

Factors Associated with Malaria Relapse among Patients in the Halilulik Community Health Center Catchment Area, Belu Regency, Indonesia

Izak Freitas¹, Maria Adolfina Rafu², Bahrul Ilmi³, Adwianty Barra⁴, Umi Aniroh⁵

¹Bachelor Nursing Program, Universitas Ngudi Waluyo, izakfreitas90@gmail.com

²Bachelor Nursing Program, Universitas Ngudi Waluyo, norarafu91@gmail.com

³Bachelor Nursing Program, Universitas Ngudi Waluyo, bahrulilmi.imi@gmail.com

⁴Bachelor Nursing Program, Universitas Ngudi Waluyo, adwiantybarra@gmail.com

⁵Bachelor Nursing Program, Universitas Ngudi Waluyo, umianiroh1@gmail.com

Email Correspondence: izakfreitas90@gmail.com

Article Info	Abstract
Article History Submitted, 2026-05-13 Accepted, 2026-06-24 Published, 2026-06-30	Malaria remains a major global public health concern, particularly in tropical regions. Indonesia is among the malaria-endemic countries, recording approximately 443,530 cases, with around 89% of confirmed infections originating from Papua Province. This high burden is influenced by environmental conditions that support mosquito breeding, as well as the ability of the parasite to remain dormant in the body when treatment is incomplete or improperly followed, leading to malaria recurrence. This study aimed to identify factors associated with malaria relapse among patients in the working area of Halilulik Community Health Center, Belu Regency. An analytic study with a cross-sectional approach was employed, and data were collected through questionnaires. A total of 27 respondents who met the inclusion criteria were included in this study using a total sampling technique. Data were collected through structured epidemiological investigation forms and analyzed using the Chi-square test and Fisher’s Exact Test where appropriate. Accidental sampling technique. Data from epidemiological investigation forms were analyzed statistically using the chi-square test. The findings showed that age (p = 0.413), occupation (p = 0.224), and nutritional status (p = 0.131) were not significantly associated with malaria relapse. In contrast, gender was found to have a significant relationship with relapse (p = 0.049). Furthermore, education level (p = 0.000) and medication adherence (p = 0.001) were identified as significant factors related to malaria recurrence. Education appeared to play a dominant role, as it influences understanding of disease management, which may contribute to parasite dormancy in the body, repeated relapse episodes, and potential drug resistance when treatment is not properly followed. In conclusion, gender, education level, and medication adherence showed significant associations with malaria recurrence among patients in the working area of Halilulik Community Health Center.
Keywords: Malaria relapse, education level, medication adherence, malaria control	

Introduction

Malaria is a life-threatening infectious disease that remains a major global health problem, particularly in tropical and subtropical regions. According to the World Health Organization (WHO), malaria is caused by Plasmodium parasites and is transmitted to humans through the bite of infected female Anopheles mosquitoes, with clinical manifestations ranging from mild symptoms such as fever, chills, and headache to severe conditions including seizures, confusion, respiratory distress, and even death. Although malaria is preventable and treatable, it continues to cause a significant burden worldwide, especially in vulnerable populations. The WHO Global Malaria Report 2024 highlights that in 2024 there were approximately 282 million malaria cases and 610,000 deaths across 80 countries, with the African Region accounting for about 95% of both cases and deaths, and children under five contributing nearly 75% of mortality. These data illustrate that malaria remains a critical public health issue requiring continuous control efforts (WHO, 2024).

In Indonesia, malaria is still considered an endemic disease. National data report hundreds of thousands of cases, with the majority concentrated in Papua Province, reflecting persistent

transmission in high-risk areas (Ministry of Health RI, 2022). In addition, East Nusa Tenggara Province remains one of the regions with a high malaria burden, recording thousands of cases annually, including 4,315 cases in 2025, with certain districts contributing the highest proportions (BPS NTT, 2025). Belu Regency is located in East Nusa Tenggara Province, Indonesia, and directly borders Timor-Leste. This geographical position makes Belu a strategic transit area with high population mobility, which increases the risk of imported malaria cases. The study was conducted in the service area of Halilulik Community Health Center because it reported the highest number of malaria cases in Belu Regency in 2025, accounting for 27 out of 64 reported cases. In addition, a substantial proportion of patients had a history of working in malaria-endemic regions, particularly Papua, making this area highly relevant for investigating factors associated with malaria relapse (Ministry of Health RI, 2022).

