Biomedical Journal of Indonesia
Journal Homepage: https://bji-fk.ejournal.unsri.ac.id

Determinant Factors Influencing Malaria Incidence in an Endemic Area of Sumbawa, Indonesia

Herni Hasifah[1*], Nikodimus Margo Rinengggantyas[2],

[1]Program of Public Health, STIKES Griya Husada Sumbawa, Sumbawa, Indonesia
[2]Program of Nursing, STIKES Griya Husada Sumbawa, Sumbawa, Indonesia

ARTICLE INFO

Keywords:
Endemic area
Knowledge
Malaria
Perception
Preventive behaviour

Corresponding author:
Herni Hasifah
E-mail address:
yenihasifah@gmail.com

All authors have reviewed and approved the final version of the manuscript.

https://doi.org/10.32539/BJI.v11i3.276

Received 15 July 2025;
Accepted 8 August 2025

ABSTRACT

Introduction. Indonesia still records the incidence of malaria every year, as several malaria cases still occur in the country. Contributing factors and community aspects have a noteworthy effect on any malaria elimination activities. **Methods**. This study is a correlational study with a cross-sectional time approach. The population in this study were 59 respondents in Ropang sub-district, Sumbawa. The sampling technique used was simple random sampling. Bivariate analysis of statistical tests used was logistic regression. **Results.** There are two variables that have a significant effect on the incidence of malaria, namely knowledge and preventive behavior. The knowledge variable had a significance value of 0.019 ($p < 0.05$), and an odds ratio value of 0.235. The preventive behavior variable also showed a significant influence on malaria incidence with a significance value of 0.008 ($p < 0.05$). Meanwhile, the perception variable did not show a significant effect on the incidence of malaria, with a significance value of 0.359 ($p > 0.05$). **Conclusion.** The results of this study showed that knowledge and preventive behavior had a significant effect on the incidence of malaria in respondents, while perception did not show a statistically significant relationship. These findings provide a new contribution to the understanding of the determinants of malaria prevention behavior in the study area.

1. Introduction

Malaria is an infectious disease caused by the Plasmodium parasite and transmitted through the bite of infected Anopheles mosquitoes.[1] Malaria can cause a decrease in work productivity and even cause death, especially in high-risk groups, namely infants, children under five, pregnant women.[2] Although global malaria control strategies continue to advance, the persistence of malaria in certain endemic areas points to the need for localized behavioral interventions.

Malaria control efforts are increasingly directed toward enhancing community-based interventions, particularly by strengthening public knowledge, shaping positive perceptions, and promoting preventive behaviors.[3] These behavioral aspects are critical to ensuring the effectiveness and sustainability of malaria prevention programs in endemic areas.[4] However, the success of these strategies is often undermined by human factors, including community knowledge, perception, and behavior regarding malaria prevention.[5] Human factors, particularly insufficient knowledge, negative perceptions, and poor preventive behavior within communities, remain key barriers to the successful implementation of malaria control strategies.[6]

Behavioral and social factors continue to be instrumental in the perpetuation of malaria transmission, in addition to biomedical and technical obstacles.[7] Limited knowledge about malaria transmission, low risk perception, and inadequate adoption of preventive practices remains widespread in many endemic regions.[8] Communities with poor awareness are less likely to engage in effective prevention measures, such as consistent use of mosquito nets or seeking prompt treatment.[9] These behavioral determinants represent critical gaps that must be addressed to achieve malaria elimination, especially in geographically isolated or high-mobility populations.

Indonesia still faces a high burden of malaria. In West Nusa Tenggara (NTB) province, malaria cases are still found, including in Sumbawa district. Sumbawa district is one of the malaria endemic areas

and is the focus of the malaria elimination program. The Sumbawa District Health Office report in 2025 showed that there were 10 sub-districts that still reported malaria cases, with Ropang sub-district having the highest number of cases with 20 cases. The results of entomological surveillance show that the Anopheles mosquito population in Ropang Sub-district is increasingly difficult to control with commonly used insecticides, and is exacerbated by the geographical condition of the forest which is a community mining location where community mobility is very high. The dynamics of malaria transmission describes the pattern of spread of this disease in an area based on epidemiological or ecological conditions. This pattern is influenced by the presence of patients as a source of infection, as well as various other risk factors, in this case environmental factors that are analyzed spatially.[10]

A low level of education is the cause of a lack of knowledge so that understanding of malaria eradication is also lacking. This condition causes poor community action in malaria eradication or disease prevention behavior.[11] The poor knowledge and perceptions about malaria lead to incorrect behavior in efforts to prevent malaria transmission. The various components of preventive behavior include the use of mosquito repellent, the use of mosquito nets when sleeping, the use of wire mesh in home ventilation, reducing going out at night, keeping the house clean, and draining stagnant water .[12]

