FICCO PUBLIC HEALTH JOURNAL
Publisher: Ficco Scientific Corner
Website: http://journal.theficco.com/index.php/publichealth

e-ISSN: 3047-9126
Vol. 02 | No. 03 | December 2025

Open Access

ORIGINAL ARTICLE

Determinants of Malaria Incidence among Mine Workers: The Role of Length of Stay and Risk Perception

Rezha Rafsanjani Lakoro[1)]*, Margaretha Solang[1)], Irwan[1)]
[1)] Master of Public Health, Gorontalo State University, E-mail: rezalakoro04@gmail.com (RRL)
*** Author Correspondence**; E-mail: rezalakoro04@gmail.com

DOI: 10.5281/zenodo.18147188 **Received:** November 24, 2025 **Accepted:** December 29, 2025 **Published:** December 31, 2025

ABSTRACT

Background: Prolonged duration of stay in mining areas increases exposure to malaria vectors, thereby elevating the risk of transmission. Additionally, workers' perceptions of malaria risk influence their engagement in preventive behaviors, such as using mosquito nets, applying repellents, and avoiding outdoor activities at night. This study analyzes the relationships between the length of stay in mining areas and risk perception, and between the incidence of malaria among mine workers and risk perception. **Methods**: A quantitative, analytical cross-sectional design was employed. The study population comprised miners in Hulawa Village, Buntulia District, Pohuwato Regency. Key variables included the habit of going out at night and risk perception. Data were collected using a questionnaire, with total sampling. Data analysis utilized the Chi-Square test and Multiple Logistic Regression. **Results**: There was a significant association between duration of stay in the mining area (ρ value = 0.00; OR = 31.179) and risk perception (ρ value = 0.03; OR = 8.916) with the incidence of malaria among mine workers. **Conclusion**: The findings indicate a relationship between the duration of stay in mining areas and risk perception, and the incidence of malaria among mine workers.

Keywords: Length of stay, Malaria, Mine workers, Risk perception

INTRODUCTION

Mining environments generally have different characteristics compared to general settlements. Mining sites are often located in forested areas, close to water sources, and are characterized by many puddles of water from extraction activities. These conditions create an optimal habitat for mosquito breeding. In addition, mine workers generally live in temporary settlements of poor quality, such as tents or simple barracks, without protection against mosquitoes. These factors make the mining environment a high-risk area for malaria transmission.

In the epidemiology of infectious diseases, the duration of exposure to a risky environment is an important indicator of the likelihood of exposure. The longer an individual stays in a malaria-endemic area, the greater the likelihood of exposure to environmental risk factors, such as infectious mosquito bites, unsuitable living conditions, and limited prevention facilities. The duration of stay also reflects the frequency of exposure to vectors, thereby cumulatively influencing the incidence of infection.

For mine workers, length of stay is a highly relevant factor because most reside in the mining area for varying periods, ranging from several weeks to years. Workers with longer stays tend to be more active at night in open work areas and have lifestyle habits that can increase the risk of transmission. Previous studies have shown that length of stay correlates with malaria incidence, as repeated exposure increases the risk of infection despite preventive behaviors.

In malaria control efforts, individual behavior plays a very significant role. One aspect of behavior that influences this is risk perception, an

e-ISSN: **3047-9126**
Vol. **02** | No. **03** | **December 2025**

individual's assessment of the likelihood and severity of disease threats they may face. A high risk perception generally encourages individuals to take protective measures, such as using mosquito nets, repellents, protective clothing, or following recommended prevention procedures. Conversely, a low risk perception can lead individuals to neglect preventive measures, even in an environment with a high transmission rate.

Risk perception refers to the extent to which individuals assess their vulnerability to disease and the severity of possible impacts. The higher the risk perception, the more likely individuals are to take preventive measures (Health Belief Model). In this study, workers who considered malaria dangerous and felt vulnerable tended to use mosquito nets or avoid nighttime activities.

The Gorontalo Provincial Health Office reported an alarming spike in malaria cases through e-SISMAL. In 2022, only 52 cases were recorded, of which 32 came from North Gorontalo Regency. However, in 2023, there was a drastic spike to 1,577 cases. Entering the 37th week of the 2024 epidemiological year, the number of cases has reached 1,073, with Pohuwato District contributing the most with 814 cases. With a case growth rate of 1.3 per 1,000 population, Gorontalo Province is predicted to enter the moderate endemicity category in 2025.

E-SISMAL data shows that from 2023 to July 2025, there were 2,003 indigenous malaria cases in Pohuwato District. Data from the Buntulia Community Health Center recorded 59 positive cases of indigenous malaria from January to July 2025, with Hulawa Village contributing the most, namely 19 cases from 125 miners originating from Gorontalo, Central Sulawesi, and North Sulawesi. Hulawa Village is directly adjacent to small-scale gold mining areas, particularly in Poladingo Hamlet, which is the center of small-scale gold mining. The hilly and valley-filled topography of the village has led to the formation of many depressions and pools of water, especially in former mining pits.

