Factors Affecting The Incidence of Dengue Hemorrhagic Fever (DHF) At Tumpaan Health Center, South Minahasa Regency

Revony Yulli Turang[1*], Grace D. Kandou[2], Eva M. Mantjoro[3]

[1,2,3]Universitas Sam Ratulangi Manado, Indonesia
[*] Corresponding author:
Email: revoniturang@gmail.com

Abstract.

This study presents a comprehensive analysis of the factors influencing Dengue Hemorrhagic Fever (DHF) incidence in the working area of Puskesmas Tumpaan, South Minahasa. Utilizing a case-control design, 88 respondents—44 laboratory-confirmed DHF cases and 44 matched controls—were assessed to determine the association between behavioral and environmental risk factors and DHF transmission. Five key variables were examined: level of public knowledge, vector control practices (PSN), indoor clothing habits, household cleanliness, and water storage conditions. Bivariate and multivariate statistical analyses were employed to evaluate significant predictors of disease occurrence. The results identified knowledge about DHF (OR = 0.27; p = 0.013) and the habit of hanging clothes indoors (OR = 0.15; p = 0.000) as significant risk factors. Other variables—PSN, household cleanliness, and water storage—showed no statistical significance but remain epidemiologically relevant. These findings indicate that behavioral factors, particularly knowledge and indoor clothing practices, play a central role in influencing dengue transmission in endemic regions. The study underscores the importance of integrated health education and behavior-focused interventions in dengue prevention strategies.

Keywords: *Dengue Hemorrhagic Fever; vector control; indoor clothing; logistic regression amd community behavior.*

I. INTRODUCTION

Dengue Hemorrhagic Fever (DHF) continues to be a persistent public health issue in tropical regions, with Indonesia among the countries facing recurring outbreaks. The global rise in dengue cases has prompted health authorities to adopt multi-faceted prevention strategies. In 2023 alone, WHO recorded over 6 million cases globally, highlighting the growing urgency of the disease, especially in densely populated and environmentally vulnerable regions. In Indonesia, the Ministry of Health reported more than 114,000 cases and nearly 900 deaths in 2023. Locally, in North Sulawesi, 1,120 cases with 10 deaths were recorded, while South Minahasa Regency reported 123 cases in the same year. The Tumpaan Health Center has consistently ranked among the top three contributors to case numbers in the region. DHF transmission is influenced not only by environmental conditions but also by community behaviors and awareness levels.

Epidemiological frameworks emphasize the interaction between host, agent, environment, and vector—the so-called “epidemiologic triad.” In the context of dengue, factors such as population density, stagnant water, poor sanitation, and behavioral habits—such as hanging used clothes indoors—are known to significantly increase risk. While national and international studies have examined climate, vector dynamics, and preventive behaviors, specific research in the Tumpaan region has remained limited. Yet, understanding localized factors is critical, given the variation in community practices, environmental settings, and access to health services.This study investigates the factors influencing the incidence of dengue in the Tumpaan Health Center's service area, focusing on five key variables: public knowledge about dengue, household sanitation, vector breeding environments (water containers), the practice of hanging clothes indoors, and community mosquito eradication efforts (PSN/3M). A case-control design was adopted, using structured questionnaires, and statistical analyses such as Chi-Square and logistic regression were employed to identify significant determinants of DHF risk.

II. METHODS

To ensure accurate identification of key factors contributing to dengue fever incidence, this study adopted an epidemiologically grounded, quantitative approach. The selected research design and analysis methods align with public health standards for observational studies, allowing investigation without manipulation of variables. Data collection instruments were structured to minimize bias and maximize

comparability between case and control groups. A case-control model was chosen due to its suitability for identifying associations between exposure and disease outcomes within a defined population. Behavioral and environmental variables were measured using standardized instruments, while analytical procedures included both bivariate and multivariate techniques to ensure statistical robustness. All respondents were selected using clearly defined inclusion and exclusion criteria, ensuring a balanced representation across case and control groups.

Study Design

This study utilized an analytic observational design with a case-control approach, matching one control to each case (1:1). A total of 88 respondents were selected—44 confirmed dengue cases (NS1/IgM/IgG-positive) and 44 non-dengue controls (negative on the same lab tests but exhibiting similar symptoms).

Study Site and Duration

The research was conducted at Puskesmas Tumpaan, South Minahasa Regency, over a two-month period (May–June 2025).

Population and Sampling

The population consisted of all patients tested for dengue at the Puskesmas during the study window. Sampling employed a total sampling technique under a matching model, pairing each confirmed case with a control based on similar exposure windows and demographic conditions.

Inclusion Criteria:

- Cases: Individuals testing positive for DBD via NS1, IgM, or IgG lab results.
- Controls: Individuals with negative lab results but similar febrile symptoms.

Variables

- Dependent Variable: Incidence of dengue hemorrhagic fever (DBD).
- Independent Variables: Knowledge of DBD, mosquito nest eradication practices (PSN), the habit of hanging clothes indoors, household cleanliness, and water storage conditions.