The persistence of malaria cases in areas declared malaria-free is often associated with imported infections and relapse cases. Literature explains that relapse may occur due to the persistence of dormant parasites in the liver when treatment is incomplete or not fully effective, leading to reactivation of infection in the body (Sunita et al., 2024). At Halilulik Health Center, the number of imported relapse cases increased significantly from 3 cases in 2024 to 27 cases in 2025, indicating a worsening trend. Preliminary observations conducted by the researchers in Salore Hamlet on March 19, 2026, and records from Halilulik Community Health Center indicated that several relapse cases occurred among individuals who had previously worked in malaria-endemic areas such as Timika, Papua, particularly in mining-related occupations. Furthermore, health records suggested that some patients did not complete the prescribed antimalarial treatment regimen. These findings indicate the potential contribution of population mobility, occupational exposure, and treatment adherence to malaria relapse.

Based on this background, this study aims to analyze the factors associated with malaria relapse among patients living in the service area of Halilulik Health Center, Belu Regency. The findings of this study are expected to contribute theoretically to the development of malaria relapse literature and practically as input for health workers in strengthening prevention and control strategies, particularly in high-mobility populations. Previous studies have emphasized that malaria control requires not only vector management, but also patient compliance and monitoring of high-risk populations to prevent recurrence and re-establishment of transmission in areas approaching elimination status (Sunita et al., 2024). This evidence provides an important basis for the present study, as it helps explain the underlying rationale for further exploration of the issue.

Methods

This study employed an analytical approach using a cross-sectional design to examine the research problem at a specific point in time. The population consisted of 27 respondents, and a total sampling technique was applied to include all eligible participants in the study. Data were collected through patient interviews using a structured epidemiological investigation form designed for malaria cases. The collected data were then processed and analyzed statistically using the Chi-square test to determine the relationship between variables.

Results and Discussion

Table 1. Distribution of Respondents According to Age, Gender, Education, Occupation, Nutritional Status, Medication Adherence, and Malaria Recurrence

No	Characteristic	Category	Relapsed n (%)	Not Relapsed n (%)	Total (f)	Total (%)	p- value
1	Age	> 20 years	12 (70.6)	5 (29.4)	17	63	0.413
		< 20 years	5 (50.0)	5 (50.0)	10	37	
2	Gender	Male	16 (72.7)	6 (27.3)	22	81	0.049
		Female	1 (20.0)	4 (80.0)	5	19	
3	Education	Elementary / Junior High	16 (88.9)	2 (11.1)	18	67	0.000
		Senior High School	1 (11.1)	8 (88.9)	9	33	
4	Occupation	Risk	13 (72.2)	5 (27.8)	18	67	0,224
		Less Risk	4 (44.4)	5 (55.6)	9	33	
5	Nutritional Status	Risk	17 (68.0)	8 (32.0)	25	93	0,131
		Not at Risk	0 (0.0)	2 (100)	2	7	
6	Medication Adherence	Non-compliant	14 (93.3)	1 (6.7)	15	56	0.001
		Compliant	3 (25.0)	9 (75.0)	12	44	
Total			17 (63.0)	10 (37.0)	27	100	

Table 1 shows that the majority of respondents were aged over 20 years (63%), male (81%), and had an elementary or junior high school educational background (67%). Most respondents also worked in high-risk occupations (67%) and had poor nutritional status (93%). In terms of treatment behavior, more than half of the respondents were categorized as non-compliant with malaria medication (56%). Overall, 63% of respondents experienced malaria recurrence, while 37% did not experience recurrence. These findings indicate that the study population was dominated by productive-age males with relatively low educational attainment and high occupational exposure to malaria transmission. Individuals in productive age groups are generally more active outside the home, increasing the possibility of contact with mosquito vectors. Furthermore, limited educational attainment may restrict individuals' understanding of malaria prevention and the importance of completing treatment. High-risk occupations combined with poor nutritional status may also contribute to reduced immune resistance and increased susceptibility to recurrent infection. According to (Kemismar et al., 2022), adults are more vulnerable to malaria exposure because of higher mobility and work-related activities. Safi et al. (2024) also reported that occupational exposure, especially outdoor work activities, significantly increases the risk of contact with malaria-transmitting mosquitoes. In addition, poor nutritional status may weaken immune response and reduce the body's ability to fight infection effectively, although recurrence is also influenced by treatment-related factors such as medication adherence.

