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RISK FACTORS FOR MALARIA IN THE WORKING AREA OF THE KALIORANG HEALTH CENTER IN EAST KUTAI REGENCY IN 2023

Ketut Pilih Kasih*[1]
Faculty of Public Health, Mulawarman University
Email: putuanandhita.20@gmail.com

Irfansyah Baharuddin Pakki
Faculty of Public Health, Mulawarman University
Email: irfanchango@gmail.com

Iwan M. Ramdan
Faculty of Public Health, Mulawarman University
Email: iwan.m.ramdan@fkm.unmul.ac.id

Abstract

This observational study with a case-control design aims to analyze risk factors for the incidence of Malaria in the Kaliorang Health Center Working Area, East Kutai Regency in 2023. The population in this study is all malaria patients recorded at the Kaliorang Health Center, East Kutai Regency for the period from January to November 2023 as many as 85 people as a group of cases. The population of the control group is also 85 people. The results showed that work and the existence of resting places had a significant relationship with the incidence of malaria. The chi-square analysis showed a p-< value of 0.001 for both variables. The odds ratio for employment is 0.150, which means respondents with at-risk jobs have a 0.150 times greater risk of developing malaria. Meanwhile, the Odds Ratio for resting places was 6,295, indicating that respondents whose environments had resting places such as shrubs and shrubs were 6,295 times more likely to develop malaria than those who did not.

Keywords: Risk Factors, Malaria, Anopheles Mosquito, Health Center, Scrub

INTRODUCTION

Malaria is an infectious disease caused by the parasite Plasmodium sp., which lives and multiplies in human red blood cells. Until now, malaria is still a health problem in more than 100 countries, especially in tropical regions such as Africa, Asia, and Latin America. According to a 2020 WHO report, global malaria

cases in 2019 reached 229 million with 409,000 deaths. In Indonesia, malaria cases reached 94,610 in 2021. Data from East Kalimantan Province shows that the malaria incidence rate reached 0.92 percent in 2022 with 61 positive cases spread across several regions, including East Kutai Regency.[1][1]

Malaria control ideally involves promotive and preventive aspects, such as the use of mosquito nets, protective clothing, and mosquito repellents, without neglecting curative and rehabilitative aspects. These measures aim to reduce morbidity and mortality, break the chain of transmission, and prevent drug resistance. Malaria elimination is a continuous effort to break the local chain of transmission in order to keep the disease rate as low as possible so that it does not become a health problem.[2]

The results of previous studies show various risk factors for malaria events. Sembiring et al. (2020) found a relationship between night out habits, the use of mosquito repellent, and the existence of mosquito breeding grounds.[3] Manangsang et al. (2021.) showed that the presence of shrubs around the house increases the risk of malaria[4]. Tiyas (2019) found a relationship between work, the habit of using gauze, and the use of mosquito nets with the incidence of malaria[5]. Other research shows that human activities such as mining and oil palm plantations increase the risk of malaria because it disturbs the natural habitat of the Anopheles mosquito.[6]

Although many studies have been conducted, there are still some shortcomings in the handling of malaria, especially in the mining sector where it is difficult to obtain malaria event reporting. This is exacerbated by mining activities that leave former dugout holes, becoming breeding grounds for Anopheles mosquitoes. In addition, there is still a lack of public awareness about the importance of malaria prevention and treatment as an obstacle in reducing the incidence of malaria.

This study offers a new perspective with a focus on the work area of the Kaliorang Health Center in East Kutai Regency, which has not been widely discussed in previous research. Data shows a significant increase in malaria cases in the region, from 31 cases in 2022 to 94 cases in the January-November 2023 period. This study will analyze the risk factors of behavioral, environmental, and health services that affect the incidence of malaria in this region.

The general purpose of this study is to find out the risk factors that affect the incidence of malaria in the working area of the Kaliorang Health Center, East Kutai Regency in 2023. The special objectives include analyzing the influence of

behavioral, environmental, and health service factors as risk factors for malaria events. This research is important because it provides information that can be used as a basis for formulating policies to improve service quality in handling malaria, increasing the knowledge of health workers, and providing education to the public about malaria prevention and treatment.