Hulawa Village is one of the main areas of malaria transmission in Pohuwato Regency, particularly in Buntulia District, accounting for around 56% of the region's total malaria cases. Based on these conditions, this study aims to evaluate the factors causing malaria among mine workers and identify vector breeding sites in the mining area of Hulawa Village, Buntulia District, Pohuwato Regency. Mining workers are at high risk not only because they live in an endemic area, but also because their work patterns and lifestyles require outdoor activities at night, when Anopheles mosquitoes are most active in seeking prey.

METHODS

This study used a quantitative, cross-sectional design. The research was conducted at the Hulawa Village mine in Buntulia District, Pohuwato Regency, Gorontalo Province, in August 2025. The research population consisted of 125 mine workers in Hulawa Village, selected by simple random sampling. Data analysis included univariate and bivariate analyses using the Chi-Square test and multivariate analysis using the Logistic Regression test. The Logistic Regression test was used to analyze the most influential predictor factors after controlling for other variables. The instrument used was a questionnaire. The research instrument was first tested for validity and reliability. Ethical approval recommendation number 146/ UN47.B7 / KE / 2025.

RESULTS AND DISCUSSION

Based on the data in Table 1, 62 respondents (49.6%) had a long duration of stay in the mining area, while 63 respondents (50.4%) reported a short duration of stay, potentially increasing the risk of exposure to Anopheles mosquito bites. The distribution of respondents' risk perceptions shows that 63 people (50.4%) have a high risk perception, while 62 people (49.6%) have a low risk perception. This slight difference indicates that the risk perception of mine workers towards malaria is relatively balanced between those who feel at risk and those who do not. This condition underscores the need to strengthen health education to enhance risk perception, thereby optimizing preventive behavior.

e-ISSN: **3047-9126**
Vol. **02** | No. **03** | **December 2025**

Table 1. Frequency of duration of stay in the mining area and risk perception

No	Variable	Frequency	
		n	%
Duration of Stay in the Mining Area			
1	Duration	62	49.6
2	Short	63	50.4
	Total	125	100
Risk Perception			
1	High	63	50.4
2	Low	62	49.6
	Total	125	100

Table 2. Analysis of the relationship between duration of stay in the mining area and risk perception with malaria incidence among mine workers

Variable	Malaria Incidence				Total		*P-Value*
	Positive		Negative				
	n	%	n	%	N	%	
Length of Stay in Mining Area							
Length	42	33.6	20	16.0	62	49.6	
Short	6	4.8	57	45.6	63	50.4	0.00
Total	**48**	**38.4**	**77**	**61.6**	**125**	**100**	
Risk Perception							
High	30	24.0	33	26.4	63	50.4	
Low	18	14.4	44	35.2	62	49.6	0.03
Total	**48**	**38.4**	**77**	**61.6**	**125**	**100**	

Table 3. Analysis of variables most associated with malaria incidence among mine workers

No	Research Variable	*P-Value*	*Odds Ratio*	95% C.I for EXP (B)	
				Lower	*Upper*
1	Duration of Stay in Mining Area	0.001	31,179	4,447	218,583
2	Risk Perception	0.043	0.132	0.019	0.934

Table 2 shows that of the 125 respondents, 62 (49.6%) had lived in the mining area for a long time, while 63 (50.4%) had lived there for a short time. In the group that had lived there for a long time, 42 people (33.6%) tested positive for malaria, and 20 people (16.0%) tested negative. In the group that had only recently moved there, 6 people (4.8%) tested positive for malaria, and 57 people (45.6%) tested negative.

The statistical test results showed a p-value = 0.00 ($\alpha < 0.05$), indicating a significant relationship between the duration of residence in the mining area and the incidence of malaria in Hulawa Village, Buntulia District. These findings show that the longer a person lives in a mining area, the higher the risk of malaria infection.

The longer a person lives in an endemic area, the higher the risk of exposure to malaria-carrying mosquito bites. Mining areas usually have a lot of standing water and high humidity, which supports the mosquito life cycle. Standing water in former mine pits is an ideal habitat for mosquito breeding. In addition, mine workers generally live in temporary housing with poor sanitation, limited ventilation, and minimal personal protection, thereby increasing the risk of malaria transmission.

Long-term residence in endemic areas also increases the likelihood of repeated exposure to

e-ISSN: 3047-9126
Vol. 02 | No. 03 | December 2025

mosquito bites. Individuals who have lived in these areas for a long time are more likely to be exposed to mosquitoes carrying Plasmodium, either through their work or through proximity to puddles of water. In malaria epidemiology, long-term exposure increases the risk of recurrent infection, especially when vector control and preventive behaviors remain low.