Respondents aged above 20 years experienced a higher proportion of malaria recurrence (70.6%) compared to respondents aged below 20 years (50.0%). Among respondents aged over 20 years, 12 individuals experienced recurrence while 5 respondents did not relapse. In contrast, among younger respondents, the proportion between recurrence and non-recurrence was balanced. However, the statistical analysis demonstrated that age was not significantly associated with malaria recurrence, with a p-value of 0.413. Although malaria recurrence was numerically more frequent among adults, age alone cannot be considered a determining factor for malaria recurrence. Malaria risk is multifactorial and is strongly influenced by human exposure patterns rather than demographic characteristics alone. Evidence from previous studies shows that increased malaria exposure in adults is associated with behavioral and occupational factors such as mobility, work-related travel, and frequent outdoor activities during evening and nighttime hours when *Anopheles* mosquitoes are most active. These conditions increase the likelihood of repeated exposure to malaria vectors regardless of age group (Abdalal et al., 2023).

Human mobility and occupational exposure have been identified as important drivers of malaria transmission, particularly in populations engaged in outdoor work or frequent movement across endemic areas, which increases contact with infected mosquito vectors (Hast et al., 2022). Nevertheless, other factors such as immunity, treatment adherence, environmental conditions, and preventive behavior may play a more important role in determining recurrence outcomes. Safi et al. (2024) explained that productive-age individuals tend to have greater exposure to mosquito bites because of work-related activities, while Kemismar et al. (2022) highlighted that recurrence is not solely dependent on age but also on behavioral and environmental risk factors. Therefore, the absence of a significant relationship in this study suggests that malaria recurrence is multifactorial and cannot be explained by age differences alone.

Male respondents had a substantially higher recurrence rate (72.7%) compared to female respondents (20.0%). Among the respondents, malaria recurrence was more frequently observed in male participants compared to female participants. In the male group, 16 individuals experienced recurrence while 6 did not. In contrast, only 1 female participant experienced recurrence, whereas 4 did not experience recurrence. The statistical test demonstrated a significant relationship between gender and malaria recurrence, with a p-value of 0.049. This finding suggests that gender is an important factor influencing malaria recurrence patterns in the study population. Male respondents are generally more involved in outdoor occupations and nighttime activities such as fishing, farming, trading, or other work-related tasks that increase exposure to *Anopheles* mosquito bites. In contrast, females are more likely to remain indoors, thereby reducing direct exposure to malaria vectors. Behavioral and occupational differences between males and females likely contributed to the significant disparity observed in recurrence rates. Weripang et al. (2024) reported that men tend to engage more frequently in outdoor activities during nighttime, which increases their exposure to mosquito bites that transmit malaria. The study also explains that social and cultural roles may contribute to differences in preventive behaviors between men and women, particularly in the use of mosquito nets, protective clothing, and patterns of seeking early treatment. These behavioral differences suggest that gender-related factors play an important role in malaria recurrence in this study.

Among respondents with lower educational attainment (elementary and junior high school), the recurrence rate was considerably higher, accounting for 88.9%. In this group, 16 out of 18 respondents experienced recurrence, while only 2 did not. In contrast, respondents

with higher educational attainment (senior high school) showed a lower proportion of recurrence (11.1%). Of the 18 respondents with low educational levels, 16 experienced recurrence, while only 2 did not relapse. Conversely, among respondents with higher education, only 1 experienced recurrence and 8 respondents did not relapse. Statistical analysis revealed a highly significant relationship between education level and malaria recurrence, with a p-value of 0.000. This finding indicates that education plays a major role in influencing recurrence outcomes among malaria patients. Individuals with higher educational attainment are generally more capable of understanding health information, recognizing symptoms, following medical instructions, and completing prescribed treatment properly. In contrast, lower educational background may reduce awareness regarding the importance of medication adherence and malaria prevention practices. According to Notoatmodjo (2018), education affects individual knowledge, attitudes, and health behavior, including decision-making related to disease management. Weni et al. (2019) also emphasized that education contributes indirectly to treatment compliance by improving the ability to absorb and apply health information effectively. Therefore, respondents with lower educational levels may face greater challenges in understanding treatment regimens and preventive measures, which can increase the likelihood of malaria recurrence.