METHOD

This study is an analytical observational study with a case control design that aims to study the relationship between various risk factors and the incidence of malaria in the working area of the Kaliorang Health Center, East Kutai Regency. The research was conducted from January to February 2024. The study population includes all malaria patients recorded at the Kaliorang Health Center in the period January to November 2023, as many as 85 people as the case group and 85 people as the control group, with a 1:1 matching ratio based on age and region of residence, so that the total population is 170 people.

Data was collected through questionnaires consisting of two types, namely a malaria risk factor questionnaire and a malaria knowledge questionnaire. The malaria risk factor questionnaire includes socio-demographic data of respondents as well as clinical information on malaria diagnosis, which has been standardized by the Indonesian Ministry of Health. The malaria knowledge questionnaire, created based on previous research, consisted of 10 multiple-choice question items. The malaria test result data is recorded in an observation sheet that includes respondent number, examination date, malaria laboratory value, and interpretation of the results.[7]

Data analysis was carried out in three stages: univariate, bivariate, and multivariate. Univariate analysis is used to describe the characteristics of each variable studied through frequency and percentage. Bivariate analysis with the Chi-Square test was used to test the relationship between the independent variables (occupation, knowledge, habits of going out at night, use of mosquito nets, use of mosquito repellents, existence of breeding places, existence of resting places, existence of livestock cages, access to health services, support of health center staff, provision of information) and bound variables (incidence of malaria). Multivariate analysis with logistic regression tests was carried out to identify the most dominant factors associated with malaria incidence.

Research Hypothesis

Employment Factors

H0: Occupational factors are not a risk factor for malaria incidence in the working area of the Kaliorang Health Center, East Kutai Regency.

H1: Occupational factors are risk factors for malaria incidence in the working area of the Kaliorang Health Center, East Kutai Regency.

Knowledge Factor

H0: Knowledge factor is not a risk factor for malaria incidence in the working area of the Kaliorang Health Center, East Kutai Regency.

H1: The knowledge factor is a risk factor for malaria incidence in the working area of the Kaliorang Health Center, East Kutai Regency.

Factors of the habit of going out at night

H0: The habit of going out at night is not a risk factor for malaria incidence in the working area of the Kaliorang Health Center, East Kutai Regency.

H1: The habit of going out at night is a risk factor for malaria in the working area of the Kaliorang Health Center, East Kutai Regency.

Factors for the use of mosquito nets

H0: The use of mosquito nets is not a risk factor for malaria in the working area of the Kaliorang Health Center, East Kutai Regency.

H1: The use of mosquito nets is a risk factor for malaria incidence in the working area of the Kaliorang Health Center, East Kutai Regency.

Factors for the use of mosquito repellent

H0: The use of mosquito repellent drugs is not a risk factor for malaria in the working area of the Kaliorang Health Center, East Kutai Regency.

H1: The use of mosquito repellent is a risk factor for malaria incidence in the working area of the Kaliorang Health Center, East Kutai Regency.

Factors for the existence of breeding places

H0: The existence of a breeding place is not a risk factor for malaria incidence in the working area of the Kaliorang Health Center, East Kutai Regency.

H1: The existence of a breeding place is a risk factor for malaria incidence in the working area of the Kaliorang Health Center, East Kutai Regency.

Factors for the existence of resting places
H0: The existence of resting places is not a risk factor for malaria in the working area of the Kaliorang Health Center, East Kutai Regency.
H1: The existence of resting places is a risk factor for malaria incidence in the working area of the Kaliorang Health Center, East Kutai Regency.

Factors for the existence of cattle pens
H0: The existence of livestock pens is not a risk factor for malaria incidence in the working area of the Kaliorang Health Center, East Kutai Regency.
H1: The existence of livestock pens is a risk factor for malaria events in the working area of the Kaliorang Health Center, East Kutai Regency.

Access to health care factors
H0: Access to health services is not a risk factor for malaria incidence in the work area of the Kaliorang Health Center, East Kutai Regency.
H1: Access to health services is a risk factor for malaria incidence in the work area of the Kaliorang Health Center, East Kutai Regency.