Regarding the risk perception variable, among the 63 respondents with high risk perception, 30 (24.0%) were confirmed positive for malaria, while 33 (26.4%) were in the malaria-negative group. Meanwhile, among 62 respondents with low risk perception, 18 (14.4%) were confirmed positive for malaria, and 44 (35.2%) were malaria-negative. These data show that workers with high risk perception have a greater proportion of malaria cases. These findings indicate that high-risk perception is likely formed from personal experience or prior exposure to information about malaria cases in the work environment. Conversely, in the low-risk-perception group, the number of malaria cases was lower than in the high-risk-perception group.

The statistical test results showed a p-value = 0.03, which is smaller than $\alpha = 0.05$. Thus, there is a significant relationship between risk perception and malaria incidence among mine workers. These findings confirm that risk perception influences the likelihood of malaria, both through preventive behavior and the level of individual awareness of the dangers of malaria.

Workers who have a high perception of risk tend to be more consistent in implementing preventive measures, such as using mosquito nets, maintaining environmental hygiene, and avoiding outdoor activities at night. The effectiveness of risk perception in malaria prevention is greatly influenced by education programs that can change mindsets and raise collective awareness among mine workers. Collaboration among health workers, village officials, and community leaders can strengthen risk perception and encourage sustainable malaria prevention behaviors at the household and mining community levels.

Respondents who had a high perception of risk but were still infected with malaria showed a gap between their knowledge of risk and their preventive behavior. A high perception of risk reflects an understanding of the dangers of malaria, but this awareness has not been fully translated into concrete action. A similar phenomenon is often observed in endemic areas, where people understand how malaria is transmitted but inconsistently implement preventive behaviors, such as using insecticide-treated mosquito nets, spraying insecticides, or managing the environment.

Table 3 presents the results of a logistic regression analysis identifying the variables most strongly associated with the incidence of malaria among mine workers. The two variables analyzed were duration of stay in the mining area and risk perception.

The duration-of-stay variable showed a p-value of 0.001, indicating a statistically significant relationship with malaria incidence ($p < 0.05$). This finding indicates that the length of stay is a strong factor influencing the incidence of malaria among mine workers. An odds ratio (OR) value of 31.179 indicates that workers with a longer length of stay in the mining area have a 31 times higher risk of contracting malaria than workers with a shorter length of stay. This very large OR value illustrates the strength of the relationship. The 95% confidence interval ranges from 4.447 to 218.583. Although the interval is wide, all CI values are above 1, reinforcing that the risk increases significantly with increasing length of stay. The width of the interval also indicates variation in exposure levels among workers, but does not change the main conclusion.

These results indicate that the longer workers remain in the mining area, a malaria-endemic region, the greater their cumulative exposure to Anopheles mosquitoes. A longer duration of stay indicates repeated exposure to a risky environment, poorly protected living conditions, and nighttime activities that increase the potential for infection. Therefore, the duration of stay is the most dominant factor in this regression model.

Epidemiologically, a longer duration of stay in a malaria-endemic area increases the likelihood

e-ISSN: **3047-9126**
Vol. **02** | No. **03** | **December 2025**

of exposure to Anopheles mosquito bites. Mining areas often have environmental conditions that support mosquito breeding, such as puddles left behind by excavation, water storage ponds, and poor drainage. These conditions increase vector exposure with increasing length of stay at the mine site, thereby increasing the risk of malaria transmission.

Longer stays are also associated with changes in worker behavior. At the beginning of their stay in the mining area, workers tend to be more aware of the risk of malaria and more compliant with preventive measures, such as using mosquito nets, mosquito repellents, or protective clothing. However, over time, awareness levels may decline as workers become accustomed to their surroundings. This decline in vigilance could increase the risk of mosquito bites and malaria cases.

Workers who have lived in the mining area for a long time generally have high workloads and long working hours, including working until late at night or early in the morning. Anopheles mosquitoes are active at night, increasing the risk of contact with malaria vectors, especially if workers do not consistently use personal protective equipment.

The length of stay in the mining area is also related to work behavior and fatigue. Workers with long stays tend to work long hours, including at night, increasing the risk of contact with active mosquitoes. Fatigue can also reduce compliance with malaria prevention behaviors, such as using mosquito repellent or sleeping under a mosquito net.

Workers with long stays in mining areas should be prioritized in malaria prevention programs, including the provision of insecticide-treated mosquito nets, indoor residual spraying, mining site management, and ongoing education on malaria prevention. These efforts must be carried out consistently and continuously to reduce the risk of malaria in groups of workers with high exposure levels.

Thus, the duration of stay in the mining area is an important determinant of malaria incidence among mine workers. Malaria prevention efforts need to focus on workers with long stays through environmental control, improving clean and healthy living behaviors, and strengthening self-protection programs against mosquito bites. Continuous intervention is necessary to reduce the risk of malaria in groups of mine workers with high exposure levels.

The risk perception variable had a p-value of 0.043 and an odds ratio of 0.132, indicating that workers with high risk perception were less likely to contract malaria than those with low risk perception. Good risk perception has a protective effect, reducing the risk by 87% (1 – 0.132). Workers with high risk perception tend to be more disciplined in using personal protective equipment, such as mosquito nets and repellents, and in avoiding outdoor activities during risky times.