Respondents with high-risk occupations experienced a higher recurrence rate (72.2%) compared to respondents with lower-risk occupations (44.4%). Among respondents categorized in high-risk occupations, 13 experienced recurrence while 5 did not relapse. Meanwhile, among respondents with less risky occupations, recurrence occurred in 4 respondents and non-recurrence in 5 respondents. Despite these differences, statistical testing indicated that occupation was not significantly associated with malaria recurrence, with a p-value of 0.224. Occupational exposure alone is not sufficient to fully explain malaria recurrence patterns among respondents. Individuals engaged in occupations that involve frequent outdoor activities have a higher probability of exposure to *Anopheles* mosquito vectors, thereby increasing their risk of malaria infection. However, malaria recurrence is a multifactorial process that is not solely determined by exposure level. Evidence shows that recurrence is influenced by several interacting factors, including incomplete adherence to antimalarial treatment, pharmacological properties of antimalarial drugs, host immunity, and preventive behaviors such as the use of insecticide-treated bed nets and environmental control measures (World Health Organization, 2024). In particular, the World Health Organization emphasizes that effective malaria management requires early diagnosis and completion of full treatment regimens, as poor adherence can contribute to treatment failure and recurrent infection (World Health Organization, 2023). Furthermore, clinical evidence from systematic reviews indicates that reduced adherence to antimalarial therapy significantly increases the risk of recurrence compared to full adherence (Mehdipour et al., 2023). Oktafiani et al. (2022) explained that recurrence is strongly influenced by compliance with treatment regimens rather than occupation alone. Thus, although high-risk occupations may contribute to greater exposure, the absence of a statistically significant relationship in this study indicates that recurrence is influenced by multiple interacting factors beyond occupational status.

Respondents with poor nutritional status experienced a higher recurrence rate (68.0%), whereas none of the respondents with normal nutritional status experienced recurrence. Of the 25 respondents classified as nutritionally at risk, 17 experienced recurrence and 8 did not relapse. Meanwhile, among the 2 respondents with normal nutritional status, all respondents did not experience recurrence. However, statistical analysis showed no significant relationship between nutritional status and malaria recurrence, with a p-value of 0.131. Although poor nutritional conditions appeared to be associated with higher recurrence proportions, the relationship was not statistically meaningful in this study. Nutritional status is closely related to immune system function because inadequate nutrition can weaken the body's defense mechanisms against infectious diseases, including malaria (World Health Organization, 2023). Individuals with poor nutritional status tend to have lower resistance to parasitic infections and may experience slower recovery processes due to impaired immune response and reduced physiological capacity. However, malaria recurrence is not determined solely by nutritional status. Several other contributing factors include severity of infection, adherence to antimalarial treatment, repeated exposure in endemic areas, environmental conditions, and overall health status (World Health Organization, 2023). Flatby et al. (2023) explained that malnutrition can reduce immune response and increase susceptibility to infectious diseases. However, Nur et al. (2021) emphasized that the relationship between nutritional status and malaria recurrence is complex and affected by multiple biological and environmental variables. Therefore, although respondents with poor nutritional status showed higher recurrence proportions, nutrition alone could not be confirmed as an independent predictor of recurrence in this study.

Respondents who were non-compliant with malaria medication experienced a very high recurrence rate (93.3%), whereas respondents who adhered to medication had a much lower recurrence rate (25.0%). Among the 15 non-compliant respondents, 14 experienced recurrence

and only 1 did not relapse. In comparison, among the 12 compliant respondents, recurrence occurred in only 3 respondents while 9 respondents did not experience recurrence. Statistical analysis demonstrated a highly significant relationship between medication adherence and malaria recurrence, with a p-value of 0.001. This finding highlights medication adherence as one of the most important determinants of malaria recurrence in the study population. Failure to complete anti-malarial treatment may allow parasites to remain in the bloodstream or liver, increasing the possibility of relapse and repeated infection. Non-adherence to treatment is influenced by multiple factors such as limited knowledge, adverse drug effects, forgetfulness, and poor understanding of the necessity to complete the prescribed therapy regimen (World Health Organization, 2023). According to the Ministry of Health of Indonesia (2024), incomplete use of anti-malarial drugs can result in treatment failure and persistence of parasites within the body. Kemenkes RI (2023) also explained that inadequate drug concentrations caused by irregular medication intake may enable Plasmodium parasites to survive and adapt, ultimately leading to recurrent malaria episodes. Therefore, improving patient adherence to anti-malarial therapy is essential in reducing recurrence rates and supporting successful malaria control programs.

