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## Risk Factors of Malaria Incidence in the Work Area of the Waghete Public Health Center, Tigi District, Deiyai Regency, Central Papua Province

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### Abstract

**Background:** Malaria is an endemic disease in Deiyai Regency, Central Papua Province which is influenced by age, sex, education, socio-economic, use of mosquito repellents, use of insecticide-treated nets, installation of wire netting, house walls, stagnant water, the presence of large animal cages and the distance between houses and breeding sites. **Objectives:** This study aimed to determine risk factors for Malaria incidence in the Work Area of the Waghete Health Center, Tigi District, Deiyai Regency, Central Papua Province. **Methods:** Analytical descriptive uses a cross sectional study design approach. The population is the people who visit the Waghete Health Center as many as 100 people as a sample by accidental sampling. Data were obtained using a questionnaire and analyzed using chi square and binary logistic regression. **Result:** Factors that influence the incidence of malaria in the Waghete Health Center, Tigi District, Deiyai Regency were the habit of using mosquito repellents ( $\rho$ -value = 0.009; RP = 2.091; CI95% = (1.225 – 3.568); use of insecticide-treated nets ( $\rho$ -value = 0.001; RP) = 2.700; CI95% = (1.466 – 4.972); use of wire netting ( $\rho$ -value = 0.009; RP = 2.182; CI95% = (1.215 – 3.919); house walls ( $\rho$ -value = 0.004; RP = 2.364; CI95% = (1.316 – 4.247); standing water ( $\rho$ -value = 0.018; RP = 2.222; CI95% = (1.136 – 4.344).

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Meanwhile, the factors that has no effect on the incidence of malaria in the Waghete Health Center, Tigi District, Deiyai Regency were gender ( $\rho$ -value = 0.379; RP = 0.379; CI95% = (0.453 – 1.248); age ( $\rho$ -value = 0.104; RP = 0.618; CI95% = (0.376 – 1.015); education ( $\rho$ -value = 1.000; RP = 0.993; CI95 % = (0.586 – 1.683); socioeconomic ( $\rho$ -value = 0.601; RP = 0.825; CI95% = (0.491 – 1.387); breeding place ( $\rho$ -value = 0.018; RP = 1.583; CI95% = (0.955 – 2.625) ); the presence of large livestock cages ( $\rho$ -value = 0.842; RP = 1.112; CI95% = (0.6467– 1.854). The dominant risk factors that influence the incidence of malaria in the Waghete Health Center, Tigi District, Deiyai Regency are the habit of using mosquito repellents, using insecticide-treated nets, using wire netting, and the most dominant risk factor is the use of mosquito nets.

**Keywords:** Risk Factors; Malaria Incidence.

## 1. Introduction

Plasmodium, a genus with numerous species, is the causative agent of malaria. The species that typically cause malaria are Plasmodium vivax, Plasmodium falciparum, Plasmodium malariae, and Plasmodium ovale. Anopheles mosquitoes, which carry Plasmodium in their bodies, are the primary vectors of malaria. Anopheles mosquito breeding places serve as transmission vectors for malaria, and their presence has a significant impact on the disease's endemicity and dissemination [1].

According to the 2020 World Malaria Report, there were 238 million cases of malaria worldwide in 2000 in 108 malaria-endemic countries, but in 2019 there are only an estimated 229 million cases in 87 malaria-endemic countries. Between 2000 and 2019, the number of malaria deaths decreased, going from 736,000 in 2000 to 409,000 in 2019. In 2000, 84% of all malaria deaths in children under 5 years old occurred; in 2019, that number dropped to 67% [2]. 32 countries account for about 95% of malaria deaths worldwide. Around 51% of all malaria deaths worldwide in 2019 were caused by Nigeria (23%), the Democratic Republic of the Congo (11%), the United Republic of Tanzania (5%), Burkina Faso (4%), Mozambique (4%), and Nigeria (4%). Approximately 49 (1%) of deaths in 2019 were attributable to Indonesia.

As of 2020, there were 250,644 malaria cases in Indonesia, making it the second-most malaria-affected nation in Southeast Asia after India. The highest number of cases occurred in Central Papua Province, where there were 216,380 cases, followed by NTT Province with 12,909 cases and West Central Papua Province with 7,079 cases. The eradication process has not yet been completed in Central Papua Province.

Elimination proclaimed in The United Nations Sustainable Development Goals (SDGs) agreed to achieve the target of eradicating malaria in 2015 and specifically in the eastern part of Indonesia, the achievement of the target is estimated in 2030 due to the limited funds and the difficulty of reaching the area [3].

The fight against malaria has not produced sufficient results. This is due to a number of factors, including the fact that there is still a severe lack of public awareness of malaria prevention measures and the risks they pose, as well as a general lack of community attitudes and behaviors that would allow them to protect themselves and their families from these risks. Through the use of insecticide-treated mosquito nets, vector control (spraying homes, larviciding, and biological control), diagnosis, and treatment, malaria can be eradicated, lowering

mortality and mortality rates. Malaria is endemic in Central Papua Province, which is situated in the easternmost region of Indonesia. The three Anopheles mosquito species that are known to spread throughout the region of Papua are the species of Anopheles farauti, Anopheles koliensis, and Anopheles punctulatus [3].