Support factors for health center staff
H0: The support factor of the health center staff is not a risk factor for malaria events in the working area of the Kaliorang Health Center, East Kutai Regency.
H1: The support factor of health center staff is a risk factor for malaria events in the working area of the Kaliorang Health Center, East Kutai Regency.

Informational factors
H0: The factor of providing information is not a risk factor for malaria incidence in the working area of the Kaliorang Health Center, East Kutai Regency.
H1: The factor of providing information is a risk factor for malaria incidence in the working area of the Kaliorang Health Center, East Kutai Regency.

RESULTS AND DISCUSSION

Univariate Analysis

Univariate analysis is a technique of analyzing data on one variable independently, each variable is analyzed without being associated with other variables. The results of the univariate analysis of malaria cases in Kaliorang

District can be seen in the following table:

Distribution of Respondent Frequency on Malaria Case Variables Based on Community Habits in Kaliorang District

Table 1. Frequency Distribution in Malaria Case Variables

Variable	Sum (n=170)	
	Frequency (n)	Percentage (%)
Work		
Risky (related to work in and out of forests, oil palm lands, and mines)	140	82.4
Not Risky (not related to work in and out of forests, oil palm lands, and mines)	30	17.6
Information about malaria		
At risk (Never informed about malaria)	130	76.5
Not at risk (Have been informed about malaria)	40	23.5
The Existence of *Breeding Place*		
At risk (the environment has or is adjacent to <75m *breeding place*)	150	88.2
Not at risk (the environment does not have or is far away >75m *breeding place*)	20	11.8
The Existence of *Resting Place*		
Risky (the environment has *resting places* such as bushes and shrubs)	141	82.9
Not at risk (the environment does not have *resting places* such as bushes and shrubs)	29	17.1
Knowledge		
Risky (lack of knowledge)	38	22.4
No risk (good knowledge)	132	77.6
Habit of going out at night		
Risky (usually leaving the house at night within a span of > 2 hours)	14	8.2
Not risky (not usual to go out at night, only occasionally in the span of 1-2 hours)	156	91.8
Habits of using mosquito nets		
Risky (it is not customary to use mosquito nets when sleeping at night)	134	78.8
No risk (used to use mosquito nets when sleeping at night)	36	21.2
Habits of using mosquito repellent		
Risky (Unusual to use mosquito repellent)	105	61.8
No risk (usually using mosquito repellent)	65	38.2

Variable	Sum (n=170)	
	Frequency (n)	Percentage (%)
The existence of cattle pens		
At risk (the environment has a livestock)	94	55.3
Not at risk (the environment does not have a cattle pen)	76	44.7
Distance from home to health center		
Risky (The location of the house > 2 km from the health center)	166	97.6
Not at risk (the location of the house < 2 km from the health center)	4	2.4
Support from Health Center Officers		
No	2	1.2
Already	168	98.8

Most respondents (82.4%) had risky jobs related to activities in forests or mines, and the majority (76.5%) had never been informed about malaria. Also, many respondents were in environments with breeding places (88.2%) and resting places (82.9%), and had good knowledge of malaria (77.6%), although most did not use mosquito nets (78.8%) or mosquito repellent (61.8%).

Most respondents had risky jobs related to activities in forests or mines and lived in environments with breeding and resting places, which could increase the risk of developing malaria. Although the majority of respondents had good knowledge of malaria, many did not use mosquito nets or mosquito repellents, which indicates a lack of effective preventive measures.[8]

Bivariate Analysis

1. Employment Relationship with Malaria Incidence in Kaliorang Regency

Table 2. Employment Relationship with Malaria Incidence

Work	Malaria						*P*	OR
	Positive		Negative		Total			
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	n	%		
Risky	60	42.9	80	57.1	140	100		
No risk	25	83.3	5	16.7	30	100	<0.001	0.150

The analysis showed that although respondents with at-risk occupations had a higher proportion of those who did not experience malaria, at-risk occupations were significantly associated with a lower risk of developing malaria than non-at-risk occupations ($p < 0.001$, Odds Ratio 0.150). Although respondents with at-risk occupations had a higher proportion of those who did not experience

malaria, at-risk occupations were significantly associated with a lower risk of developing malaria compared to non-at-risk occupations.[9]

