Open Access Health Scientific Journal
https://oahsj.org/index.php/oahsj Vol. 7 No. 2 August 2026, pp. 226-233
Research article

Behavioral Analysis of Malaria Incidence in the Working Area of Hebeybhulu Yoka Public Health Center, Jayapura City

Dolfinus Yufu Bouway, Elsa Destalya Pasanda, Konstantina Marthina Pariaribo.

Universitas Cendrawasih, Jayapura, Indonesia
*Corresponden Author: Dolfinus Yufu Bouway (yuboepidfkm@gmail.com)

ARTICLE INFO

Keywords:
Behavior,
Case-Control Study,
Indonesia,
Malaria,
Risk Factor.

ABSTRACT

Background: Malaria remains a global public health concern. In Jayapura City, Hebeybhulu Yoka Public Health Center ranked second highest in malaria cases in 2024, with 2,797 cases recorded. This study aimed to analyze behavioral risk factors associated with malaria incidence in the working area of Hebeybhulu Yoka Public Health Center, Jayapura City.
Methods: This analytic survey used a case-control design conducted from 10–30 September 2025. A total of 92 respondents (46 cases and 46 controls; ratio 1:1) were selected using simple random sampling with age matching between groups. Data were collected through structured interviews using a questionnaire and analyzed using univariate, bivariate (chi-square, odds ratio), and multivariate (backward LR logistic regression) tests.
Results: Bivariate analysis showed that hanging clothes indoors (p=0.005; OR=3.927; 95% CI=1.583–9.743) and going outdoors at night (p=0.027; OR=3.024; 95% CI=1.218–7.510) were significant risk factors for malaria incidence, while bed net use (p=0.021; OR=0.341; 95% CI=0.145–0.798) and mosquito repellent use (p=0.027; OR=0.331; 95% CI=0.133–0.821) were significant protective factors. Multivariate analysis identified hanging clothes indoors as the most dominant behavioral factor associated with malaria incidence (p=0.015; Exp(B)=3.213; 95% CI=1.254–8.235).
Conclusion: Hanging clothes indoors and nighttime outdoor activity increase the risk of malaria, while bed net and mosquito repellent use are protective. Hanging clothes indoors is the dominant behavioral risk factor in this population. Community-based interventions targeting these specific behaviors are recommended to reduce malaria transmission in the study area.

INTRODUCTION

Malaria is a mosquito-borne infectious disease caused by Plasmodium parasites, transmitted to humans through the bite of infected female Anopheles mosquitoes. Five Plasmodium species are known to infect humans: Plasmodium vivax, Plasmodium falciparum, Plasmodium malariae, Plasmodium ovale, and Plasmodium knowlesi (WHO, 2022). The parasite invades the liver, kidneys, and red blood cells as it matures, causing anemia, fever, and splenomegaly in affected individuals (Rokhayati et al., 2022).
Globally, an estimated 263 million malaria cases occurred in 2023, representing an increase of 11 million cases from the previous year, with an incidence of 60.4 cases per 1,000 population at risk. The African Region continued to bear the highest burden, accounting for an estimated 94% of malaria cases worldwide in 2023, led by Nigeria (26%), the Democratic Republic of the Congo (13%), Uganda (5%), Ethiopia (4%), and Mozambique (4%) (WHO, 2024).
Indonesia remains endemic for malaria, particularly in the eastern regions of Papua, Maluku, Nusa Tenggara, Sulawesi, and Kalimantan (WHO, 2018). Malaria morbidity is measured using the Annual

Received 26 April 2026; Accepted 12 July 2026; Published 1 August 2026
 DOI: https://doi.org/10.55700/oahsj.v7i2.237

Parasite Incidence (API), the proportion of confirmed malaria cases per 1,000 population at risk. Although Indonesia successfully reduced its national API to below 1 per 1,000 population between 2015 and 2020, the API rose again to 1.1 per 1,000 population in 2021; Papua Province recorded the highest sub-national API in the country at 80.05 per 1,000 population, a substantial contributor to the national figure (Kemenkes RI, 2021).