The most malaria cases were reported in five of the 29 regencies in Central Papua Province: Mimika Regency had 36,378 cases, Deiya Regency had 23,966 cases, Jayapura Regency had 22,516 cases, Jayapura City had 14,888 cases, and Nabir Regency had 10,482 cases. Malaria cases in Central Papua Province reached 147,239 in 2019, and by 2020, there were 261,617 cases of malaria reported nationwide and 192,648 cases in Papua.

The number of Malaria cases in Deiyai Regency in 2021 was 25,912 cases of API 482.9%, in 2017 there were 20,571 cases of API 373.9%, while the Wagethe Health Center in 2014 amounted to 6332 cases of API 415.5%, in 2015 there were 6496 cases of API 453, 2%, in 2016 there were 7783 cases of API 499.6%, in 2017 there were 6753 cases of API 482.3% [4].

Several factors may have contributed to the high number of malaria cases in Deiyai Regency, including the environment, such as stagnant water around the house, such as water storage containers for daily use, small ponds around the house, such as watercress ponds, ponds for livestock to drink. , this can be a breeding place for malaria mosquitoes (Breeding place), because the flight range of malaria mosquitoes (flight range) can reach 0.5-3 Km, if there are strong winds malaria mosquitoes can be carried up to 20-30 Km, besides that the presence of bushes shrubs/plantations, swamps and cattle pens as resting places for mosquitoes [5].

In Deiyai Regency, malaria cases rank first among the top ten diseases. Efforts have been made to stop malaria transmission through treatment and program management for vector control, but in reality, malaria incidence actually tends to rise, necessitating continued serious attention and management. Global and regional issues are included in the SDG indicator goal 3.3. It was followed by a promise made by state leaders in the Asia Pacific area at the 9th East Asia Summit conference in 2014 to eradicate malaria in the region by 2030.

Based on this, researchers are interested in conducting research on risk factors for malaria in the working area of the Wagethe Health Center, Tigi District, Deiyai Regency, Central Papua Province.

## **2. Methods**

The research method used in this study is observational analytic with a cross-sectional approach, where the variables studied are independent or risk variables and dependent variables or effect variables collected at the same time [6]. This research was carried out in November 2022. The population in this study were all patients who came to check for malaria in November 2022 at the Wagethe Health Center, totaling 131 people. The Slovin formula yields a sample size of 98.68, which is then rounded to 100. Accidental sampling was the method employed in this study, and the participants were patients who were scheduled to have a health checkup at the Wagethe Health Center, were willing to participate in the study, and resided in the study area. The data were collected using a questionnaire. The chi-square test and binary logistic regression were used in analyzing the data at significant level of 5%.

**3. Results**

**3.1. The effect of gender on the incidence of malaria**

**Table 3.1:** The Effect of Gender on the Incidence of Malaria at the Waghete Health Center, Tigi District, Deiyai Regency, Central Papua Province.

Gender	Malaria incident				Total	%
	Positive		Negative			
	n	%	n	%		
Female	20	32.8	41	67.2	61	100
Male	17	43.6	22	56.4	39	100
<b>TOTAL</b>	37	37.0	63	63.0	100	100

*P-value = 0.379; RP=0.752; CI 95% (0.453-1.248)*

*Source: Primary data, 2022*

Based on Table 3.1, it shows that 20 female respondents (32.8%) suffer from malaria and 41 respondents (67.2%) do not have malaria. Meanwhile, there were 17 male respondents (43.6%) who suffered from malaria and 22 respondents (56.4%) who did not suffer from malaria. The chi square test results obtained  $p$ -value =  $0.379 > 0.05$ . This means that there is no effect of gender on the incidence of malaria at the Waghete Health Center, Tigi District, Deiyai Regency. The results of the prevalence ratio test obtained  $RP = 0.379$ ;  $CI95\% = (0.453 - 1.248)$ , and because the lower limit and upper limit include the number 1, it can be said that the effect of gender on the incidence of malaria is not significant.

**3.2. The effect of age on the incidence of malaria**

**Table 3.2:** The Effect of Age on the Incidence of Malaria at the Waghete Health Center, Tigi District, Deiyai Regency, Central Papua Province.

Age	Malaria incident				Total	%
	Positive		Negative			
	n	%	n	%		
> 20 years old	21	30.9	47	69.1	68	100
≤ 20 years old	16	50.0	16	50.0	32	100
<b>TOTAL</b>	37	37.0	63	63.0	100	100

*P-value = 0.104; RP=0.618; CI 95% (0.376-1.015)*

*Source: Primary data, 2022*

Based on Table 3.2, it shows that the respondents aged > 20 who suffered from malaria were 21 people (30.9%) and there were 47 people who did not suffer from malaria (69.1%). While respondents aged ≤ 20 years who

suffered from malaria were 16 people (50%) and 16 people who did not suffer from malaria (50%). The chi square test results obtained  $p\text{-value} = 0.104 > 0.05$ . This means that there is no effect of age on the incidence of malaria at the Waghete Health Center, Tigi District, Deiyai Regency. The results of the prevalence ratio test obtained  $RP = 0.618$ ;  $CI_{95\%} = (0.376 - 1.015)$ , and because the lower limit and upper limit include the number 1, it can be said that the effect of age on the incidence of malaria is not significant.