2. The Relationship of Knowledge with the Incidence of Malaria in Kaliorang District

Table 3. The Relationship of Knowledge with the Incidence of Malaria

Knowledge	Malaria						*P*	OR
	Positive		Negative		Total			
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	N	%		
Risky	21	55.3	17	44.7	38	100		
No risk	64	48.5	68	51.5	132	100	0.581	1.313

The analysis showed that there was no significant association between knowledge and malaria incidence (p = 0.581), although respondents with knowledge more or less experienced malaria more often than those with good knowledge. Although there was no significant association between knowledge and malaria incidence (p = 0.581), respondents with less knowledge were less likely to experience malaria more often than those with good knowledge.[10]

3. The Relationship between Night Out Habits and Malaria Incidence

Table 4. Relationships Habit of Going Out at Night

Habit of Going Out at Night	Malaria						*P*	OR
	Positive		Negative		Total			
	Frequenc y (n)	Percentage (%)	Frequenc y (n)	Percentage (%)	N	%		
Risky	7	50	7	50	14	100		
No risk	78	50	78	50	156	100	1.000	1.000

The analysis showed no significant association between the habit of going out at night and the incidence of malaria (p = 1,000, Odds Ratio = 1,000), with the same proportion of respondents experiencing and not experiencing malaria in both groups. This conclusion means that based on the analysis of the data, no significant association was found between the habit of going out at night and the incidence of malaria. This means that the habit of going out at night does not affect a person's chances of developing malaria, because the risk of malaria is the same between those who go out at night and those who do not go out at night.[11]

4. The Relationship between the Habit of Using Mosquito Nets and the Incidence of Malaria

Table 5. Relationship with the Habit of Using Mosquito Nets

Habits of Using Mosquito Nets	Malaria						*P*	OR
	Positive		Negative		Total			
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	N	%		
Risky	65	48.5	69	51.5	134	100		
No risk	20	55.6	16	44.4	36	100	0.573	0.754

The analysis showed no significant association between the habit of using mosquito nets at night and the incidence of malaria (p = 0.573), although respondents who did not use mosquito nets had a 0.754 times greater risk of developing malaria than those who used mosquito nets. The use of mosquito nets is not statistically associated with the likelihood of developing malaria.[12]

5. The Relationship between the Habit of Using Mosquito Repellents and the Incidence of Malaria

Table 6. Relationship with the Habit of Using Mosquito Repellent

Habits of Using Mosquito Repellent	Malaria						*P*	OR
	Positive		Negative		Total			
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	n	%		
Risky	48	45.7	57	54.3	105	100		
No risk	37	56.9	28	43.1	65	100	0.207	0.637

The analysis showed that there was no significant association between the habit of using mosquito repellent and the incidence of malaria (p = 0.207), although respondents who did not use mosquito repellent had a risk of 0.637 times more and no significant association was found between the habit of using mosquito repellent and the incidence of malaria (p = 0.207), so the use of mosquito repellent did not statistically affect the likelihood of developing malaria. mosquito repellent.[13]

6. The Relationship between the Existence *of Breeding Places* and the Incidence of Malaria in Kaliorang Regency

Table 7. The Relationship Between the Existence of Breeding Places and the Incidence of Malaria

Breeding Place	Malaria						*P*	OR
	Positive		Negative		Total			
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	N	%		
Risky	77	51.3	73	48.7	150	100		
No risk	8	40	12	60	20	100	0.475	1.582

The analysis showed no significant association between the presence of breeding sites and the incidence of malaria (p = 0.475), although respondents whose environment was close to the breeding site had a 1,582 times greater risk of developing malaria than those whose environment was far away. In conclusion, although there was no significant association between the presence of a breeding site and the incidence of malaria (p = 0.475), respondents whose environment was close to the breeding site had a 1,582 times greater risk of developing malaria compared to those whose environment was far away.[14]

7. The Relationship between the Existence *of Resting Places* and the Incidence of Malaria

Table 8. The Relationship between the Existence *of Resting Places* and the

Resting Place	Malaria						*P*	OR
	Positive		Negative		Total			
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	N	%		
Risky	80	56.7	61	43.3	141	100		
No risk	5	17.2	24	82.8	29	100	<0.001	6.295