Papua Province, with a population of approximately 1.05 million in 2023, reported 199,220 malaria cases that year, and malaria remains one of the province's leading public health problems (BPS Papua, 2024). Jayapura City, an endemic area comprising 14 Puskesmas (primary health center) working areas, recorded 46,929 confirmed malaria cases in 2024, representing a marked increase from 5,738 cases in 2022 and 35,410 cases in 2023. Among these working areas, Hebeybhulu Yoka Public Health Center ranked second highest, with cases rising from 1,540 in 2022 to 1,687 in 2023 and 2,797 in 2024 (Dinas Kesehatan Kota Jayapura, 2024). This upward trend has coincided with community behavioral patterns observed in the area, including sleeping without bed nets, not using mosquito repellent, hanging worn clothes indoors, and engaging in outdoor activities at night.

A clear understanding of the behavioral determinants of malaria transmission is essential for designing effective prevention and control strategies (Lewinsca et al., 2021). Field observations conducted by the researchers at Hebeybhulu Yoka Public Health Center further indicated that insecticide-treated bed nets distributed to the community were frequently left unused, motivating closer examination of behavioral risk factors in this setting. Given the persistently high and increasing malaria burden in this working area, this study aimed to analyze the risk associated with four specific behaviors: bed net use, mosquito repellent use, hanging clothes indoors, and nighttime outdoor activity, with malaria incidence in the working area of Hebeybhulu Yoka Public Health Center, Jayapura City, and to identify the most dominant behavioral determinant.

METHODS

Study Design and Setting

This study used an analytic survey with a case-control (retrospective) design, in which malaria status was identified first and behavioral risk factors were subsequently traced retrospectively (Notoatmodjo, 2018). The study was conducted in the working area of Hebeybhulu Yoka Public Health Center, Jayapura City, Papua Province, Indonesia, from 10 to 30 September 2025.

Population and Sample

The case population comprised all patients diagnosed with malaria and recorded at Hebeybhulu Yoka Public Health Center within a one-week surveillance period (n=189), of whom 106 met the inclusion criteria. The control population consisted of individuals residing in the same neighborhood as each case (i.e., neighbors) who were not recorded as having malaria during the same period, matched to cases by age.

The minimum sample size was calculated using the Lemeshow (1997) formula for case-control studies, based on a control-group exposure proportion (P2) of 75% (Dimi et al., 2020) and an odds ratio of 6.909 derived from a prior study conducted in South Jayapura District (Midayanti et al., 2022), with $Z1-\alpha/2 = 1.96$ (95% confidence level) and $Z1-\beta = 0.84$ (80% statistical power). This calculation yielded a minimum of 46 cases; with a 1:1 case-control ratio, the total sample size was 92 respondents (46 cases and 46 controls).

Inclusion criteria were: comparable age between the case and control groups, permanent residence in Yoka Village, and willingness to participate. Exclusion criteria were: absence during the data collection period and unwillingness to participate. Cases and controls were selected using simple random sampling combined with a purposive approach based on the pre-defined case/control criteria; controls were recruited after age-matching to each corresponding case.

Data Collection

Primary data on bed net use, mosquito repellent use, the habit of hanging clothes indoors, and nighttime outdoor activity were collected through structured interviews using a pre-tested questionnaire. Secondary data on malaria case records were obtained from the Jayapura City Health Office and Hebeybhulu Yoka Public Health Center. All respondents provided written informed consent prior to participation.

Data Analysis

Data were processed through editing, coding, entry, cleaning, and tabulation, and analyzed using SPSS software. Univariate analysis described the distribution and frequency of respondent characteristics (sex, age, education, occupation, income, and ethnicity) and the four behavioral variables. Bivariate analysis used the chi-square test to examine the association between each behavioral variable and malaria incidence; odds ratios (OR) and 95% confidence intervals (CI) were calculated, with an association considered statistically significant at $p<0.05$. An OR greater than 1 indicated a risk factor, an OR equal to 1 indicated no association, and an OR less than 1 indicated a protective factor. Variables with $p<0.25$ in the bivariate analysis were entered into a multivariate logistic regression model using the backward likelihood ratio (LR) method to identify the variable(s) most strongly and independently associated with malaria incidence, with significance set at $p<0.05$.