Workers with high risk perception tend to be more aware of preventive measures, such as using mosquito nets, maintaining environmental hygiene, and avoiding nighttime outdoor activities. The effectiveness of risk perception in preventing malaria depends heavily on education programs that can shift perspectives and increase collective awareness among mine workers. Collaboration between health workers, village officials, and community leaders can strengthen risk perception and encourage sustainable malaria prevention behaviors at the household and mining community levels.

Respondents with high risk perception but who remain positive about malaria indicate a gap between risk knowledge and preventive behavior. High risk perception indicates an understanding of the dangers of malaria, but this awareness has not been fully translated into concrete action. This phenomenon often occurs in endemic areas, where people know how malaria is transmitted but do not consistently practice preventive behaviors such as using insecticide-treated bed nets, spraying insecticides, or managing the environment.

CONCLUSION

Based on the research results, the following conclusions can be drawn: the duration of stay in the mining area is significantly related to the incidence of malaria among mine workers in Hulawa Village, Pohuwato District (p-value = 0.00; α

e-ISSN: **3047-9126**
Vol. **02** | No. **03** | **December 2025**

< 0.05), and perception of malaria risk is significantly related to the incidence of malaria among mine workers in Hulawa Village, Buntulia Subdistrict, Pohuwato Regency (p-value = 0.04; α < 0.05). The most influential variable for the incidence of malaria among mine workers in Hulawa Village, Buntulia Subdistrict, Pohuwato Regency, is the duration of stay in the mining area, with an OR of 31.179.

ACKNOWLEDGMENTS

The author expresses gratitude to the Rector, Director of Postgraduate Studies, Coordinator of the Postgraduate Public Health Study Program, Supervisory Team, his parents, and all who have provided support at Gorontalo State University.

REFERENCES

Aferizal, A., et al. (2023). Analysis of factors associated with malaria cases in the working area of the Lahomi Non-Inpatient Health Center, Lahomi District, West Nias Regency. *Prepotif: Journal of Public Health*, 8(1), 474–492.

Alemu, G., Abate, A., & Tadesse, M. (2023). Knowledge and preventive practices towards malaria among adults in endemic areas of Ethiopia. *Malaria Journal, 22*(1), 115–124

Amaral, P. S. T., et al. (2024). *Malaria in areas under mining activity in the Amazon: ecological and social drivers. Malaria Journal*, 23(6).

Amiruddin, A., & Hamzah, H. (2022). *The relationship between risk perception and malaria prevention behavior in endemic areas of South Sulawesi.* Journal of Environmental Health, 14(2), 98–107.

Anggraini, R., Fitriani, D., & Widiyastuti, D. 2022. Ecological and behavioral characteristics of *Anopheles* mosquitoes as malaria vectors in Indonesia. *Journal of Health Ecology*, 21(1), 45–54.

Indonesian Health Research and Development Agency. 2024. *Malaria Entomology Report in the Mining Area of Puncak Jaya Regency*. Jakarta: Indonesian Ministry of Health.

Bahruddin, M., & Alam, S. (2022). *Factors associated with malaria incidence in the mining area of Kolaka Regency*. Journal of Tropical Environmental Health, 10(2), 45–56.

National Institute of Vector and Disease Reservoir Research and Development. 2025. *Monitoring Report on Breeding Places in Mining Areas of Papua and North Maluku in 2025*. Jakarta: Ministry of Health of the Republic of Indonesia.

National Institute of Vector and Disease Reservoir Research and Development. 2024. *Evaluation Report on the Malaria Control Program in Small-Scale Mining Areas*. Jakarta: Indonesian Agency for Health Research and Development.

Bandura, A. (2012). *Social Foundations of Thought and Action: A Social Cognitive Theory.* Englewood Cliffs: Prentice Hall.

BBPK Makassar. 2024. *Surveillance of Malaria Reinfection during the Rainy Season in Mines in Sulawesi and Kalimantan*. Internal Report.

Budiarti, L. N., Syahrani, S., & Prasetya, H. 2023. Determinants of Malaria Prevention in Communities Surrounding Mines. *Indonesian Journal of Environmental Health*, 22(1), 15–22.

Dalimunthe, K. T., et al. 2023. Factors associated with malaria incidence in Tanjung Tiram District, Batubara Regency in 2023. *Journal of Social Research* (Online).

Dewi, W. C., Hasyim, H., & Novrikasari, N. 2022. *Analysis of risk factors for malaria incidence among mine workers in Tanjung Agung District, Muara Enim Regency* (Master's Thesis, Sriwijaya University).

Directorate General of Disease Prevention and Control. 2022. *Technical guidelines for malaria risk factor control*. Jakarta: Ministry of Health of the Republic of Indonesia.