Previous studies in Indonesia have shown that poor understanding of malaria transmission is associated with low compliance with preventive measures, such as sleeping under mosquito nets and seeking early treatment. For example, studies in Papua and East Nusa Tenggara linked low knowledge to delayed diagnosis and treatment behaviors.[13,14] Despite the existence of government-supported programs, there remains limited evidence from Sumbawa District on how knowledge, perception, and preventive behaviors influence malaria incidence. This gap is critical, considering the high mobility and ecological vulnerability of forest-fringe communities in endemic areas like Ropang.

A person's health depends on the interaction between host, agent and environment. Environmental factors, behavior, knowledge and health services affect the high number of malaria cases in Indonesia. Mobility factors, especially from non-endemic areas to malaria endemic areas, can also affect the spread of malaria. In addition to the environment, which plays a major role as a factor affecting the breeding and breeding grounds of the Anopheles mosquito, there are other factors that can influence the spread of malaria.[15]

Previous studies have shown that limited community knowledge about malaria transmission often leads to poor adoption of preventive measures such as sleeping under mosquito nets or seeking timely treatment.[16] Research in other endemic areas has found that community perceptions about the severity and risk of malaria significantly influence individual and household-level prevention behaviors.[17] Several studies have highlighted that behavioral factor, rather than access to health services alone, play a crucial role in determining malaria incidence in rural and high-risk communities.[18]

Despite extensive malaria control efforts in Indonesia, there remains a lack of locally grounded research that explores the behavioral dimensions of malaria transmission, particularly in geographically remote and ecologically complex regions such as Sumbawa. Most previous studies have predominantly focused on biomedical and vector control interventions, with limited attention to how community-level knowledge, perceptions, and preventive behaviors influence malaria incidence.[16,11] This study addresses that gap by examining behavioral determinants in a high-risk, high-mobility setting where traditional vector control measures may be insufficient. The novelty of this research lies in its focus on integrating community behavioral insights into malaria prevention strategies, offering a more contextualized understanding of how human factors contribute to sustained transmission in endemic rural areas.

The purpose of this study was to determine the factors affecting malaria in communities living in endemic areas of Sumbawa based on knowledge, community perceptions, and preventive behavior towards malaria incidence.

2. Methods

This study employed a descriptive observational approach with a cross-sectional design to identify behavioral determinants influencing malaria prevention practices in endemic areas of Sumbawa Regency, Indonesia. The research aimed to examine factors affecting malaria incidence based on knowledge, perception, and preventive behavior. Data collection was conducted in Ropang District—one of the subdistricts with the highest malaria incidence—between May and June 2025. A total of 59 respondents were selected through simple random sampling from the local community, of whom 27 had a prior history of malaria.

Prior to data collection, the study obtained ethical approval from the Health Research Ethics Committee of STIKES Griya Husada Sumbawa under ethical clearance number 83/LPPM/S.GHS/V/2025. Written informed consent was obtained from all participants after they received a detailed explanation of the study objectives, the voluntary nature of participation, and the assurance of no physical or psychological risks.

Primary data were collected using a structured questionnaire and direct observation sheets. The questionnaire was developed based on a literature review and relevant guidelines from the Indonesian Ministry of Health and the World Health Organization

(WHO).[19–21] Knowledge (10 items) assessed respondents' understanding of malaria causes, transmission, symptoms, treatment, and prevention. Responses were dichotomous ("correct" = 1, "incorrect" = 0), and the total score was categorized into "good" (≥ 80% correct answers) and "poor" (< 80% correct answers). Perception (8 items) measured beliefs about susceptibility, severity, benefits, and barriers to malaria prevention using a 4-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree). The summed score was categorized into "positive" and "negative" perception based on a cut-off point determined by the median score. Preventive behavior (10 items) evaluated the frequency of preventive practices such as using insecticide-treated bed nets, seeking prompt treatment, and participating in vector control programs. Responses were rated as "always" (4), "often" (3), "sometimes" (2), or "never" (1), and categorized into "good" and "poor" preventive behavior using the median score as a cut-off.

To ensure the quality of the research instrument, content validity was assessed by three public health experts specializing in malaria and behavioral sciences. The content validity index (CVI) for each item ranged from 0.83 to 1.00, and only items with a CVI ≥ 0.80 were retained. Reliability testing was conducted through a pilot study involving 15 respondents with similar characteristics from a neighboring village. The overall Cronbach's alpha was 0.78, indicating acceptable internal consistency, with subscale values of 0.76 for knowledge, 0.80 for perception, and 0.78 for preventive behavior.