RESULTS

Respondent Characteristics

Table 1 presents the sociodemographic characteristics of the 92 respondents (46 cases, 46 controls). Male respondents comprised 58.7% of the case group and 56.5% of the control group. The most common age group in both groups was 17–25 years (19.6% each). The majority of respondents in both groups had completed senior high school education (cases: 50.0%; controls: 47.8%), were students (cases: 28.3%; controls: 26.1%), had low income (cases: 89.1%; controls: 91.3%), and were of Papuan ethnicity (cases: 84.8%; controls: 76.1%).

Table 1. Sociodemographic Characteristics of Respondents (N=92)

Characteristic	Case (n=46) n	%	Control (n=46) n	%
Sex				
Male	27	58.7	26	56.5
Female	19	41.3	20	43.5
Age group (years)				
0–5	7	15.2	7	15.2
6–11	5	10.9	5	10.9
12–16	3	6.5	3	6.5
17–25	9	19.6	9	19.6
26–35	4	8.7	4	8.7
36–45	6	13.0	6	13.0
46–55	7	15.2	7	15.2
56–65	5	10.9	5	10.9
Education				
No formal education	13	28.3	15	32.6
Primary school	1	2.2	2	4.3
Junior high school	7	15.2	6	13.0
Senior high school	23	50.0	22	47.8
Bachelor's degree	2	4.3	1	2.2
Occupation				
Unemployed	7	15.2	11	23.9
Laborer	1	2.2	0	0.0
Teacher	1	2.2	0	0.0
Housewife	6	13.0	6	13.0

Characteristic	Case (n=46) n	%	Control (n=46) n	%
University student	4	8.7	3	6.5
Trader	0	0.0	5	10.9
Student (school)	13	28.3	12	26.1
Logger	0	0.0	1	2.2
Farmer	2	4.3	4	8.7
Livestock breeder	3	6.5	1	2.2
Civil servant	2	4.3	2	4.3
Private employee	7	15.2	1	2.2
Income				
High	5	10.9	4	8.7
Low	41	89.1	42	91.3
Ethnicity				
Papuan	39	84.8	35	76.1
Non-Papuan	7	15.2	11	23.9

Distribution of Behavioral Variables

Table 2 shows the distribution of the four behavioral variables among all 92 respondents. Overall, 54.3% of respondents did not use a bed net while sleeping, 66.3% did not use mosquito repellent, 63.0% frequently hung clothes indoors, and 66.3% frequently went outdoors at night.

Table 2. Distribution of Behavioral Variables among Respondents (N=92)

Behavioral Variable	n	%
Bed net use		
Used	42	45.7
Not used	50	54.3
Mosquito repellent use		
Used	31	33.7
Not used	61	66.3
Hanging clothes indoors		
Yes	58	63.0
No	34	37.0
Nighttime outdoor activity		
Yes	61	66.3
No	31	33.7

Bivariate Analysis

Table 3 presents the results of the bivariate analysis. Bed net use was significantly associated with malaria incidence as a protective factor (p=0.021; OR=0.341; 95% CI=0.145–0.798): among the 46 malaria cases, 31 (67.4%) did not use a bed net. Mosquito repellent use was similarly protective (p=0.027; OR=0.331; 95% CI=0.133–0.821): among cases, 36 (78.3%) did not use mosquito repellent. In contrast, hanging clothes indoors was significantly associated with increased malaria risk (p=0.005; OR=3.927; 95% CI=1.583–9.743): 36 (78.3%) of malaria cases frequently hung clothes indoors, corresponding to a 3.93-fold higher risk compared with respondents who did not. Nighttime outdoor activity was similarly associated with increased risk (p=0.027; OR=3.024; 95% CI=1.218–7.510): 36

(78.3%) of cases frequently went outdoors at night, corresponding to a 3.02-fold higher risk compared with respondents who did not.