**3.3. The effect of education on the incidence of malaria**

**Table 3.3:** The Effect of Education on the Incidence of Malaria at the Waghete Health Center, Tigi District, Deiyai Regency, Central Papua Province.

Education	Malaria incident				Total	%
	Positive		Negative			
	n	%	n	%		
Low (< SHS)	14	36.8	24	63.2	38	100
High ( $\geq$ SHS)	23	37.1	39	62.9	62	100
<b>TOTAL</b>	37	37.0	63	63.0	100	100

$P\text{-value} = 1.000$ ;  $RP=0.993$ ;  $CI\ 95\% (0.586-1.683)$

Source: Primary data, 2022

Based on Table 3.3, it shows that as many as 14 people (36.8%) of respondents with low education suffer from malaria and 24 people (63.2%) do not suffer from malaria. Meanwhile, 23 people (37.1%) who had higher education had malaria and 39 people (62.9%) did not have malaria. The chi square test results obtained  $p\text{-value} = 1.000 > 0.05$ . This means that there is no effect of education on the incidence of malaria in the Waghete Health Center, Tigi District, Deiyai Regency. The results of the prevalence ratio test obtained  $RP = 0.993$ ;  $CI_{95\%} = (0.586 - 1.683)$ , and because the lower limit and upper limit include the number 1, it can be said that the effect of education on the incidence of malaria is not significant.

**3.4. The effect of socioeconomic on the incidence of malaria**

**Table 3.4:** The Effect of Socioeconomic on the Incidence of Malaria at the Waghete Health Center, Tigi District, Deiyai Regency, Central Papua Province.

Socioeconomic	Malaria incident				Total	%
	Positive		Negative			
	n	%	n	%		
Lack	16	33.3	32	66.7	48	100
Enough	21	40.4	31	59.6	52	100
<b>TOTAL</b>	37	37.0	63	63.0	100	100

*P-value = 0.601; RP=0.825; CI 95% (0.491-1.387)*

*Source: Primary data, 2022*

Based on Table 3.4, it shows that 16 respondents (33.3%) who are less socioeconomic suffer from malaria and 32 people (66.7%) do not suffer from malaria. Meanwhile, 21 people (40.4%) with moderate socioeconomic status suffered from malaria, and 31 people (59.6%) did not suffer from malaria.

The chi square test results obtained  $p\text{-value} = 0.601 > 0.05$ . This means that there is no significant socio-economic effect on the incidence of malaria at the Waghete Health Center, Tigi District, Deiyai Regency.

The results of the prevalence ratio test obtained  $RP = 0.825$ ;  $CI95\% = (0.491 - 1.387)$ , and because the lower limit and upper limit include the number 1, it can be said that the effect of socioeconomic on the incidence of malaria is not significant.

### 3.5. The effect of the habit of using mosquito repellents on the incidence of malaria

**Table 3.5:** The Effect of the habit of using mosquito repellents on the Incidence of Malaria at the Waghete Health Center, Tigi District, Deiyai Regency, Central Papua Province.

The habit of using mosquito repellents	Malaria incident				Total	%
	Positive		Negative			
	n	%	n	%		
No	23	52.3	21	47.7	44	100
Yes	14	25.0	42	75.0	56	100
<b>TOTAL</b>	37	37.0	63	63.0	100	100

*P-value = 0.009; RP=2.091; CI 95% (1.225-3.568)*

*Source: Primary data, 2022*

Based on Table 3.5, it shows that 23 people (52.3%) suffer from malaria and 21 people (47.7%) do not have malaria. Meanwhile, 14 people (25%) who used anti-mosquito drugs suffered from malaria and 42 people (75%) did not suffer from malaria. Chi square test results obtained  $p\text{-value} = 0.009 < 0.05$ .

This means that there is an effect of the habit of using mosquito repellent on the incidence of malaria in the Waghete Health Center, Tigi District, Deiyai Regency. The results of the prevalence ratio test obtained  $RP = 2.091$ ;  $CI95\% = (1.225 - 3.568)$  which interpreted that respondents who did not use malaria mosquito repellent had a risk of malaria incidence of 2.091 times higher than respondents who used malaria mosquito repellent.

**3.6. The effect of the use of insecticide-treated nets on the incidence of malaria**

**Table 3.6:** The Effect of the use of insecticide-treated nets on the Incidence of Malaria at the Waghete Health Center, Tigi District, Deiyai Regency, Central Papua Province.