Directorate General of Disease Prevention and Control. 2023. *National Action Plan for Accelerated Malaria Elimination 2020–2026*. Jakarta: Ministry of Health of the Republic of Indonesia.

Duguma, T., et al. 2022. Malaria prevalence and risk factors among patients visiting Mizan Tepi University Teaching Hospital, Southwest Ethiopia. *PLoS ONE*, 17(7), e0271771.

e-ISSN: **3047-9126**
Vol. **02** | No. **03** | **December 2025**

Fajarwati, D., Rachmawati, R., & Hidayat, M. 2022. The Relationship Between Knowledge and Malaria Prevention Behavior in Endemic Areas. *Journal of Health Epidemiology*, 10(2), 89–97

Glanz, K., Rimer, B. K., & Viswanath, K. (2015). *Health Behavior: Theory, Research, and Practice* (5th ed.). San Francisco: Jossey-Bass.

Glendening, N., et al. (2024). *Malaria prevalence and Knowledge-Attitude-Practice among settlers in a new gold mining settlement, Gambella, Ethiopia. Malaria Journal*, 23(2).

Handayani, R., Ririen, D., & Yuliana, E. (2020). *Risk perception and malaria prevention behavior in Belu Regency*, *East Nusa Tenggara Province*. Journal of Epidemiology and Tropical Diseases, 8(1), 33–42.

Hasibuan, N., Lestari, F., & Mahendra, A. (2023). *The role of community behavior in malaria vector control in endemic areas of Sulawesi.* Journal of Tropical Environmental Health, 11(1), 33–42.

Hasyim, H., Dewi, R. M., & Susanti, R. (2023). *Risk factors of malaria transmission in mining workers in Muara Enim, South Sumatra, Indonesia*. Scientific Reports, 13, 12685.

Hasyim, H., et al. (2023). *Risk factors of malaria transmission in mining workers: a study in artisanal and small-scale mining communities in South Sumatra, Indonesia. Scientific Reports*, 13(1).

Hidayah, N., & Rachman, M. A. (2022). *Relationship between history of malaria and incidence of malaria in endemic areas of West Kalimantan.* Jurnal Epidemiologi Tropis, 9(2), 72–81.

Hidayat, M., & Prasetyo, A. (2023). *Risk perception and malaria prevention behavior among communities in endemic areas of Sulawesi.* Journal of Tropical Public Health, 11(2), 67–76.

Hidayat, M., Pranoto, S., & Dewi, K. (2023). *The role of vectors in malaria transmission and control efforts in endemic areas of Indonesia.* Journal of Tropical Environmental Health, 11(2), 87–96.

Irwan. (2022). Health Research Methods. Zahir Publisher: Yogyakarta

Katale, R. N., et al. (2023). Spatio-temporal analysis of malaria incidence and its risk factors in North Namibia. *Malaria Journal*, 22(1), 149.

Ministry of Health of the Republic of Indonesia. (2024). *Roadmap for Malaria Elimination in Indonesia 2025–2045*.

Ministry of Health of the Republic of Indonesia. 2022. *Technical guidelines for malaria risk factor control* (pp. 43–44). Jakarta: Ministry of Health of the Republic of Indonesia.

Ministry of Health of the Republic of Indonesia. 2023. *Pocketbook on malaria case management*. Jakarta: Ministry of Health of the Republic of Indonesia.

Ministry of Health of the Republic of Indonesia. 2025. *National Guidelines for Malaria Elimination 2025–2030*. Jakarta: Directorate of Vector-Borne Disease Prevention and Control.

Kurniawan, H., & Azizah, S. (2023). *The relationship between distance from standing water and malaria incidence in coastal areas of Kalimantan.* Indonesian Journal of Tropical Epidemiology, 12(2), 77–85.

Kusumaningrum, A., Dewi, N., & Susanti, R. (2022). Self-efficacy and Malaria Prevention Behavior in Central Kalimantan. *Journal of Health Promotion*, 20(3), 197–204.

Langi, F. M., Pangemanan, J. M., & Supit, W. (2022). *The relationship between nighttime outings and malaria incidence in Minahasa Regency.* Journal of Tropical Public Health, 10(2), 88–96.

Lestari, A., Widyastuti, M., & Arifin, R. (2021). *The relationship between self-efficacy and social support with malaria prevention behavior in Sarmi Regency*. Indonesian Journal of Public Health, 12(3), 211–220.

Lestari, F., Runtuwene, M., & Sitorus, R. (2023). *The relationship between Anopheles vector density and malaria incidence in Papua Province.* Journal of Tropical Epidemiology and Entomology, 10(3), 145–154.

Lestari, R. A. F., et al. (2022). Risk factors for malaria incidence in mining communities: A literature review. *Batanghari University Scientific Journal*, 22(3), 1700–1705.