Data analysis was performed using IBM SPSS Statistics version 29.0. Univariate analysis was applied to describe the distribution of each variable. For bivariate analysis, the chi-square test was employed because both dependent (malaria incidence: yes/no) and independent variables (knowledge, perception, and preventive behavior categories) were categorical. Variables with p-values < 0.25 in the bivariate analysis were included in a multivariate logistic regression model to identify determinant factors, with statistical significance set at $p < 0.05$.

3. Results

Table 1 showed the descriptive data from 59 respondents, the majority were female, namely 42 people (71.2%), while 17 people (28.8%) were male. When viewed from the age group, most respondents were over 35 years old, namely 38 people (64.4%), and the remaining 21 people (35.6%) were under 35 years old. In terms of education, the highest proportion came from elementary school and senior high school graduates, each totaling 20 people (33.9%). There were only 2 respondents (3.4%) who had never attended school and 2 respondents who worked as honorary workers. Meanwhile, 7 respondents (11.9%) were university graduates, and 10 respondents (16.9%) were junior high school graduates. Most respondents worked as farmers, as many as 38 people (64.4%). Other occupations that were also quite dominant were housewives, totaling 13 people (22.0%). Other respondents worked as civil servants (8.5%), self-employed (1.7%), and honorary (3.4%). Regarding experience with malaria infection, the majority of respondents stated that they had never suffered from malaria, namely 32 people (54.2%). There were 27 respondents (45.7%) who had experienced malaria.

Table 1. Descriptive data of respondents

Descriptive Data of Respondents	Number (n)	Percentage (%)
Gender		
Male	17	28.8
Female	42	71.2
Age (years old)		
< 35	21	35.6
>35 tahun	38	64.4
Education		
No School	2	3.4
Elementary	20	33.9
Junior High	10	16.9
High School	20	33.9
University	7	11.9
Occupation of Respondent		
Housewife	13	22.0
Farmer	38	64.4
Self-employed	1	1.7
Civil Servant	5	8.5
Honorer	2	3.4
Experience with Malaria		
Never had Malaria	32	54.2
Had Malaria	27	45.7
Total	**59**	**100**

Table 2. Results of logistic regression data analysis

Variable	*B (coefficient)*	*S.E (error)*	*Sig. p value*	*Odds Ratio*
Knowledge	-1.45	0.62	0.019	0.235
Perception	-0.55	0.60	0.359	0.576
Preventive Behavior	-1.70	0.64	0.008	0.183
Constant	1.20	0.58	0.039	3.320

The results of logistic regression analysis showed in Table 2. There are two variables that have a significant effect on the incidence of malaria, namely knowledge and preventive behavior. The knowledge variable has a regression coefficient (B) of -1.45 with a significance value of 0.019 ($p < 0.05$), and an odds ratio value of 0.235. This shows that respondents with a good level of knowledge have a 76.5% lower chance of experiencing malaria compared to respondents who have less knowledge (1 - 0.235 = 0.765).

Preventive behavior variables also showed a significant influence on malaria incidence with a coefficient value of -1.70 and a significance value of 0.008 ($p < 0.05$). The odds ratio value of 0.183 indicates that respondents who have good prevention behavior have an 81.7% lower chance of experiencing malaria than those who do not take precautions.

Meanwhile, the perception variable did not show a significant effect on malaria incidence, with a coefficient value of -0.55 and a significance value of 0.359 ($p > 0.05$). The odds ratio value of 0.576 indicates that statistically, respondents' perceptions do not make a significant contribution in influencing malaria incidence in this model.

The constant value in the model of 1.20 with a significance value of 0.039 indicates that if all independent variables are zero, the log odds of malaria incidence still have a basic effect.

Knowledge was shown to have a significant relationship with malaria incidence with a p value = 0.019 and an odds ratio of 0.235. Preventive behavior was also found to have a significant influence on malaria incidence with a p value = 0.008 and an odds ratio of 0.183. The findings of this study for the perception variable did not show a significant association (p = 0.359) with malaria incidence.

4. Discussion

The results of this study showed that the variables of knowledge and preventive behavior had a significant effect on the incidence of malaria in respondents, while perception did not show a statistically significant relationship. These findings contribute to the understanding of the determinants of malaria prevention behavior in endemic areas.