Data Collection

Structured questionnaires were used as instruments, administered via direct interviews. The instruments were validated and pre-tested. Knowledge scores were calculated based on six-point scales, with cutoffs distinguishing "Good" vs "Poor" knowledge. Similarly, PSN efforts and cleanliness were scored based on respondent practices. The presence or absence of specific habits (e.g., hanging clothes indoors) was measured categorically.

Statistical Analysis

Data were analyzed in two stages:

- Bivariate analysis: Performed using the Chi-Square test to evaluate associations between each independent variable and DBD incidence.
- Multivariate analysis: Conducted using logistic regression to identify dominant risk factors, controlling for potential confounders.

The strength of associations was expressed through odds ratios (OR) and 95% confidence intervals (CI). Significance was set at $p < 0.05$.

III. RESULT AND DISCUSSION

Dengue Hemorrhagic Fever (DHF) is influenced by a combination of behavioral, environmental, and socio-economic factors. This study aims to elucidate which among these have the strongest statistical association with dengue incidence in Tumpaan Health Center, South Minahasa. Five key variables were investigated: public knowledge of DHF, household vector control practices (PSN), the habit of hanging clothes indoors, home cleanliness, and water storage conditions. The study population consisted of 88 participants: 44 lab-confirmed dengue cases and 44 matched controls. Data were analyzed using bivariate and multivariate methods to evaluate significant predictors of disease risk. Results are organized into major variable categories below.

Knowledge about DHF

Analysis revealed that poor knowledge about DHF transmission and prevention is strongly associated with disease incidence. Respondents categorized as having "less knowledge" were significantly more likely to be in the case group (OR = 0.27; 95% CI = 0.09–0.76; p = 0.013). These findings align with studies highlighting that awareness about mosquito behavior, symptom recognition, and vector habitats directly influences community-level prevention effectiveness. Education campaigns must emphasize behavioral reinforcement in addition to information delivery.

Clothing Habits Indoors

Among all behavioral variables, the habit of hanging clothes indoors showed the strongest association with DHF incidence. Respondents who practiced indoor drying of clothes were nearly 7 times more likely to contract DHF (OR = 0.15; 95% CI = 0.05–0.41; p = 0.000). Aedes aegypti mosquitoes prefer dark, humid environments to rest, and hanging clothes serve as an ideal resting surface. This behavioral factor has been overlooked in traditional health promotion yet has proven to be critical in vector exposure reduction.

Vector Control Efforts (PSN)

Efforts to eliminate mosquito breeding sites through the 3M Plus approach (Menguras, Menutup, Mendaur ulang) were measured via questionnaire. Although PSN practices were not significantly associated in bivariate analysis, logistic regression suggested a protective trend among households who routinely conducted mosquito control activities. Nonetheless, statistical significance was not reached (p > 0.05), suggesting inconsistency in implementation.Future intervention strategies must not only promote PSN but also ensure continuity and community-level monitoring for effectiveness.

Water Storage Practices

Although water storage containers (such as bathtubs, drums, or buckets) are commonly known breeding sites for Aedes larvae, this variable did not show significant association with disease risk in this population (OR = 0.68; p = 0.492). This may reflect a relatively high adoption of closed water storage or larvicide use in the study area. However, environmental monitoring remains essential, as even small uncovered containers can lead to local outbreaks.

Household Cleanliness

Cleanliness of the home environment—especially regarding waste disposal, clutter, and stagnant water—was evaluated through structured observation and self-reports. While descriptive statistics indicated that most DHF-positive respondents had poorer sanitation scores, the variable did not reach statistical significance in regression models. Nevertheless, this trend reinforces findings from WHO and national health reports that environmental sanitation plays a key role in reducing vector density and limiting exposure.

Summary of Multivariate Results

Variable	p-value	Odds Ratio (OR)	95% Confidence Interval
Knowledge about DHF	0.013	0.27	0.09–0.76
Hanging clothes indoors	0.000	0.15	0.05–0.41
Vector control (PSN)	>0.05	–	–
Water storage conditions	0.492	0.68	Not significant
Household cleanliness	>0.05	–	Not significant

IV. CONCLUSION

The findings of this study highlight the significant role of community knowledge and behavioral practices in the incidence of Dengue Hemorrhagic Fever (DHF) in the working area of Puskesmas Tumpaan, South Minahasa. The case-control approach, supported by quantitative analysis, revealed that two key factors—limited public knowledge of DHF and the habit of hanging clothes indoors—were significantly associated with higher disease risk.While other factors such as vector control efforts (PSN), household cleanliness, and water storage conditions did not demonstrate statistically significant associations in multivariate models, they remain epidemiologically relevant and warrant continued focus in public health interventions.

The results affirm that behavioral and environmental elements are interlinked in vector-borne disease transmission, and that socio-behavioral education must accompany technical vector control measures. Ensuring accurate community understanding of mosquito behavior, alongside discouraging high-risk practices such as indoor clothing storage, could greatly improve prevention outcomes.In conclusion, this study contributes valuable insight for public health practitioners, especially in endemic regions. The findings support the development of more targeted, behaviorally driven education and prevention campaigns. Future studies may expand this work by incorporating environmental assessments and exploring longitudinal impacts of behavior change on dengue incidence.

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