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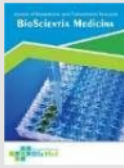
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Relationship between Preventive Behavioral Factors and Malaria Incidence in Endemic Areas of Lahat Regency in 2021

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ABSTRACT

Background: Malaria is still one of the main infectious diseases of concern in the world. Lahat Regency is a moderate malaria-endemic area in South Sumatra, where there are still several villages with an API value above 1 and indigenous cases, although the average API value in all health facilities is below 1.

Methods: Quantitative research with a case-control design was employed. The sampling technique used stratified random sampling with year strata, namely 2018, 2019 and 2020 with 50 case respondents and 100 control respondents. The total number of samples collected was 150. Case respondents were people who suffered from malaria and are recorded in the Malaria Surveillance Information System in the working area of the community health center, which has a village with an API value of 1 and the presence of indigenous cases. Control respondents were the closest neighbours of cases with the same age characteristics as the case. This study aimed to identify and analyse risk factors for preventive behaviour related to malaria incidence in the endemic area of the Lahat Regency.

Results: Bivariate analysis revealed that the habit of using insect repellent was connected with the incidence of malaria in the endemic region of Lahat Regency, with a p-value of 0.042 and an odds ratio of 2.160 in the endemic area. The results of multivariate analysis showed that the most dominant risk factor was the habit of using mosquito repellent.

Conclusions: The habit of using mosquito repellent is a risk factor for malaria incidence in endemic areas of the Lahat Regency. It is necessary to increase individual self-prevention behaviour and counselling activities regarding preventive behaviour by local health service facilities.

1. Introduction

An infectious disease that still concerns the whole world is malaria. In addition to HIV, AIDS and Tuberculosis, controlling malaria is also part of the Sustainable Development Goals (SDGs), which are global commitments by United Nations (UN) to be achieved by 2030¹. The parasite *Plasmodium spp* causes malaria and is transmitted through the *Anopheles spp* mosquito, its vector. Of the many existing species, the most abundant and common Plasmodium causing malaria is *Plasmodium (Pl.) vivax*, *Pl. falciparum*, *Pl. malaria*, and *Pl. ovale*².

An estimated 35% of the Indonesian population lives in areas at risk for contracting malaria. Indonesia is an area with tropical and subtropical climates, which are the preferred habitat for malaria mosquitoes, the *Anopheles spp*³. In the last three years, the Annual Parasite Incidence (API) of malaria in Indonesia has increased. In 2018, the Indonesian malaria API was 0.8, while in 2019 and 2020, it was 0.9 per 1000 population¹. Efforts to stop the local malaria transmission chain in a certain geographic area, is one of three actions to eliminate malaria. The three indicators for an area to be free of malaria elimination

are the annual Parasite Incidence <1 per 1000 population and the Slide Positive Rate (SPR) <5% for three consecutive years, and the non-occurrence of indigenous cases. Vigilance is always needed to prevent re-infection⁴.

In Indonesia, 318 districts/cities (62%) obtained malaria elimination certificates in 2020. There are still 29% districts/cities where malaria is low endemic, 4% moderate endemic and 5% high endemic. South Sumatra is one of the low endemic areas in Indonesia, with an API rate less than 1. Lahat Regency is one of eight low malaria-endemic areas in South Sumatra that have not received a malaria elimination certificate in 2020⁵. In the Endemicity Map on the SISMAL (Malaria Surveillance Information System), in 2018, the Annual Parasite Incidence (API) of Lahat Regency has decreased in the last three years. In 2018 the API value of Lahat Regency was 1.31; in 2019, it was 0.10, while in 2020, it was 0.02 per 1000 population. Even though the overall API number has decreased, there are still API values that are more than 1 in several villages in Lahat Regency⁶. Indigenous cases are still present in Lahat Regency for the last three years⁶.

Malaria is known as one of the most common public health problems found in households⁷. Based on previous research¹ there are several preventive behavioral factors related to the incidence of malaria, such as the habit of using mosquito nets, the habit of using mosquito repellent and the habit of going out at night. This study aims to identify and analyse the preventive behavior factors that influence or relate to

malaria incidence in the endemic area of Lahat Regency.

2. Methods

This study uses a quantitative method with a case-control design. Sample calculation stratified random sampling by dividing the population into groups according to year. The population were people with positive malaria recorded in the data pertaining to 2018, 2019, and 2020 and found in villages with API >1 and villages with indigenous cases. The total cases in 2018 were 114 cases; in 2019, there were 19 cases, and in 2020 there were 5 cases.

The minimum sample size is determined based on stratified random sampling. A sampling ratio of 1:2 was used for this. The case sample selection technique used simple random sampling using excel. The case samples comprised 50 samples: 42 in 2018, 6 samples in 2019, and 2 samples in 2020 by division using stratified random sampling; while the control samples were 100 in a total of 150 samples.

Variables analysed included the habit of using mosquito nets, using mosquito repellent, and going out at night. Univariate, bivariate and multivariate regression analysis was performed with SPSS version 22 . This study passed ethical review by the Health Research Ethics Commission, Faculty of Health, Sriwijaya University, with number 208/UN9.FKM/TU.KKE/2021 on June 25, 2021.