Table 3. Bivariate Analysis of Behavioral Risk Factors for Malaria Incidence

Variable	Case n (%)	Control n (%)	p-value	OR	95% CI
Bed net use					
	Not used: 31 (67.4)	19 (41.3)	0.021	0.341	0.145–0.798
	Used: 15 (32.6)	27 (58.7)			
Mosquito repellent use					
	Not used: 36 (78.3)	25 (54.3)	0.027	0.331	0.133–0.821
	Used: 10 (21.7)	21 (45.7)			
Hanging clothes indoors					
	Yes: 36 (78.3)	22 (47.8)	0.005	3.927	1.583–9.743
	No: 10 (21.7)	24 (52.2)			
Nighttime outdoor activity					
	Yes: 36 (78.3)	25 (54.3)	0.027	3.024	1.218–7.510
	No: 10 (21.7)	21 (45.7)			

p-values from continuity-corrected chi-square test (2×2 tables); OR = odds ratio.

Multivariate Analysis

Variables with p<0.25 in the bivariate analysis (bed net use, mosquito repellent use, hanging clothes indoors, and nighttime outdoor activity) were entered into a multivariate logistic regression model using the backward LR method. In the final model (Table 4), bed net use was not significantly associated with malaria incidence (Exp(B)=2.255; 95% CI=0.919–5.533; p=0.076). Hanging clothes indoors remained significantly and independently associated with malaria incidence (Exp(B)=3.213; 95% CI=1.254–8.235; p=0.015), identifying it as the most dominant behavioral risk factor: respondents who hung clothes indoors had 3.21 times greater odds of malaria than those who did not.

Table 4. Multivariate Logistic Regression Analysis (Backward LR Method, Final Model)

Variable	B	p-value	Exp(B)	95% CI
Bed net use (not used)	0.813	0.076	2.255	0.919–5.533
Hanging clothes indoors (yes)	1.167	0.015	3.213	1.254–8.235
Constant	−1.956	0.004	0.141	—

Final model (Step 3) of backward LR logistic regression.

DISCUSSION

The higher proportion of male respondents observed in this study is consistent with findings by Suni (2018), who reported a higher prevalence of malaria among males, likely reflecting greater outdoor activity among men. Malaria transmission itself does not differentiate by sex, since risk depends on contact with infected Anopheles mosquitoes regardless of the host's sex (Ishak & Arsin, 2017); several studies (Sitepu et al., 2018; Setiawan et al., 2021) similarly found no significant association between sex and malaria incidence, suggesting that observed differences instead reflect exposure-related behaviors such as occupation and nighttime activity patterns (Aferizal et al., 2024).

No dominant age pattern was observed in this study. Susceptibility to malaria may be shaped less by age itself than by household-level exposure to mosquito-resting sites, such as unused hanging clothes, which affect all age groups similarly when present (Lusiyana et al, 2025). The majority of respondents had at least a senior-high-school education; this study did not identify a significant association between education level and malaria incidence, who likewise reported no significant relationship between education and malaria in a border-region population.

Most respondents were students, housewives, or unemployed, rather than engaged in high-exposure occupations such as farming or fishing; this study did not find occupation type to be significantly associated with malaria incidence, consistent with Hermalini et al. (2023). Nonetheless, behaviors common among students and non-working respondents, such as staying outdoors and socializing in the evening, may still contribute to exposure risk independent of occupational classification.

The predominance of low-income respondents in both groups is consistent with the well-documented association between poverty and malaria risk, which may reflect substandard housing that fails to exclude mosquitoes and limited resources for preventive measures such as insecticide-treated nets. The predominance of Papuan ethnicity among respondents reflects the demographic profile of the study area; Harijanto and Gunawan (2009) noted that populations with long-term residence in endemic areas may acquire greater partial natural immunity compared with more recently settled populations, although ethnicity-specific immunity was not directly assessed in this study.