The use of insecticide-treated nets	Malaria incident				Total	%
	Positive		Negative			
	n	%	n	%		
No	27	54.0	23	46.0	50	100
Yes	10	20.0	40	80.0	50	100
<b>TOTAL</b>	37	37.0	63	63.0	100	100

*P-value = 0.001; RP=2.700; CI 95% (1.466-4.972)*

*Source: Primary data, 2022*

Based on Table 3.6, it shows that the respondents who did not use insecticide-treated nets suffered from malaria as many as 27 people (54%) and as many as 54 people (47.7%) did not suffer from malaria. While the respondents who used insecticide-treated nets suffered from malaria as many as 10 people (20%) and as many as 40 people (80%) did not suffer from malaria. The results of the chi square test obtained a  $p$ -value = 0.001 <0.05. This means that there is an effect of the use of insecticide-treated nets on the incidence of malaria at the Waghete Health Center, Tigi District, Deiyai Regency. The results of the prevalence ratio test obtained RP = 2.700; CI95% = (1.466 – 4.972) which interpreted that respondents who did not use insecticide-treated nets had a risk of malaria incidence of 2.700 times higher than respondents who used insecticide-treated nets.

**3.7. The effect of the use of wire gauze on ventilation on the incidence of malaria**

**Table 3.7:** The Effect of the use of wire gauze on ventilation on the Incidence of Malaria at the Waghete Health Center, Tigi District, Deiyai Regency, Central Papua Province.

The use of wire gauze on ventilation	Malaria incident				Total	%
	Positive		Negative			
	n	%	n	%		
No	26	50	26	50	52	100
Yes	11	22.9	37	77.1	48	100
<b>TOTAL</b>	37	37.0	63	63.0	100	100

*P-value = 0.009; RP=2.182; CI 95% (1.215-3.919)*

*Source: Primary data, 2022*

Based on Table 3.7, it shows that the respondents who did not use wire gauze suffered from malaria as many as 26 people (50%) and as many as 26 people (50%) did not suffer from malaria. Meanwhile, 11 respondents

(22.9%) who used wire gauze suffered from malaria and 37 people (77.1%) did not suffer from malaria. Chi square test results obtained  $p\text{-value} = 0.009 < 0.05$ . This means that there is an effect of the use of wire gauze on the incidence of malaria in the Waghete Health Center, Tigi District, Deiyai Regency. The results of the prevalence ratio test obtained  $RP = 2.182$ ;  $CI_{95\%} = (1.215 - 3.919)$  which is interpreted that respondents who do not use wire mesh at home have a risk of malaria incidence of 2.182 times higher than respondents who use wire mesh at home.

**3.8. The effect of the House wall on the incidence of malaria**

**Table 3.8:** The Effect of the House wall on the Incidence of Malaria at the Waghete Health Center, Tigi District, Deiyai Regency, Central Papua Province.

The House wall	Malaria incident				Total	%
	Positive		Negative			
	n	%	n	%		
Wood/board	26	52	24	48	50	100
Cement wall	11	22.0	39	78.0	50	100
<b>TOTAL</b>	<b>37</b>	<b>37.0</b>	<b>63</b>	<b>63.0</b>	<b>100</b>	<b>100</b>

*P-value = 0.004; RP=2.364; CI 95% (1.316-4.247)*

*Source: Primary data, 2022*

Based on Table 3.8, it shows that 26 people (52%) suffer from malaria and 24 people (48%) don't have malaria. Meanwhile, only 11 people (22%) suffer from malaria and 39 people (79%) suffer from malaria without having the walls of their houses made of cement walls. The chi square test results obtained  $p\text{-value} = 0.004 < 0.05$ . This means that there is an effect of the walls of the house on the incidence of malaria in the Waghete Health Center, Tigi District, Deiyai Regency. The results of the prevalence ratio test obtained  $RP = 2.364$ ;  $CI_{95\%} = (1.316 - 4.247)$  which is interpreted that respondents whose house walls are made of boards or wood have a risk of malaria incidence of 2.364 times higher than respondents whose house walls are made of cement walls.

**3.9. The effect of the puddle on the incidence of malaria**

**Table 3.9:** The Effect of the puddle on the Incidence of Malaria at the Waghete Health Center, Tigi District, Deiyai Regency, Central Papua Province.

Puddle	Malaria incident				Total	%
	Positive		Negative			
	n	%	n	%		
Yes	22	41.5	31	58.5	53	100
No	15	31.9	32	68.1	47	100
<b>TOTAL</b>	<b>37</b>	<b>37.0</b>	<b>63</b>	<b>63.0</b>	<b>100</b>	<b>100</b>



*P-value = 0.018; RP=2.222; CI 95% (1.136-4.344)*

*Source: Primary data, 2022*

Based on Table 3.9, it shows that 22 people (41.5%) of respondents whose houses had standing water suffered from malaria and 31 people (58.5%) did not suffer from malaria. Meanwhile, as many as 15 people (31.9%) of respondents whose houses did not have stagnant water suffered from malaria and 32 people (68.1%) did not suffer from malaria. Chi square test results obtained  $\rho$ -value = 0.018 < 0.05.