Respondents with good knowledge about malaria tend to have a lower risk of being infected. The research findings show that sufficient knowledge about how malaria is transmitted, symptoms, and prevention is positively correlated with preventive actions taken by the community. Good knowledge tends to trigger vigilance and compliance in implementing preventive measures such as the use of mosquito nets, draining water reservoirs, and early examination to health facilities. This finding is in line with a previous study by Athalia which stated that most respondents already understood the definition of malaria which is an infectious disease transmitted through the bite of Anopheles mosquitoes, knew how to prevent it such as maintaining environmental hygiene and using mosquito nets, and the importance of early treatment of malaria sufferers.[22]

Individuals who actively take preventive measures are less likely to be infected. These results strengthen the Health Belief Model theory which states that health behavior is determined by perceptions of disease threat and beliefs in the effectiveness of preventive measures. One theory that can describe health actions is the Health Belief Model. The Health Belief Model is a theory of health behavior change and a psychological model used to predict health behavior by focusing on an individual's perceptions and beliefs about a disease.[23] The findings of this study indicate that respondents who have good preventive behaviors such as the use of mosquito repellent, maintaining environmental hygiene, and using mosquito nets, are more protected from malaria infection. This is in line with research stating that prevention efforts such as clearing standing water, managing waste properly, and planting mosquito repellent plants can help reduce the risk of malaria transmission. Poor environmental sanitation can also increase the risk of malaria transmission.[24] Consistent preventive actions led to lower incidence of malaria.[25]

Good prevention and treatment-seeking attitudes at the time of malaria incidence indicate that the community's understanding to immediately take preventive measures in accordance with what is conveyed by health workers and other information media, as well. Good behavior can occur because of experiences gained by a person and environmental factors both physical and non-physical. Then the experience and environment are known, perceived and believed to cause motivation, intention to act and finally the manifestation of the intention in the form of behavior.[15,26]

The perception variable did not show a statistically significant relationship with malaria incidence (p = 0.359). One possible explanation is that while individuals may perceive malaria as a serious illness, this perception does not necessarily translate into preventive behavior unless supported by adequate knowledge or behavioral motivation. Additionally, the perception scale used in this study

may not have fully captured the multidimensional aspects of perceived risk, severity, and self-efficacy.[27] Cultural and contextual factors may also play a role; in some communities, malaria is considered a "common" or seasonal disease, potentially reducing the sense of urgency despite awareness.[28] This is supported by prior qualitative studies in Indonesia and Sub-Saharan Africa, which note that normalization of malaria in endemic areas weakens individual motivation for consistent prevention.[29,30]

This study's strength lies in its approach of combining the analysis of individual behavior with actual malaria incidence, which allows for the identification of key factors that can inform community-based interventions. Additionally, logistic regression analysis provides a deeper understanding of each variable's contribution to malaria incidence risk. However, this study has some limitations. First, the small sample size (n = 59) limits the generalizability of the results to a larger population. Additionally, psychosocial variables, such as the role of health workers and community leaders, have not been examined. Therefore, further studies using a mixed-methods approach are needed to strengthen the evidence and more comprehensively explore the dynamics of malaria prevention behavior.

The implication of findings of this study highlights the importance of targeted health education interventions in malaria-endemic areas. Tailored health education programs that are culturally sensitive and locally relevant are crucial to enhance public knowledge and promote effective preventive behaviors.[31] Health promotion strategies should be designed to address specific gaps in community awareness, particularly among populations with limited access to formal education or health services.[32] In addition, integrating malaria prevention education into existing community health frameworks such as Posyandu activities or village health posts may increase coverage and sustainability.[33] Policymakers and public health officials are encouraged to allocate resources and training that empower local health workers to deliver consistent and practical malaria education, especially in remote or underserved regions.[34]

In summary, this study underscores the importance of educational interventions that aim to increase knowledge and empower communities to prevent malaria. These findings can inform the planning of community health programs in endemic areas, particularly those that take a participatory and contextual approach.

5. Conclusion

This study can be concluded that the factors of knowledge and preventive behavior are variables that affect the incidence of malaria from the community aspect. Regular and continuous education efforts can be a key factor so that people have efforts to prevent malaria even though they are in endemic areas. Future research could integrate not only aspects of the community but also aspects of stakeholders, including environmental factors for Malaria prevention strategies.

6. Author Contribution

HH conceived the study idea, participated in study design, data acquisition, analysis and interpretation. NMR participated in manuscript drafting and revision. All authors read and approved the final manuscript.

7. Acknowledgements

The authors would like to thank the respondents who voluntarily answered the questionnaire and agreed to be observed. We also thank the Ministry of Research, Technology and Higher Education for providing funding for this research through the *Penelitian Dosen Pemula* Schema (PDP).

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