Bed net use was a significant protective factor against malaria in this study (OR=0.341), consistent with the well-established role of insecticide-treated nets (ITNs) in limiting human-vector contact during the peak nocturnal biting period of Anopheles mosquitoes (Darmawansyah et al., 2019). Several respondents in this study reported avoiding bed nets due to discomfort from heat while sleeping, a barrier that has been reported previously. Insecticide-treated net (ITN) use has been shown to reduce malaria risk by up to 50%, while breathing discomfort, unpleasant odor, and heat are common reasons for non-use in Papuan communities (Fadillah & Azizah, 2022; Mukin et al., 2023). Similarly, non-use of bed nets has been associated with a 3.2-fold higher risk of malaria in Jayapura District (Darmawansyah et al., 2019; Mofu, 2022). These findings underscore the need for community-level promotion of ITN use alongside efforts to improve comfort and acceptability.

Mosquito repellent use was also significantly protective against malaria (OR=0.331), consistent with earlier studies (Ningtyas et al., 2023; Wahyuni et al., 2022). Some respondents in this study avoided repellent use due to breathing discomfort, indicating an acceptability barrier similar to that reported for bed nets and suggesting that consistent use, not merely availability, determines protective effect.

The habit of hanging clothes indoors emerged as the strongest and most dominant behavioral risk factor for malaria in this study, both in the bivariate (OR=3.927) and multivariate (Exp(B)=3.213) analyses. Clothes left hanging in bedrooms or bathrooms may serve as resting sites for Anopheles mosquitoes, which are attracted to dim, humid spaces and to residual human scent — particularly carbon dioxide and perspiration retained on worn clothing (Wahida et al., 2021). The greater the amount of clothing left hanging indoors, the greater the likelihood of providing resting sites that increase mosquito-bite exposure. This finding is consistent with Mufara et al. (2023) and Hamdani et al. (2020), both of whom reported significant associations between this habit and malaria incidence in other Indonesian settings.

Going outdoors at night was significantly associated with increased malaria risk (OR=3.024), consistent with the peak biting activity of the exophagic Anopheles mosquito, which occurs between approximately 18:00 and 04:00 (Hamdani et al., 2020). Respondents in this study commonly reported socializing outdoors in the evening without wearing long sleeves or trousers, increasing skin exposure to mosquito bites. Similar associations were reported by Septira and Susilawati (2022) in a coastal Sumatran population, and by Utami et al. (2022), whose literature review found a two-fold higher malaria risk among individuals active outdoors at night. These findings support community education encouraging the use of protective clothing and repellent during evening outdoor activity, in addition to consistent insecticide-treated bed net use.

Age matching between cases and controls was performed at the neighborhood level; because neighboring households do not always share closely comparable age profiles, some residual age variation between groups cannot be ruled out. Future studies should consider broader control-selection strategies to strengthen age comparability between groups.

CONCLUSION

This case-control study found that hanging clothes indoors and going outdoors at night were significant behavioral risk factors for malaria in the working area of Hebeybhulu Yoka Public Health Center, Jayapura City, while bed net use and mosquito repellent use were significant protective factors. Hanging clothes indoors was the most dominant behavioral risk factor, associated with a 3.21-fold increase in the odds of malaria in the multivariate model. These findings suggest that community-based interventions, including physical barriers such as window screens, repair of gaps in housing structures, promotion of natural mosquito repellents, consistent use of insecticide-treated bed nets, and targeted health education discouraging the indoor storage of worn clothing and unprotected nighttime outdoor activity, should be prioritized to reduce malaria transmission in this setting. Future research incorporating environmental determinants and variables related to knowledge and attitudes is recommended to provide a more comprehensive understanding of malaria risk in this population.