This means that there is an effect of stagnant water on the incidence of malaria at the Waghete Health Center, Tigi District, Deiyai Regency. The results of the prevalence ratio test obtained  $RP = 2.222$ ;  $CI95\% = (1.136 - 4.344)$  which is interpreted that respondents whose houses have stagnant water have a risk of malaria incidence of 2.222 times higher than respondents whose houses do not have stagnant water.

**3.10. The effect of the distance between the house and the breeding place on the incidence of malaria**

**Table 3.10:** The Effect of the distance between the house and the breeding place on the Incidence of Malaria at the Waghete Health Center, Tigi District, Deiyai Regency, Central Papua Province.

The distance between the house and the breeding place	Malaria incident				Total	%
	Positive		Negative			
	n	%	n	%		
Close	19	47.5	21	52.5	40	100
Far	18	30.0	42	70.0	60	100
<b>TOTAL</b>	37	37.0	63	63.0	100	100

*P-value = 0.118; RP=1.583; CI 95% (0.955-2.625)*

*Source: Primary data, 2022*

Based on Table 3.10, it shows that 19 people (47.5%) of respondents whose houses are close to the breeding place suffer from malaria and 21 people (52.5%) do not suffer from malaria. while only 18 people (30%) had malaria from their homes far from the breeding place and 42 people (70%) did not have malaria.

The results of the chi square test obtained  $\rho$ -value = 0.118 > 0.05. This means that there is no significant effect of breeding place on the incidence of malaria in the Waghete Health Center, Tigi District, Deiyai Regency.

The results of the prevalence ratio test obtained  $RP = 1.583$ ;  $CI95\% = (0.955 - 2.625)$  and because the lower limit and upper limit include the number 1, it can be said that the effect of breeding place on the incidence of malaria is not significant.

**3.11. The effect of the presence of large livestock enclosures on the incidence of malaria**

**Table 3.11:** The Effect of the presence of large livestock enclosures on the Incidence of Malaria at the Waghete Health Center, Tigi District, Deiyai Regency, Central Papua Province.

The presence of large livestock enclosures	Malaria incident				Total	%
	Positive		Negative			
	n	%	n	%		
Far	18	39.1	28	60.9	48	100
Close	19	35.2	35	64.8	54	100
<b>TOTAL</b>	<b>37</b>	<b>37.0</b>	<b>63</b>	<b>63.0</b>	<b>100</b>	<b>100</b>

*P-value = 0.842; RP=1.112; CI 95% (0.647-1.854)*

*Source: Primary data, 2022*

Based on Table 3.11, it shows that 18 people (39.1%) of respondents who are far away from large livestock pens suffer from malaria and 28 people (60.9%) do not suffer from malaria. while 19 people (35.2%) suffered from malaria and 35 people (64.8%) did not suffer from malaria. The chi square test results obtained  $p$ -value = 0.842 > 0.05. This means that there is no significant effect of the presence of large livestock pens on the incidence of malaria in the Waghete Health Center, Tigi District, Deiyai Regency. The results of the prevalence ratio test obtained  $RP = 1.112$ ;  $CI_{95\%} = (0.6467 - 1.854)$ , and because the lower limit and upper limit include the number 1, it can be said that the effect of the presence of large livestock pens on the incidence of malaria is not significant.

### 3.12. Multivariate Analysis

Multivariate analysis is used to obtain the dominant risk factors related to the incidence of malaria, so it is necessary to carry out bivariate analysis and proceed to multivariate tests. The independent variables that meet the requirements to be included in the multivariate analysis are age, the habit of using mosquito repellents, the use of insecticide-treated mosquito nets, the use of wire gauze, the house wall, the puddle, and the distance between the house and the breeding place. Backward LR method was used in the multiple logistic regression multivariate tests. The result of the analysis can be seen in Table 3.12.

**Table 3.12:** Analysis of Multiple Logistics Regression with Backward LR Method on the risk factor of malaria incidence.

Variables	B	<i>p-value</i>	OR	95% C. I. for Exp (B)	
				Lower	Upper
The habit of using mosquito repellents	1.078	0.033	2.939	1.088	7.934
Use of insecticide-treated mosquito nets	1.603	0.002	4.968	1.762	14.007
Use of wire gauze	1.169	0.024	3.218	1.167	8.875
House wall	0.873	0.088	2.393	0.879	6.516
Puddle	0.910	0.102	2.483	0.835	7.384
Constant	-7.611	0,000	0,000		

*Source: Primary Data, 2022*

Table 3.12 shows the dominant risk factors that influence the incidence of malaria at the Waghete Health Center, Tigi District, Deiyai Regency, namely the habit of using mosquito repellents, using insecticide-treated nets, using wire netting, and the most dominant risk factor is the use of insecticide-treated nets.

