental conditions were collected through self-reported questionnaires and observations, which may be subject to recall and reporting bias. Third, this study did not include entomological indicators such as larval density indices, which could provide a more direct assessment of vector abundance. Future studies employing longitudinal designs and incorporating entomological and climatic data are recommended to strengthen causal inference and enhance dengue prevention strategies.

In conclusion, this study contributes to the international body of evidence by demonstrating that DHF risk is shaped by the interaction of environmental and behavioral factors within a community context. By integrating these dimensions in a single analysis, the findings provide valuable insights for the development of comprehensive, context-sensitive, and sustainable dengue control strategies applicable to semi-rural and similar settings.

CONCLUSION

This study identified three variables that were significantly associated with the incidence of Dengue Hemorrhagic Fever (DHF) in the Huta Rakyat Community Health Center area: the waste disposal system, respondents' knowledge, and respondents' attitudes. The variable related to water reservoir conditions did not remain significant and acted as a confounding factor in the multivariate model. Among the significant factors, the waste disposal system showed the highest odds ratio (OR = 5.567), followed by attitudes (OR = 3.31) and knowledge (OR = 3.06). These findings indicate that both environmental and cognitive factors contribute to DHF incidence, with variations in effect sizes observed across the measured variables. Qualitative data provided additional contextual understanding, highlighting operational constraints such as limited human resources, weak intersectoral coordination, and inconsistent community participation. These contextual insights help explain the challenges encountered in sustaining DHF prevention activities but do not serve as measures of statistical influence. Overall, the results emphasize that DHF incidence in this setting is shaped by a combination of environmental conditions and individual behavioral factors. Further research with larger samples and comparative effect-size testing is recommended to more precisely determine the relative contribution of each factor.

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