Incidence of Malaria

The analysis showed a significant relationship between the presence of resting places and the incidence of malaria (p < 0.001), with respondents whose environments had resting places such as shrubs and shrubs had a 6,295 times greater risk of developing malaria than those whose environments did not have such resting places. There was a significant association between the existence of resting places and the incidence of malaria (P < 0.001), where respondents whose environments had resting places such as shrubs and shrubs were 6,295 times more likely to develop malaria than those whose environments did not have such resting places.[15]

8. The Relationship between the Existence of Livestock Cages and the Incidence of Malaria

Table 9. Relationship with the Existence of Livestock Cages

The Existence of Cattle Cages	Malaria						*P*	OR
	Positive		Negative		Total			
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	n	%		
Risky	52	55.3	42	44.7	94	100		
No risk	33	43.4	43	56.6	76	100	0.165	1.613
No risk	33	43.4	43	56.6	76	100	0.165	1.613

The analysis showed no significant association between the presence of cattle pens and the incidence of malaria (p = 0.165), although the risk of malaria was 1,613 times higher in the environment with cattle pens. Although not statistically significant, the presence of cattle pens may contribute to an increased risk of malaria, which is reflected in a 1,613-fold higher risk in environments with cattle pens.[16]

9. The Relationship between the Distance of Home Location to the Health Center and the Malaria Incidence

Table 10. Relationship between Home Location Distance to Health Center

Distance from Home Location to Puskesmas	Malaria						*P*	OR
	Positive		Negative		Total			
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	n	%		
Risky	83	50	83	50	166	100		
No risk	2	50	2	50	4	100	1.000	1.000

The analysis showed no significant association between home distance to health centers and malaria incidence (p = 1,000), with the same risk of malaria in both distance groups (Odds Ratio 1,000). Although the distance from home to the health center did not show a significant association with malaria incidence (p = 1,000), the risk of malaria remained the same in both distance groups, suggesting that this factor may not significantly affect malaria incidence.[17]

10. The Relationship between Health Center Staff Support and Malaria Incidence

Table 11. Support Relationship of Health Center Officers

Support from Health Center Officers	Malaria						*P*	OR
	Positive		Negative		Total			
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	n	%		
Risky	1	50	1	50	2	100		
No risk	84	50	84	50	168	100	1.000	1.000

The analysis showed no significant association between the support of health center staff and the incidence of malaria (p = 1,000), with the same risk between respondents who received and did not receive support (Odds Ratio 1,000). Although the support of health center staff did not show a significant association with malaria incidence (p = 1,000), the risk of malaria remained the same among respondents who received support and those who did not, indicating that such support may have no effect on malaria incidence.[18]

11. The Relationship between Providing Information About Malaria and Malaria Incidence in Kaliorang Regency

Table 12. Relationship of Providing Information About Malaria

Malaria information	Malaria						*P*	OR
	Positive		Negative		Total			
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	N	%		
Risky	68	52.3	62	47.7	130	100		
No risk	17	42.5	23	57.5	40	100	0.366	1.484

The analysis showed no significant association between information about malaria and malaria incidence (p = 0.366), although respondents who were not informed had a 1,484 times greater risk of developing malaria than those who were informed. Although there was no significant association between information about malaria and malaria incidence (p = 0.366), respondents who were not informed about malaria had a 1,484 times higher risk of developing malaria, suggesting that information could potentially play a role in reducing the risk, although it was not significantly detected in this analysis.[19]

Data Normality Test

The normality test is used to determine whether the data population is normally distributed or not. The normality test used in this study is *the One Sample Kolmogorov-Smirnov Test.* Based on the results of the normality test with *Kolmogorov-Smirnov*, the significance value (p-value) was obtained as follows:

No	Variable	P value	Information
	Bound variables		
1	Malaria	<0.001	Abnormal
	Independent Variable		
1	Work	<0.001	Abnormal
2	Malaria Information	<0.001	Abnormal
3	The Existence of *Breeding Place*	<0.001	Abnormal
4	The Existence of *Resting Place*	<0.001	Abnormal
5	Knowledge	<0.001	Abnormal
6	Habit of going out at night		
7	The habit of using mosquito nets when sleeping at night	<0.001	Abnormal
8	Habits of using mosquito repellent The existence of cattle cages	<0.001	Abnormal
9	Distance from Home Location to Puskesmas	<0.001	Abnormal
10	Support from Health Center Officers	<0.001	Abnormal
11		<0.001	Abnormal

Based on the table, it is illustrated that there are no normally distributed variables, so the analysis continues using nonparametric analysis in the form of multiple logistic regression.

Multivariate Analysis

1. **Variable Independence Test**

It	Variable	P value	Information
1	Work	<0.001	Model Entry
2	Malaria Information	0.366	Not included in the model
3	The Existence of *Breeding Place*	0.475	Not included in the model
4	The Existence of *Resting Place*	<0.001	Model Entry
5	Knowledge	0.581	Not included in the model
6	Habit of going out at night	1.000	Not included in the model
7	The habit of using mosquito nets when sleeping at night	0.573	Not included in the model

8	Habits of using mosquito repellent	0.207	Model Entry
9	The existence of cattle cages	0.165	Model Entry
10	Distance from Home Location to Puskesmas	1.000	Not included in the model
11	Support from Health Center Officers	1.000	Not included in the model

Based on the table, it shows that there are seven (7) variables that are not included in the model, while the other four (4) variables (occupation, existence of *resting place*, habit of using mosquito repellent, and existence of livestock cages) are stated as multivariate modeling candidate variables.

2. **Simultaneous Parameter Significance Test (Step 1)**

Chi-Square	**df**	***p*-value**
(1)	(2)	(3)
37.727	4	<0.001

The table shows that *the chi square* value is 37,727 > the value of *the chi square* table (df = 4, α = 0.05) is 9,488 so it was decided that H0 was rejected, meaning that at least one of the variables that affects the incidence of malaria is present. After simultaneous testing, it is followed by partial testing.

3. **Partial Parameter Significance Test (Step 1)**

Variable	**B**	**S.E.**	**Forest**	***p*-value**	**Exp(b)**
(1)	(2)	(3)	(4)	(5)	(6)
Work	-2.178	0.569	14.648	<0.001	0.113
The Existence of *Resting Place*	1.695	0.557	9.246	0.002	5.446
Habits of using mosquito repellent	-0.765	0.364	4.413	0.036	0.465
The existence of cattle pens	0.504	0.358	1.991	0.158	1.656
Cash	0.583	0.756	0.595	<0.001	1.791

The table shows *step* 1 Table of wald test results of all variables that have been included in the modeling. In this *step,* all variables that have no effect will be eliminated and the best model is obtained in the last iteration, which is *step* 2.

4. **Simultaneous Parameter Significance Test (Step 2)**

Chi-Square	**Df**	***p*-value**
(1)	(2)	(3)
35.714	3	<0.001

The table shows the value *of chi square* of 149,469 > the value of *the chi square* table (df = 3, α = 0.05) which is 7,815 so it was decided that H0 was rejected, meaning that there is at least one variable that affects the incidence of malaria. After simultaneous testing, it is followed by partial testing.

5. **Partial Parameter Significance Test (Step 2)**

Variable	B	S.E.	Forest	*p*-value	Exp(b)
(1)	(2)	(3)	(4)	(5)	(6)
Work	-2.099	0.560	14.057	<0.001	0.123
The Existence of *Resting Place*	1.785	0.551	10.509	0.001	5.961
Habits of using mosquito repellent	-0.668	0.354	3.547	0.060	0.513
Cash	0.666	0.753	0.781	0.377	1.946

The table shows that occupational variables, the existence *of resting places*, and the habit of using mosquito repellent drugs have a significant effect on the incidence of malaria. The logit model was formed based on *the Step* 2 test as follows:

$$g(x) = 0.666 - 2.099\ (pekerjaan) + 1.785(keberadaan\ resting\ place - 0.668(kebiasaan\ menggunakan\ obat\ anti\ nyamuk)$$