## **4. Discussion**

### ***4.1. The effect of gender on the incidence of malaria***

The results showed that there was no significant effect of gender on the incidence of malaria in the Waghete Health Center, Tigi District, Deiyai Regency. Malaria can cause death that affects all age groups, both men and women [7]. Malaria directly causes increased morbidity and mortality so it can reduce work productivity [8].

There were 14 responders who were pregnant, and the prevalence of malaria indicated that women were more likely to get the disease. This was demonstrated by Mayasari (2016), who found that while gender had no bearing on the prevalence of malaria, pregnant women were more susceptible to the disease than non-pregnant individuals as well as the general population [9]. Pregnancy can result in repeated infections, serious problems, miscarriage, early birth, low birth weight, congenital illnesses, and mortality in both the mother and the child in addition to making one more susceptible to malaria. This is because the mother's antibody to infections from the malaria parasite decreases during pregnancy. In the meanwhile, the placenta is where the malaria parasite may reproduce.

There is no difference in malaria risk between men and women at the Waghete Health Center in the Tigi District of the Deiyai Regency. Because it has a connection to the habit of leaving the house and working, gender is one of the elements that affects the occurrence of malaria, claims Ruliansyah (2020). Men are more likely to contract malaria since they frequently venture outside at night and labor in the forest. This condition is possible since, in principle, a number of risk variables might affect the prevalence of malaria [10].

In Tigi District, Deiyai Regency, the majority of the women work as farmers, putting both men and women at the equal risk of contracting malaria. According to Mayasari and his colleagues (2016), age, sex, genetics, pregnancy, nutritional status, nighttime activity, and contextual risk factors (housing environment, seasonal circumstances, socioeconomic) are all individual risk factors that contribute to the development of malaria infection [9].

The findings of this study are consistent with those of Manumpa's (2016) investigation at the Moru Health Center in NTT, which found no statistically significant relationship between gender and malaria incidence [11]. Women, especially pregnant women, are more prone to contracting malaria. Compared to non-pregnant women, pregnant women are twice as likely to get an infection [5].

### ***4.2. The effect of age on the incidence of malaria***

The results showed that there was no significant effect of age on the incidence of malaria in the Waghete Health

Center, Tigi District, Deiyai Regency. The results of this study are in line with Elbands' research (2022) that age is not a risk factor for the incidence of malaria [12].

Basically, malaria may affect anyone. Differences in immunity caused by varying exposure to mosquito bites are really connected to changes in prevalence according to age, sex, race, and prior experience of malaria [13].

Differences in prevalence according to age are actually related to differences in levels of immunity due to variations in exposure to mosquito bites. The agent (*Plasmodium*) is an essential factor that must be present for disease to occur. Agents can be living things, non-living things, something abstract, in an amount that is more or less the main/essential cause of disease.

Adults and adolescents are more susceptible to contracting malaria because of their high levels of activity both during the day and at night, including working. Natural antibodies, meanwhile, have developed in maturity as a result of either past infections or unique dietary circumstances. Adults who are very active in connection to the task being done, on the other hand, frequently fail to pay attention to and disregard mosquito bites while working. The high prevalence of malaria is a result of certain occupations, such as farming, raising animals, and labor [5].

#### ***4.3. The effect of education on the incidence of malaria***

The findings indicated that there was no discernible relationship between education and malaria prevalence at the Waghete Health Center in the Tigi District of the Deiyai Regency. The findings of Apriliani's research (2021) demonstrated that there was no relationship between education and the prevalence of malaria. This is owing to the fact that, while typically influencing a person's kind of employment and health behavior, education degree really has little direct impact on the prevalence of malaria [14].

This contradicts Wibowo's research (2017), which found that education is a risk factor for malaria and that those with low levels of education are more likely to be unaware of the risk factors that contribute to the disease [15]. According to Talombo and his colleagues (2018), a person's education also has an impact on the likelihood of contracting malaria. Individuals with lower levels of education have a 6.11 times higher risk of contracting malaria than those with higher levels of education, and they are less likely to seek out information about malaria prevention [16].

In contrast to fever, a different study by Delil (2016) in Ethiopia found that the prevalence of malaria is still a significant cause of death. Malaria is brought on by a lack of education, the use of unclean bedding, and endemic regions near stagnant water. Therefore, there is a need for intervention, instruction, information sharing, and malaria prevention and control [17].

#### ***4.4. The effect of socioeconomic on the incidence of malaria***

The findings indicated that in the Waghete Health Center in the Tigi District of the Deiyai Regency, there was no appreciable socioeconomic effect on the risk of malaria. This is consistent with Manik's findings from Biak

Numfor in 2022, which found that socioeconomic factors had little impact on the prevalence of malaria [18].

Due to general absolute poverty, which is defined as the inability to satisfy the minimal requirements for food, clothes, health care, housing, and education necessary to be able to live and work, poverty contributes to the spread of infectious illnesses from many types of infectious diseases. Poverty and malaria are linked as a cause and consequence. The situation of the impoverished in isolated locations far from medical facilities is significantly impacted by malaria.