ACKNOWLEDGMENTS:

The authors sincerely thank all study participants and the staff of Hebeybhulu Yoka Public Health Center, Jayapura City, for their valuable cooperation and support throughout this study.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

REFERENCES

Aferizal, A., Nababan, D., Sitorus, M., Manurung, K., & Tarigan, F. (2024). Analisis faktor yang berhubungan dengan kejadian malaria di wilayah kerja UPT Puskesmas Non Rawat Inap Lahomi Kecamatan Lahomi Kabupaten Nias Barat. *Prepotif: Jurnal Kesehatan Masyarakat*, 8(1), 474–492. https://doi.org/10.31004/prepotif.v8i1.26256

Badan Pusat Statistik Provinsi Papua. (2024). *Data kasus malaria tahun 2023*. BPS Provinsi Papua.

Darmawansyah, Habibi, J., Ralis, R., & Wulandari. (2019). Determinan kejadian malaria (kajian epidemiologi di daerah wabah). *Jurnal Kesehatan Masyarakat*, 8(3), 136–142. https://doi.org/10.33221/jikm.v8i03.370

Dimi, B., Adam, A., & Alim, A. (2020). Prevalensi malaria berdasarkan karakteristik sosio demografi. *Jurnal Ilmiah Kesehatan*, 19(1), 4–9. https://doi.org/10.33221/jikes.v19i01.399

Dinas Kesehatan Kota Jayapura. (2024). *Data kasus malaria tahun 2022–2024*. Dinas Kesehatan Kota Jayapura.

Fadillah, G., & Azizah, R. (2022). Analisis faktor risiko perilaku dengan kasus malaria pada masyarakat di Indonesia – Meta analysis 2016–2021: Literature review. *Media Publikasi Promosi Kesehatan Indonesia (MPPKI)*, 5(11), 1336–1345. https://doi.org/10.56338/mppki.v5i11.2733

Hamdani, N. N., Kartini, & Mira, M. (2020). Faktor-faktor yang berhubungan dengan kejadian malaria di wilayah Puskesmas Windai Distrik Windai Kabupaten Intan Jaya Papua. *Jurnal Promotif Preventif*, 2, 1–7. https://doi.org/10.47650/jpp.v2i2.163

Harijanto, P. N., & Gunawan, C. A. (2009). *Malaria dari molekuler ke klinis* (2nd ed.). EGC Medical Publisher.

Hermalini, Meliyanti, F., & Candra, E. (2023). Faktor-faktor yang berhubungan dengan kejadian malaria. *Jurnal Ilmiah Multi Science Kesehatan*, 15(2), 36–48. https://doi.org/10.36729/bi.v15i2.1132

Ishak, H., & Arsin, A. (2017). Karakteristik lingkungan penderita malaria di Kabupaten Bulukumba. *Higiene: Jurnal Kesehatan Lingkungan*, 2(3), 73–77. https://afiasi.unwir.ac.id/index.php/afiasi/article/view/47

Kemenkes RI. (2021). *Profil kesehatan Indonesia 2021*. Kementerian Kesehatan Republik Indonesia.

Lewinsca, M. Y., Raharjo, M., & Nurjazuli, N. (2021). Faktor risiko yang mempengaruhi kejadian malaria di Indonesia: Review literatur 2016–2020. *Jurnal Kesehatan Lingkungan*, 11(1), 16–28. https://doi.org/10.47718/jkl.v11i1.1339

Lusiyana, N., & Rochmah, F. S. N. R. (2025). Faktor-faktor yang Berhubungan dengan Episode Berulang Malaria di Daerah Endemis Tinggi Malaria. Jurnal kesehatan komunitas (Journal of community health), 11(2), 410-418. https://doi.org/10.25311/keskom.Vol11.Iss2.2207

Midayanti, S., Raharjo, M., & Purwanto, H. (2022). Faktor risiko yang mempengaruhi kejadian malaria di wilayah Distrik Jayapura Selatan Kota Jayapura. *Jurnal Kesehatan Lingkungan Indonesia*, 21(3), 358–365.

Mofu, R. M. (2022). Faktor determinan kejadian malaria pada masyarakat di Kampung Sosiri Kabupaten Waibu, Kabupaten Jayapura tahun 2020. *Jurnal Publikasi Kebidanan*, 13(1), 66–75.