Lestari, R. A. F. 2022. *Determinants of malaria incidence among mining workers in Tanjung Agung District, Muara Enim Regency* (Master's Thesis, Sriwijaya University).

e-ISSN: **3047-9126**
Vol. **02** | No. **03** | **December 2025**

Lestari, W., Wahyuni, R., & Anggraini, D. 2023. Malaria History and Prevention Behavior: A Study in Mining Areas. *Jurnal Kesmas Tropis*, 7(1), 33–40

Marbun, R. S., Sitorus, T. A., & Simanjuntak, L. M. (2023). *Environmental and behavioral risk factors for malaria incidence in Central Kalimantan.* Indonesian Journal of Health Epidemiology, 7(1), 45–54.

Marpaung, D., Manurung, T., & Lestari, M. 2023. *Analysis of Malaria Reinfection Patterns among Mining Workers in Papua*. Indonesian Journal of Tropical Epidemiology, 6(1), 45–52.

Mboera, L. E. G., Rumisha, S. F., & Kinung'hi, S. M. 2023. Human activities, land use changes and malaria transmission in East Africa mining zones. *BMC Public Health*, 23(1), 55.

Mongabay Indonesia. 2024. *Malaria Outbreak in Gorontalo Mine, Deforested Forests and Mine Ponds Become Mosquito Breeding Grounds*.

Mulyadi, H., Sari, P., & Lodo, J. (2023). *The influence of self-efficacy on malaria prevention behavior in endemic areas of East Nusa Tenggara.* Jurnal Kesehatan Masyarakat Tropis, 11(2), 88–97.

Mustafa, M., et al. 2023. Mosquito repellent use and malaria incidence in Sangadji Village, Ternate City. *Promotive Preventive Journal*, 6(2), 211–217.

Nankabirwa, J. I., Yeka, A., & Staedke, S. G. (2023). *Factors associated with malaria resurgence in mining communities of Sub-Saharan Africa.* Malaria Journal, 22(3), 251–264

Nasir, M., Wahyudi, A., & Fitriana, L. (2021). *Nighttime activities and the risk of malaria in East Luwu Regency*. Indonesian Public Health Media, 17(4), 258–267.

Nasution, R., Purba, T., & Lumbantoruan, E. (2022). *Analysis of behavioral factors affecting malaria incidence in rural communities in North Sumatra.* Indonesian Journal of Environmental Health, 21(1), 33–42.

Nasution, R., Simbolon, A., & Harahap, D. (2022). *Environmental and behavioral factors affecting malaria incidence in mining areas of Kalimantan.* Journal of Tropical Epidemiology, 9(2), 75–84.

Notoadmodjo, S. (2018). *Health Promotion and Behavioral Science*. Jakarta: Rineka Cipta.

Nurmala, S., Hidayati, T., & Asnawi, T. (2024). Risk Factors for Malaria Incidence in the Gold Mining Area of Ketapang District. *Journal of Tropical Public Health*, 15(2), 88–96.

Olapeju, B., et al. 2022. Malaria care-seeking and treatment ideation among gold miners in Guyana. *Malaria Journal*, 21, 29.

Pasang, M. T., et al. 2023. The relationship between patients' knowledge, attitudes, and behaviors and the incidence of malaria. *MAHESA: Malahayati Health Student Journal*, 3(1), 246–260

Pasangka, O., et al. 2023. Education on malaria prevention, examination, and treatment at the Abepura Community Health Center. *EBAMUKAI: Journal of Science and Technology Service*, 1(1), 33–39.

Putra, A. R., Rahmadani, D., & Yusuf, M. (2023). *Nighttime behavior and its relationship with malaria incidence in endemic areas.* Journal of Health Research, 9(3), 120–129.

Putra, R., Hidayat, M., & Sulastri, N. (2023). *Environmental and behavioral factors associated with malaria incidence in endemic areas of South Sumatra.* Andalas Public Health Journal, 17(1), 101–110.

Putra, Y., Mahmud, R., & Idris, S. (2020). *The relationship between environmental conditions and the presence of Anopheles mosquito breeding sites with malaria incidence in Central Mamuju Regency*. Indonesian Journal of Environmental Health, 19(1), 13–22.

Putri, R., Gunawan, H., & Fauziah, D. (2023). *Human-vector-environment interactions in malaria epidemiology in endemic areas of Indonesia.* Jurnal Biomedik Tropis, 9(1), 42–51.

Rahim, A., Sitorus, T., & Maulana, E. (2022). *Analysis of environmental factors on malaria incidence in Mimika Regency.* Journal of Tropical Biomedicine, 10(3), 152–160.

Rahim, A., Sitorus, T., & Maulana, E. (2023). *Relationship between nighttime activities and malaria incidence among mine workers in Halmahera.* Tropical Biomedical Journal, 11(1), 81–90.

e-ISSN: **3047-9126**
Vol. **02** | No. **03** | **December 2025**

Rahim, N., Dewi, S., & Pratama, H. (2022). *Analysis of risk perception and malaria prevention behavior in endemic areas of East Nusa Tenggara.* Indonesian Journal of Epidemiology, 8(1), 45–54.