Table 2. Bivariate Analysis of Independent Variables with Malaria Recurrence

No	Variable	0.413
1	Age	0.049
2	Gender	0.000
3	Education	0.224
4	Occupation	0.131
5	Nutritional Status	0.001
6	Medication Adherence	0.413

Table 2 shows that gender, education, and medication adherence are significantly associated with malaria recurrence, while age, occupation, and nutritional status are not statistically significant. Overall, education and medication adherence emerge as the most influential factors. This aligns with Notoatmodjo (2018), who states that education affects health behavior and compliance. Similarly, Kemenkes RI (2024) emphasizes that adherence to treatment is essential in preventing malaria relapse, as incomplete therapy allows parasite survival and recurrence.

Conclusion and Recommendations

This study examined the relationship between several factors, namely age, gender, education, occupation, nutritional status, and medication adherence, with malaria recurrence among patients in the working area of Halilulik Health Center, Belu Regency. Overall, the analysis demonstrates that the objectives of the study were successfully achieved because the statistical tests were able to identify which factors significantly influenced malaria recurrence and which did not. The findings revealed that age, occupation, and nutritional status were not significantly associated with malaria recurrence, as indicated by p-values of 0.413, 0.224, and 0.131, respectively. These results suggest that although respondents with older age, high-risk occupations, and poor nutritional status tended to show higher recurrence proportions, these variables were not strong determinants of recurrence in this study population. In contrast, gender showed a statistically significant relationship with malaria recurrence ($p = 0.049$), indicating that male respondents were more likely to experience recurrence compared to female respondents. This condition is likely related to higher outdoor activity and occupational exposure among males, which increases the risk of contact with malaria vectors.

Among all examined variables, education level and medication adherence emerged as the most influential factors affecting malaria recurrence, with both variables showing the strongest association compared to other factors included in the analysis. Education level showed a highly significant association with malaria recurrence ($p = 0.000$), where respondents with lower educational backgrounds experienced substantially higher recurrence rates than those with higher education levels. Educational level is an important determinant in malaria prevention and treatment outcomes. Lower levels of education are associated with limited understanding of malaria transmission, treatment procedures, and the necessity of completing the full course of anti-malarial therapy, which may contribute to inadequate treatment completion and increased risk of recurrent infection (World Health Organization, 2023). Individuals with lower educational attainment may experience difficulties in comprehending medical instructions and preventive measures, thereby increasing the likelihood of incomplete adherence to prescribed therapy. Furthermore, medication adherence shows a statistically significant association with malaria recurrence ($p = 0.001$). Patients who do not adhere to anti-malarial treatment regimens have a higher risk of recurrence compared to those who complete therapy as prescribed. Incomplete, irregular, or premature discontinuation of anti-malarial medication may allow residual Plasmodium parasites to survive in the bloodstream or liver stages, which can

subsequently trigger relapse or recrudescence of infection (World Health Organization, 2023). Therefore, the factors that significantly influenced malaria recurrence in this study were gender, education level, and medication adherence, while age, occupation, and nutritional status were not proven to significantly influence recurrence.

Overall, the methods applied in this study were appropriate for addressing the research problem and effective in identifying important determinants of malaria recurrence. The findings emphasize that behavioral and educational factors play a greater role in recurrence compared to demographic or nutritional factors alone. Improving patient knowledge regarding malaria treatment and strengthening adherence to anti-malarial medication are essential strategies to reduce recurrence rates in endemic areas. Health education programs should focus on increasing public awareness regarding the importance of completing treatment regimens and preventing repeated exposure to mosquito bites. For future research, it is recommended to explore other possible contributing factors such as environmental sanitation, vector density, access to healthcare services, and community preventive behavior more comprehensively. These additional factors may provide a broader understanding of malaria recurrence and support the development of more effective malaria control interventions in endemic communities.

Acknowledgments

We acknowledge the institutional support that made this research possible. This study was conducted with permission and cooperation from the management of Halilulik Health Center, Belu Regency, which facilitated the data collection process. We also recognize the support provided by our academic institution, which contributed to the administrative and academic framework necessary for completing this research.