Due to challenges in fulfilling their daily food demands, poor individuals frequently pay less attention to their clothes and board needs. As a result, the poor people's homes are in bad shape and solely composed of low-quality materials, which invites mosquitoes inside and leads to infection. Thus, malaria infection persists even when nighttime activities are solely performed at home. Poverty also results in unmet dietary demands that are balanced, which lowers the body's resistance against malaria and makes it more vulnerable to attacks from the disease.

#### ***4.5. The effect of the habit of using mosquito repellents on the incidence of malaria***

The findings indicated that the habit of using insect repellents had a significant impact on the risk of malaria incidence at the Waghete Health Center, Tigi District, Deiyai Regency, with respondents who did not use repellents having a risk of malaria incidence that was 2.091 times higher than respondents who did. This happens if the responder employs gauze and board-made walls, although malaria insect bites can be avoided by wearing mosquito repellent.

Research by Wibowo (2017) showed that the habit of using mosquito repellents had an impact on the incidence of malaria, with those who did not use repellents having a high risk of malaria incidence of 9.27 times [15]. According to Wau and his colleagues (2019) research, those who did not use repellents had a risk of malaria incidence of 2.4 times. 4.074 times more persons get malaria than those who use insect repellents [19].

Since there was a lack of public understanding of the risks associated with malaria, respondents who did not use mosquito repellents said that the usage of such products was not necessary because they did not enjoy the smell and smoke that these products produced. Additionally, respondents seldom ever apply cream, with the exception of those who frequently go out late at night.

#### ***4.6. The effect of the use of insecticide-treated nets on the incidence of malaria***

At the Waghete Health Center in the Tigi District of the Deiyai Regency, the usage of insecticide-treated nets has an impact on the risk of malaria. The risk of malaria was 2,700 times higher for those who did not use insecticide-treated nets than for those who did.

According to Sayori's research (2017), there are negative consequences and dangers associated with not using insecticide-treated nets when there is a high malaria incidence [20]. Many nations have utilized insecticides that are safe for people in mosquito nets. In regions where indoor residual spraying (IRS) is rejected or where

mosquitoes exhibit interior biting behavior, the insecticide-treated mosquito net program provides an option for controlling malaria vectors.

This study is consistent with earlier studies carried out in the provinces of West Nusa Tenggara, East Nusa Tenggara, Maluku, North Maluku, Papua, and West Papua by Lestari and Salamah (2014) [21]. According to the findings of Rahmadiliyani's (2018) study, using insecticide-treated nets is a very efficient way to lessen or avoid malaria. It is envisaged that mosquito nets treated with pesticide at the factory will maintain very little biological activity [22].

It has been demonstrated that using mosquito netting significantly lowers the risk of malaria. This is due to the fact that, even though the respondents who don't use mosquito nets at night have used wire gauze and walls made of walls, mosquitoes can still enter through frequently opened doors. As a result, if the respondents don't use mosquito nets at night, malaria-carrying mosquitoes may enter the room and bite them.

#### ***4.7. The effect of the use of wire gauze on ventilation on the incidence of malaria***

The findings demonstrated that employing wire gauze had an impact on the risk of malaria at the Waghete Health Center in the Tigi District of the Deiyai Regency. The probability of malaria occurrence was 2.182 times greater among those who did not use wire mesh at home than among those who did.

Mosquitoes will find it simpler to enter homes without mosquito nets or strimming, where there are ventilation issues, to bite people and repose. Because the wire screens were only partially put, and some were installed but had holes, the respondents who had them had malaria. Anopheles spp. mosquitoes will find it simpler to enter the house at night if there are no mosquito screens in the ventilation system. This will, of course, make it easier for residents to come into touch with insects that transmit malaria, raising the risk of transmission—which is already greater than in houses with fitted mosquito netting of malaria. Given the high danger of malaria, efforts to repair and clean the ventilation system's wire mesh must be repeated.

#### ***4.8. The effect of the House wall on the incidence of malaria***

According to the study's findings, the Waghete Health Center in Tigi District, Deiyai Regency, has a relationship between the walls of the home and the risk of contracting malaria. In comparison to respondents whose homes were built with bricks, those whose walls were made of boards or wood had a 2.364 times greater chance of contracting malaria.

According to Nababan and his colleagues (2018), there is a connection between a home's condition and the prevalence of malaria at the District Health Center Winong. Residents who live in homes with many gaps in the walls are 0.29 times more likely to get malaria than those who live in homes with solid walls [23].

#### ***4.9. The effect of the puddle on the incidence of malaria***

The findings indicated that stagnant water had an impact on the risk of malaria at the Waghete Health Center in

the Tigi District of the Deiyai Regency. The probability of malaria occurrence was 2.222 times greater for respondents whose homes contained stagnant water than for those whose homes did not.

According to Mofu's research (2022) in Hamadi, Jayapura City, there is a correlation between the presence of standing water and the incidence of malaria, indicating that the risk of contracting malaria is 2.759 times higher for those who have stagnant water around their homes than for those who do not.