Rahmadani, A., & Yusuf, M. (2022). *Vector density and its relationship with malaria incidence in Kapuas Hulu District.* Journal of Tropical Public Health, 8(2), 78–86.

Rahmadani, D., Yusuf, M., & Pratama, H. (2023). *The relationship between length of stay and malaria incidence among mine workers in Central Kalimantan.* Indonesian Journal of Environmental Health, 21(1), 42–51.

Rahman, A., & Yusuf, M. (2020). *The role of community knowledge in reducing malaria incidence in mining areas in Central Sulawesi*. Journal of Public Health and Epidemiology, 9(2), 72–81.

Rahman, M. A., & Lestari, D. 2024. Field evaluation of larval sampling and light traps for malaria surveillance. *Asian Pacific Journal of Tropical Medicine*, 17(1), 21–29.

Rahman, N., Yusuf, M., & Dewi, F. (2023). *Self-efficacy and malaria prevention behaviors in rural communities.* Indonesian Journal of Health Sciences, 15(1), 101–110.

Rehman, S., Rantam, F. A., Rehman, A., Effendi, M. H., & Shehzad, A. (2021). Knowledge, attitudes, and practices toward rabies in three provinces of Indonesia. *Veterinary World, 14*(9), 2518–2526.

Rosenstock, I. M. (1974). *Historical Origins of the Health Belief Model*. Health Education Monographs, 2(4), 328–335.

Safitri, Y., Idris, H., & Nasution, D. S. (2024). *Risk factors for malaria among forest workers in Aceh Besar District*. Indonesian Journal of Public Health, 19(2), 89–96.

Samosir, T., & Irianto, M. 2022. Effectiveness of different mosquito trapping methods in capturing adult *Anopheles* in semi-rural areas. *Tropical Biomedicine Journal*, 40(2), 98–106.

Santos, C. L., Oliveira, R. T., & Costa, M. S. (2022). Mining activities and their influence on malaria transmission: A systematic review. *Malaria Journal*, 21(1), 112.

Sari, W., Lestari, D., & Gunawan, A. (2022). *The relationship between knowledge levels and malaria prevention behaviors in rural communities in West Kutai*. Mulawarman Public Health Journal, 4(1), 55–63.

Satria, D., Wulandari, L., & Harimurti, S. (2023). Vector control challenges: Insecticide resistance among *Anopheles* spp. in Eastern Indonesia. *Malaria Journal of Indonesia*, 15(2), 92–101.

Sihombing, E., Handayani, A., & Lubis, D. (2024). *Effectiveness of insecticide-treated bed nets in reducing malaria incidence in endemic areas.* Jurnal Kesehatan Tropika, 12(1), 66–75.

Silva, J. M., Ferreira, C. A., & Lima, D. S. 2022. Gold mining and malaria: A cross-sectional study in Brazilian Amazon. *Environmental Research*, 212, 113204.

Siregar, A., Gultom, R., & Hutabarat, T. (2023). *Dynamics of malaria vector habitats in mining environments and densely populated settlements.* Journal of Health Entomology, 9(2), 89–98.

Siregar, N., Lubis, A. M., & Hasibuan, R. (2022). *Analysis of community behavior towards malaria incidents in rural areas.* Journal of Environmental Health Sciences, 14(1), 55–63.

Siregar, N., Lubis, A. M., & Sembiring, R. (2023). *The impact of mining activities on the risk of malaria transmission in endemic areas of North Sumatra.* Journal of Tropical Public Health, 11(2), 115–123.

Sitorus, E., Manalu, R., & Lubis, T. (2023). *The influence of risk perception on malaria prevention behavior in rural communities.* Journal of Tropical Health Sciences, 12(2), 120–129.

Sitorus, T., & Hidayah, R. (2023). *Self-efficacy and malaria incidence in remote communities of South Kalimantan.* Journal of Tropical Epidemiology, 8(3), 65–74.

Sood, S., et al. (2024). *Impact of a social and behavior change campaign and volunteer malaria testers in mining communities: program evaluation. Frontiers in Communication*, 9(1462943).

e-ISSN: **3047-9126**
Vol. **02** | No. **03** | **December 2025**

Subekti, R. A., Wijayanti, M. A., & Nugroho, W. (2022). Nighttime Activities and Malaria Risk in Mining Communities. *Journal* of *Health*, 18(1), 112–118.

Sukowati, S., Yuliani, D., & Wibisono, H. (2023). *Partial immunity to malaria in high-endemic areas: An epidemiological study and prevention implications.* Jurnal Biomedik Tropis, 15(3), 144–153.

Susanto, H. (2020). *Nighttime outings and their relationship to malaria incidence in West Kalimantan*. Journal of Tropical Health Research, 7(2), 89–98.

Tahulending, J. M. F., et al. (2024). Behavior *of Anopheles* sp., the vector of malaria disease on Lembeh Island, Bitung City, North Sulawesi. *Journal of Marine Biology*, 14(2).