3. Results

Table 1. Frequency distribution of research variables

No	Characteristics	Category	Malaria incidence			
			Case (n=50)		Control (n=100)	
			n	%	n	%
1.	The habit of using mosquito nets	No	41	82%	73	73%
		Yes	9	18%	27	27%
		Total	50	100%	100	100%
2.	The habit of using mosquito repellent	No	29	58%	39	39%
		Yes	21	42%	61	61%
		Total	50	100%	100	100%
3.	The habit of going out at night	Yes	19	38%	40	40%
		No	31	62%	60	60%
		Total	50	100%	100	100%

Based on table 1, the results show that the proportion of respondents who did not have the habit of using mosquito nets was higher 41 (82%) in the controls than in the case group (73%). The majority of respondents in the control group used mosquito repellent (61%), as opposed to the case group (42%). Most case and control respondents did not go out at night (62 % vs 40% going out).

Through bivariate analysis (table 2), there was no relationship between the habit of using mosquito nets and the incidence of malaria (p =0.311). There was a

relationship between the habit of using mosquito repellent and the incidence of malaria (p =0.042). People who did not have the habit of using mosquito repellent have more than twice the risk of contracting malaria than those who did not use it (OR = 2.160, 95% confidence interval (CI): 1.083–4.309). There was no relationship between the habit of going out at night and the incidence of malaria in the endemic zone of Lahat Regency (p =0.953).

Table 2. Bivariate analysis of research variables

Variable	p-value	OR (CI 95%)
Habit of using mosquito nets	0.311	1,685 (0.723 – 3.926)
Habit of using mosquito repellent	0.042	2,160 (1,083 – 4,309)
The habit of going out at night	0.953	0.919 (0.458 – 1.846)

The multivariate analysis aimed to determine the most dominant risk factors for malaria incidence in the Lahat District, which was the habit of using mosquito repellent (table 3). The most dominant risk factor for

the incidence of malaria in endemic areas of Lahat Regency is the habit of using mosquito repellent (p =0.029). The habit of using mosquito repellent protects from malaria in Lahat Regency's endemic areas.

Table 3. Multiple logistics regression test results

Variable	B	Sig.	Exp(B)	95.0% Cifor EXP(B)	
				Lower	Upper
Habit of using mosquito repellent	-0.770	0.029	0.463	0.232	0.924
Constant	1.066	0.000	2,905		

4. Discussion

Mosquito nets are an effective method for malaria prevention, but the results showed no relationship between the habit of using mosquito nets and the incidence of malaria in the study area. Research conducted in Mumbai, India, stated that the use of mosquito nets is still very low even though respondents have known the benefits of using mosquito nets for malaria prevention⁸. The interview found that some respondents were reluctant to use mosquito nets, so they preferred to use fans and mosquito repellent. The low use of using mosquito nets is attributed to respondents feeling "hot" when using mosquito nets⁹.

In contrast to research conducted in Mexico and Nyanga, mosquito nets are products of choice and use to prevent and protect themselves from mosquito bites^{10,11}.

The mosquito nets used are easily torn, so there is still an entrance for mosquitoes. The inability of respondents to have adequate mosquito nets is due to being hindered by economic problems, so some respondents use unstandardized mosquito nets instead of insecticide-treated mosquito nets. The use of mosquito nets that are not insecticide-treated still enables contact between humans and mosquitoes and is associated with a high risk of getting malaria.

Insecticide-treated mosquito nets should not be used for more than three years¹²⁻¹⁵.

One of the preventive measures that improve public health because it can reduce the frequency of mosquito bites against oneself is mosquito repellent¹⁶. There was a positive link between the habit of using mosquito repellent and the diminished occurrence of malaria in the endemic region of Lahat Regency. Similarly to a study conducted in Sabah, Borneo, and Malaysia, the habit of not using mosquito repellent is a risk factor for malaria¹⁷. However, in Sarimi Regency of Papua province, has discovered that there was no significant relationship between the habit of using mosquito repellent and the incidence of malaria¹⁸.

The majority of respondents employed mosquito coils, with a few others using spray insect repellents. Persons who do not use mosquito repellents have a greater chance of contracting malaria than those who do¹⁹. Most respondents in East Nusa Tenggara and North Maluku Indonesia use mosquito coils to prevent malaria²⁰. A strategy for controlling and preventing malaria is necessary in terms of the habitual practice of using mosquito repellent to avoid bites from malaria mosquitoes^{17,21}.

The habit of going out at night is one of several risk factors for malaria transmission²². However, the results of the study show the opposite. In line with the Padang study, there was no significant relationship between going out at night and malaria incidence, as was shown in the Kendaga Banjarmangu study in 2013^{23,24}. It is also possible that some respondents would have worn protective clothing to avoid being bitten by malaria mosquitoes, such as long-sleeved shirts and long-sleeved pants when outside the home at night. Reducing the habit of going out at night and using protective clothing when going out at night is one of the preventive measures that can be taken. *Anopheles spp.* is actively biting between 21.00 and 04.00²⁵.

The study does have some limitations. Respondents may be biased due to recall bias. Although specific questions were asked, respondents may have forgotten some information, since the incident was a while ago and happened before they suffered from malaria.

5. Conclusions

The dominant risk factor for prevention behavior affecting malaria incidence was the habit of people to use mosquito repellent. There is the need for increased awareness from each individual to improve all malaria prevention behaviour. The community health centers should always provide counselling regarding malaria prevention attitudes, so that Lahat Regency will soon be declared a malaria-free area.

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