6. **Interpretation of the Multiple Logistic Regression Model**

The resulting model will be applied in predicting how much the incidence of acute kidney failure affects by using factors that affect it. The following is a simulation of the implementation prediction model:

7. Interpretation of Prediction Models

Variable	42 Answer	76 Respondents
(1)	(2)	(3)
Work	No Risk (0)	Risky (1)
The existence of *a resting place*	Risky (1)	No Risk (0)
Habits of using mosquito repellent	Risky (1)	Not risky (0)
Prediction Value	0.856	0.192

The results in the table can be interpreted as follows:

a. Respondents' prediction value 42

$$\pi_1 = \frac{\exp^{0.666-2.099(0)+1.785(1)-0.668(1)}}{1+\exp^{0.666-2.099(0)+1.785(1)-0.668(1)}}$$

$$\pi_1 = \frac{5.9476}{1+5.9476}$$

$$\pi_1 = \frac{5.9476}{6.9476}$$

$$\pi_1 = 0.856$$

Based on the results above, it shows that the probability of respondents having a malaria incidence is 85.6 percent. Meanwhile, the chance of respondents not having malaria incidence was 14.4 percent.

b. Respondents' predicted value 76

$$\pi_1 = \frac{\exp^{0.666-2.099(1)+1.785(0)-0.668(0)}}{1+\exp^{0.666-2.099(1)+1.785(0)-0.668(0)}}$$

$$\pi_1 = \frac{0.2385}{1+0.2385}$$

$$\pi_1 = \frac{0.2385}{1.2385}$$

$$\pi_1 = 0.192$$

Based on the above results, it shows that the probability of respondents having a malaria incidence is 19.2 percent. Meanwhile, the chance of respondents not having malaria incidence was 80.8 percent.

8. Coefficient of Determination

Nagelkerke R Square
0.253

The table shows a *Negelkerke R Square value* of 0.253, meaning that the predictor variables that are included in the model can explain the diversity by 25.3 percent, while the rest (74.7%) is explained by other variables that are not included in the model.

9. Interpretation of Parameter Coefficients

Odds Ratio It is the value of the tendency between one category and another on a qualitative explanatory variable. The value of the tendency ratio can be seen in the following table.

Variable	***Odds Ratio* Exp(β)**
(1)	(2)
Work	0.123
The Existence of *Resting Place*	5.961
Habits of using mosquito repellent	0.513
Consant	1.946

The table can be interpreted as follows:

a. Respondents who had risky jobs were 0.123 times more likely to experience malaria than respondents who did not have risky jobs.
b. Respondents who had *a resting place* were 5,961 times more likely to experience malaria than respondents who did not have *a resting place*.
c. Respondents who did not have the habit of using mosquito repellent drugs tended to experience a malaria incidence of 0.513 times greater than respondents who had the habit of using mosquito repellents.
d. The constant value of 1.946 means that if there are no independent variables that influence, the malaria incidence value is 1.946.

From the logistic regression analysis model above, it can be concluded that the most dominant variables affecting the incidence of malaria are occupation and resting place.

CONCLUSION

Research on Analysis of Risk Factors for Malaria Incidence in the Working Area of the Kaliorang Health Center, East Kutai Regency in 2023 shows that occupational factors and resting places have a significant relationship with malaria incidence. Occupations involving outdoor activities showed a higher risk of malaria with an Odds Ratio of 0.150, while mosquito resting places, such as shrubs and shrubs, showed a very high risk with an Odds Ratio of 6.295. Other variables such as knowledge, night-out habits, mosquito net use, and mosquito repellent use did not show a significant association with malaria incidence.

Based on the results of the study, it is recommended that special attention be paid to groups of workers exposed to the outside environment and malaria-endemic areas with interventions such as the provision of insecticide mosquito nets and the regulation of working hours. To address the risks of resting places, environmental modification, the use of insecticides, and improved environmental cleanliness must be a priority. Public education about the importance of maintaining environmental cleanliness and the use of personal protective equipment is also crucial in reducing the risk of malaria transmission. Collective efforts from governments, communities, and related sectors are needed to improve the effectiveness of malaria control and protect public health.

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