Tambunan, R. A., & Sitompul, J. 2022. Perception of Malaria Risk among Workers in Endemic Areas of Papua. *Journal of Epidemiology and Environmental Health*, 11(1), 27–34.

Tesema, T., & Alemu, A. (2023). *Risk perception and preventive behavior toward malaria infection among mining workers in western Ethiopia.* Journal of Public Health and Epidemiology, 15(2), 89–99

Tiono, A. B., & Sugiarto, H. (2024). Environmental modification as an integrated strategy to control malaria vector breeding sites. *Asian Pacific Journal of Tropical Biomedicine*, 14(1), 8–16.

Utami, N., Marthen, S., & Widodo, T. (2021). *History of infection and partial immunity to malaria in endemic areas of Mimika Regency, Papua*. Jurnal Biomedis Tropis, 11(2), 77–88.

Wahyuni, S., Rachmad, A., & Laila, F. 2023. Level of Knowledge and Malaria Prevention Measures in Endemic Villages. *Journal of Community Health*, 12(3), 45–52.

Wati, R., Kurniawan, H., & Amir, L. (2022). *The relationship between length of stay and environmental conditions with malaria incidence in East Kutai.* Journal of Environmental Health, 14(3), 99–108.

WHO. (2022). *World Malaria Report 2022*. Geneva: World Health Organization.

WHO. (2023). *Guidelines for Malaria Control and Elimination*. Geneva: World Health Organization.

Wijaya, A., Santoso, A., & Ramadhani, R. (2023). Surveillance of larvae and adult mosquitoes in the malaria elimination program in Eastern Indonesia. *Journal of Health Ecology*, 22(1), 11–20.

World Health Organization. (2023). *World Malaria Report 2023: Progress and challenges toward malaria elimination.* Geneva: WHO

World Health Organization. (2024). *World Malaria Report 2024.* Geneva: WHO Press

World Health Organization. 2019. *World Malaria Report 2019*. Geneva: WHO.

World Health Organization. 2023. *Guidelines for malaria vector surveillance and control*. Geneva: WHO.

World Health Organization. 2023. *World Malaria Report 2023*. Geneva: WHO.

World Health Organization. 2024. *World Malaria Report 2024: Regional Briefing for South-East Asia*.

World Health Organization. 2024. *World Malaria Report 2024: Vector Surveillance and Resistance Monitoring*. Geneva: WHO.

Wulandari, D., Prasetyo, I., & Nur, S. (2022). *The environmental impact of mining on increased malaria risk in endemic areas of Kalimantan.* Jurnal Kesehatan Tropis, 15(2), 58–67.

Wulandari, D., Prasetyo, I., & Nur, S. (2023). *Environmental factors and community behavior in the sustainability of malaria vectors in mining areas of Sulawesi.* Indonesian Journal of Tropical Health, 15(2), 58–69

Wulandari, E., Tandi, J., & Rahayu, N. (2023). *Anopheles vector density and its relationship with malaria incidence in Mimika Regency*. Journal of Vectors and Tropical Diseases, 12(1), 21–31.

Wulandari, R., Samosir, M., & Ririhena, J. (2023). *History of malaria and its relationship with malaria incidence in Mimika Regency, Papua.* Indonesian Journal of Public Health, 18(2), 115–123.

Yudhantara, R., Prasetyo, A. A., & Wulandari, R. D. (2023). Malaria risk in illegal mining areas in

e-ISSN: **3047-9126**
Vol. **02** | No. **03** | **December 2025**

Indonesia: A literature review and policy perspective. *Indonesian Journal of Environmental Health*, 22(1), 15–23.

Yudhita, R. & Manurung, D. S. (2023). *Vector control challenges in mining zones of Papua: A cross-sectional entomological survey*. *Indonesian Journal of Public Health Entomology*, 10(2), 55–64.

Yuliana, D., Wibowo, S., & Arsyad, M. (2022). *The relationship between self-efficacy and environmental support for malaria prevention behavior.* Journal of Environmental Health, 14(1), 55–63.

Yuliana, P., Nggadas, F., & Nur, H. (2023). *The relationship between risk perception and malaria prevention actions in East Sumba.* Journal of Public Health, 18(1), 87–95

Yuliani, F., Mahmud, M., & Syukur, M. (2023). Behavioral and Environmental Factors in Malaria Incidence in Small-Scale Mining. *Journal of Public Health Science*, 19(2), 101–110.

Yulianto, A., Rahayu, E., & Setiawan, T. (2023). *Analysis of determinants of malaria incidence in mining areas: An environmental epidemiological study.* Tropical Biomedical Journal, 15(1), 60–69.

Yulidar, M., Nasution, R. H., & Ahmad, L. (2024). *Behavioral and environmental risk factors of malaria among artisanal gold miners in Sulawesi, Indonesia.* International Journal of Environmental Health Research, 34(5), 612–625