References

- Abdalal, S. A., Yukich, J., Andrinopoulos, K., Alghanmi, M., Wakid, M. H., Zawawi, A & Keating, J. (2023). Livelihood activities, human mobility, and risk of malaria infection in elimination settings: a case–control study. *Malaria Journal*, 22(1), 53.
- Badan Pusat Statistik Provinsi Nusa Tenggara Timur. (2025). Number of disease cases by regency/city and type of disease. <https://ntt.bps.go.id/id/statistics-table/2/MTQ4NSMy/jumlah-kasus-penyakit-menurut-kabupaten-kota-dan-jenis-penyakit.html>
- Flatby, H. M., Ravi, A., Damås, J. K., Solligård, E., & Rogne, T. (2023). Circulating levels of micronutrients and risk of infections: A Mendelian randomization study. *BMC Medicine*, 21(1), 84.
- Hast, M., Mharakurwa, S., Shields, T. M., Lubinda, J., Searle, K., Gwanzura, L., ... & Moss, W. J. (2022). Characterizing human movement patterns using GPS data loggers in an area of persistent malaria in Zimbabwe along the Mozambique border. *BMC infectious diseases*, 22(1), 942.
- Kementerian Kesehatan Republik Indonesia. (2022). SISMAL analysis. <https://sismal.kemkes.go.id/analisis>
- Kementerian Kesehatan Republik Indonesia. (2024). Cases|malaria. <https://malaria.kemkes.go.id/case>
- Kemismar, Y. Y., Manurung, I. F. E., & Weraman, P. (2022). Risk of human characteristics and vector breeding sites on malaria incidence in Manggarai District, East Nusa Tenggara Province. *Jurnal Penelitian Kesehatan "SUARA FORIKES" (Journal of Health Research "Forikes Voice")*, 13(1), 73–76.
- Marniati, Notoatmodjo, S., Kasiman, S., & Rohadi, R. K. (2018). Patients' behavior with coronary heart disease viewed from the socio-cultural aspect of Aceh society at Zainoel Abidin Hospital. In *MATEC Web of Conferences* (Vol. 150, p. 05065). EDP Sciences.
- Mehdipour, P., Rajasekhar, M., Dini, S., Zaloumis, S., Abreha, T., Adam, I., ... & Commons, R. J. (2023). Effect of adherence to primaquine on the risk of *Plasmodium vivax* recurrence: a WorldWide Antimalarial Resistance Network systematic review and individual patient data meta-analysis. *Malaria journal*, 22(1), 306.
- Nur, Z. T., Suryana, S., & Yunianto, A. E. (2021). The relationship between disease history and nutritional status: A cross-sectional study. *Jurnal Riset Gizi*, 9(1), 16–21.
- Oktafiani, I. S., Gunawan, C. A., Yudia, R. C. P., Toruan, V. M. L., & Retnaningrum, Y. R. (2022). The relationship between occupation and behavior with malaria incidence at Sotek Health Center, Penajam Subdistrict, Penajam Paser Utara Regency. *Jurnal Kedokteran Mulawarman*, 9(1), 35–48.

- Safi, S. R., Solikah, M. P., & Putri, N. E. (2024). The relationship between age and gender factors and the increase of malaria cases in the Yausakor Community Health Center working area, South Papua. *Jurnal Kesehatan Tambusai*, 5(4), 10406–10415.
- Sunita, S., Damayanti, S., Suanti, F., Rita, R. S., Carolina, P., Farizal, J., Hamdani, H., Hermawati, I., Fasrini, U. U., Insani, A. A., Rahman, S. N., Safitri, Y. D., Helmizer, R., Susiwati, S., Nasution, D. E., Heriadi, E., & Sari, A. I. (2024). *Internal medicine* (Haryati, Ed.). https://www.google.co.id/books/edition/Ilmu_Penyakit_Dalam/_nqtEQAAQBAJ
- Weni, A. D. D. (2019). The effect of education factors on access and adherence to malaria treatment in Sikka District in 2018. *Jurnal Keperawatan Muhammadiyah*.
- Weripang, I., Marti, E., & Ratnawati, E. (2024). The relationship between head of household knowledge and malaria prevention behavior in Sakartemin Village. *I Care Jurnal Keperawatan STIKes Panti Rapih*, 5(1), 30–37.
- World Health Organization. (2023). Malnutrition. <https://www.who.int/news-room/fact-sheets/detail/malnutrition>
- World Health Organization. (2023). WHO Guidelines for Malaria Treatment. <https://iris.who.int/>
- World Health Organization. (2024). Malaria Fact Sheet. <https://www.who.int/news-room/fact-sheets/detail/malaria>
- World Health Organization. (2024). World malaria report 2024. *The Lancet Microbe*. <https://www.thelancet.com/journals/lanmic/article/PIIS2666-5247%2825%2900001-1/fulltext>