Mufara, C. N., & Wahyono, T. Y. M. (2023). Faktor Perilaku Pencegahan Terhadap Kejadian Malaria di Papua: Analisis Riskesdas 2010-2018. Media Publikasi Promosi Kesehatan Indonesia (MPPKI), 6(5), 901-911. https://doi.org/10.56338/mppki.v6i5.3294

Mukin, G. B., Togubu, D. M., & Khadafi, M. (2023). Perilaku penggunaan kelambu berinsektisida dalam upaya pencegahan penyakit malaria. *INHEALTH: Indonesian Health Journal*.

Ningtyas, R., Martini, M., Wurjanto, M. A., & Hestiningsih, R. (2023). Analisis faktor risiko kejadian malaria pada anak (usia 0-18 tahun) di Kabupaten Purworejo. Jurnal Riset Kesehatan Masyarakat, 3(2), 59-70. https://doi.org/10.14710/jrkm.2023.19153

Notoatmodjo, S. (2018). *Metodologi penelitian kesehatan*. Rineka Cipta.

Rokhayati, D. A., Putri, R. C., Said, N. A., & Rejeki, D. S. S. (2022). Analisis faktor risiko malaria di Asia Tenggara. *Balaba: Jurnal Litbang Pengendalian Penyakit Bersumber Binatang Banjarnegara*, 18(1), 79–86. https://doi.org/10.22435/blb.v18i1.5002

Septira, M., & Susilawati. (2022). Pengaruh aktivitas di malam hari terhadap risiko malaria masyarakat pesisir Kecamatan Pantai Cermin Kabupaten Serdang Bedagai. *Nautical: Jurnal Ilmiah Multidisiplin*, 1(6), 467–468. https://jurnal.arkainstitute.co.id/index.php/nautical/article/view/368

Setiawan, H., Hamisah, I., & Fahdhienie, F. (2021). Faktor risiko kejadian malaria pada masyarakat di wilayah kerja Puskesmas Krueng Sabee Kabupaten Aceh Jaya. *Jurnal Bahana Kesehatan Masyarakat (Bahana of Journal Public Health)*, 5(2), 65–71. https://doi.org/10.35910/jbkm.v5i2.527

Sitepu, R., Lukito, A., & Tarigan, E. (2018). Analisis determinan kejadian penyakit malaria di Kecamatan Kutambaru tahun 2017. *Jurnal Ilmu Kedokteran dan Kesehatan*, 5(3). https://doi.org/10.33024/jikk.v5i3.942

Suni, A. (2018). Hubungan perilaku pencegahan dengan kejadian malaria oleh masyarakat di wilayah kerja Puskesmas Kalumata, Siko dan Kalumpang Kota Ternate. *Jurnal Kesehatan Poltekkes Ternate*, 8(1), 1–12. https://doi.org/10.32763/d04s0319

Utami, T. P., Hasyim, H., Kaltsum, U., Dwifitri, U., Meriwati, Y., Yuniwarti, Y., Paridah, Y., & Zulaiha, Z. (2022). Faktor risiko penyebab terjadinya malaria di Indonesia: Literature review. *Jurnal Surya Medika*, 7(2), 96–107. https://doi.org/10.33084/jsm.v7i2.3211

Wahida, A. N., Hasan, N. Y., & Hanurawaty, N. Y. (2021). Efektivitas variasi konsentrasi fermentasi gula merah sebagai atraktan nyamuk. *Jurnal Riset Kesehatan*, 11(1), 262–268.

Wahyuni, F., & Miko Wahyono, T. Y. (2022). Analisis Faktor Risiko Kejadian Malaria di Kabupaten Batu Bara Tahun 2022. Jurnal Epidemiologi Kesehatan Indonesia, 8(1), 2. https://scholarhub.ui.ac.id/epidkes/vol8/iss1/2/

World Health Organization. (2018). *World malaria report 2018*. WHO. Link: https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2018

World Health Organization. (2022). *World malaria report 2022*. WHO. Link: https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2022

World Health Organization. (2024). *World malaria report 2024*. WHO. Link: https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2024