The majority of them are swamps, ditches, water spinach ponds, and puddles, with quiet or non-flowing water and direct sunshine on the muddy bottom. A breeding ground for Anopheles larvae exists under such circumstances. The puddles targeted by this study include those with temporary or long-term standing water, such as watercress ponds, ponds, drains with no water flow, flower pots, unused drums, empty cans, and others with water in them.

#### ***4.10. The effect of the distance between the house and the breeding place on the incidence of malaria***

The findings demonstrated that breeding sites had no impact on the risk of malaria at the Waghete Health Center in the Tigi District of the Deiyai Regency. This is consistent with Tindige's research (2017), which found no connection between the presence of breeding grounds and the frequency of malaria in the hamlet [25]. One of the abiotic environmental elements that significantly influences larvae breeding in all breeding locations is temperature. The greatest temperature for breeding is 29<sup>0</sup>C [25]. The Tiggi District in the Deiyai Regency has an average temperature of 20 to 23 °C, which is appropriate for the survival of Anopheles larvae in all breeding locations with different environmental factors. Anopheles mosquitoes may breed in temperatures between 26 and 29 degrees Celsius [5]. Brooding regions can be reduced or eliminated using a variety of techniques, such as accumulating areas where water can collect, controlling and enhancing water flow, periodically draining an irrigation system, and cleaning wild plants and bushes. The researchers discovered that the presence of trees in front of the home, which serve as numerous mosquitoes' nests and breeding grounds, was associated with a higher prevalence of malaria in this study.

#### ***4.11. The effect of the presence of large livestock enclosures on the incidence of malaria***

The findings indicated that there was no correlation between the risk of malaria at the Waghete Health Center in Tigi District, Deiyai Regency, and the presence of huge livestock cages. Pigs dominate the livestock population in the research region, among other animals. Pigs are known to lessen human mosquito bites. According to Idrus and Getrudis' (2014) study at the Koeloda Public Health Center in the Golewa District of the Ngada Regency, there is a connection between keeping cattle and the prevalence of malaria. Maintaining livestock such as cows, goats, and buffalo close to the home can operate as a barrier or Cattle Barrier to keep insects away from people [26]. The existence of cages and the factors related to cattle ownership that impact mosquito populations are unrelated. As many as 39.1% of respondents lived close to animal pens that had malaria, while 35.2% of respondents who lived distant from livestock pens had the disease. The cage's cleanliness can be used to assess this. Because they are shielded from sunshine and moisture, cattle pens serve as a resting spot for malaria mosquito vectors before and after contact with people. There are also other Anopheles mosquito species that are

zoophilic and anthropophilic, or prefer both human and animal blood. Consequently, the presence of animal enclosures increases the incidence of malaria cases [5].

#### **4.12. The dominant risk factors on the incidence of malaria**

The results showed that the dominant risk factors for malaria in the work area of the Waghete Health Center were the habit of using mosquito repellents, using insecticide-treated nets, using insecticide-treated nets and the most dominant was using insecticide-treated nets. Since mosquitoes may readily enter a home without wire netting, especially one that is adjacent to stagnant water, this main element is brought on by having a link with the danger of malaria. Additionally, a person is susceptible to mosquito bites at night if they use wire gauze, insecticide-treated nets, or neither repellent nor wire gauze.

### **5. Conclusion**

Based on the results of the discussion it can be concluded as follows:

- a. There is no significant effect of gender on the incidence of malaria at the Waghete Health Center, Tigi District, Deiyai Regency.
- b. There is no significant effect of age on the incidence of malaria at the Waghete Health Center, Tigi District, Deiyai Regency.
- c. There is no significant effect of education on the incidence of malaria at the Waghete Health Center, Tigi District, Deiyai Regency.
- d. There is no significant socio-economic effect on the incidence of malaria in the Waghete Health Center, Tigi District, Deiyai Regency.
- e. There is a significant influence of the habit of using mosquito repellents on the incidence of malaria at the Waghete Health Center, Tigi District, Deiyai Regency.
- f. There is a significant effect of the use of insecticide-treated nets on the incidence of malaria at the Waghete Health Center, Tigi District, Deiyai Regency.
- g. There is an effect of using wire gauze on the incidence of malaria at the Waghete Health Center, Tigi District, Deiyai Regency.
- h. There is an effect of the walls of the house on the incidence of malaria in the Waghete Health Center, Tigi District, Deiyai Regency.
- i. There is an effect of stagnant water on the incidence of malaria at the Waghete Health Center, Tigi District, Deiyai Regency.
- j. There is no effect of breeding place on the incidence of malaria at the Waghete Health Center, Tigi District, Deiyai Regency.
- k. There is no effect of the presence of large livestock on the incidence of malaria at the Waghete Health Center, Tigi District, Deiyai Regency.
- l. The dominant risk factors that affect the incidence of malaria in the Waghete Health Center, Tigi District, Deiyai Regency are the habit of using mosquito repellents, using insecticide-treated nets, using wire netting, and the most dominant is using insecticide-treated nets.



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