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The Risk Factors of Malaria Incidence in ARSO III Health Primary Regional Keerom Sub Province Papua Province

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ABSTRACT

Background: Malaria is an endemic disease in Keerom Regency, Papua Province which is influenced by age, sex, education, socio-economic, use of mosquito repellent, use of insecticide-treated bed nets, wire mesh installation, house walls, puddles, presence of large animal cages and distances house with a place breeding
Objective: To determine the risk factors for malaria in the working area of Arso III Community Health Center, Keerom Regency, Papua Province.
Research Methods: Descriptive analytic case control design. The population were patients who resided in the Arso III Community Health Center working area with 67 malaria cases and 67 controls taken in proportion to random sampling. Data were obtained using a questionnaire and analyzed using chi square and binary logistic regression.
Results: Factors that influence the risk of malaria incidence in Arso III Health Center in Keerom Regency are gender (ρ-value = 0.037; OR = 0.453; CI95% = (0.226 - 0.906), habit of using malaria mosquito repellent (ρ-value = 0.002; OR = 3.214; CI95% = (1,585 - 6,516), use of insecticide-treated bed nets (ρ-value = 0,000 OR = 4,526; CI95% = (2,183 - 9,384), use of wire mesh (ρ-value = 0,002; OR = 3,273 ; CI95% = (1,603 - 6,683), wall of the house (ρ-value = 0,001; OR = 3,454; CI95% = (1,694 - 7,046), standing water (ρ-value = 0,004; OR = 3,170; CI95% = (1,500 - 6,698), the distance between houses and breeding places (ρ-value = 0,036; OR = 2,237; CI95% = (1,111 - 4,504). The factors that did not influence the risk of malaria incidence in Arso III Puskesmas Keerom Regency were age (ρ-value = 0,143; OR = 0,544; CI95% = (0,263 - 1,127), education (ρ-value = 0,203; OR = 1,962; CI95% = (0,807 - 4,766), social economics (ρ-value = 0,729; OR = 0,835; CI95 % = (0,424 - 1 , 648), the existence of large livestock cages (ρ-value = 0.603; OR = 1,272; CI95% = (0.644 - 2.511). The dominant factor in malaria incidence in Arso III Health Center was the use of insecticide-treated bed nets (p value = 0,000), habit of using mosquito repellent (p value = 0,009), use of wire mesh (p value = 0,011), standing water (p value = 0,033) and gender (p value = 0.025).

Keywords: Factor, Risk, Malaria Incidence

INTRODUCTION

The Indonesian Ministry of Health reports the prevalence of malaria in 2016 as many as 200,378 cases with annual parasite incidence ((API = 0.77). While the highest prevalence of malaria is Papua Province with 128,066 cases with annual parasite incidence ((API = 39,93) compared to four provinces the other highest (East Nusa Tenggara, West Papua, Central Sulawesi and Maluku. The number of deaths of malaria patients in 2016 was 2,867 cases (Ministry of Health, 2016). The condition of the tropical climate in Indonesia and the development process that continually results in changes in the environment creates a situation that is very beneficial for the existence of Anopheles mosquitoes and public health problems in Indonesia, namely in 2016 as many as 74% of regions in Indonesia are in free territory / not at risk of malaria, 8.5% of the area in the medium category and 2.2% is a risky area for malaria (Ministry of Health, 2017).

The elimination announced 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 target was estimated in 2030 because of the limited funds and difficulties in reaching the area. Malaria prevention efforts in Indonesia since 2007 can be monitored using the Annual Parasite Incidence (API) indicator. National API value in 2011 was 1.75 per 1000 inhabitants and a decrease in 2012 was 1.69 per 1000 and in 2015 three provinces with the highest API were Papua (31.93%), West Papua (31.29 %), East Nusa Tenggara (7.14%) and Maluku (5.81%) and North Maluku (2.77%). While the provinces with the lowest API are DKI Jakarta, Bali and East Java (Ministry of Health, 2017).

Five Districts in Papua Province ranked highest among 29 Districts, including Mimika Regency with 36,378 malaria cases, Keerom District with 23,966 malaria cases, Jayapura Regency with 22,516 malaria cases, Jayapura City with 14,888 malaria cases, and Kabu Nabire patent with 10,482 cases. With the Malaria case that occurred in Papua Province in 2016, it was reported that there were 147,239 cases, Malaria experienced an increase in 2017 amounting to 261,617 National and for Papua 192,648 cases of malaria. The number of cases in Keerom Regency in 2016 was 25,912 API cases 482.9%, in 2017 amounted to 20,571 API Cases 373.9%, while Skamto Health Center in 2014 amounted to 6332 API cases 415.5%, in 2015 amounted to 6496 API cases 453.2% , in 2016 amounted to 7783 API cases 499.6%, in 2017 amounted to 6753 cases of API 482, 3%. (Case report of Keerom District Health Office and Skamto Health Center).

Several factors that might influence the high number of malaria cases in Keerom Regency include the environment such as the presence of water around the house such as containers of water storage for daily use, small ponds around the house such as water spinach ponds, ponds for livestock drinking, this can be a breeding place, because the flight range of malaria mosquitoes (flight range) can reach 0.5-3 Km, if there are strong winds of malaria mosquitoes can be carried up to 20-30 Km, besides the presence of bushes shrubs / plantations, swamps and cattle sheds as a Resting place.

Commitment of the Governor of Papua (8-9 May 2017) The aim of malaria prevention in Indonesia is to achieve elimination in stages no later than 2030 where Papua is earlier, by 2025 it must reach the stage of eliminating malaria with a Malaria Morbidity Rate of less than 1 per 1,000 residents and will undergo a maintenance phase for three consecutive years to obtain the certification of Papua Malaria Free in 2028 carried by the ELMARIPA AT 2028 slogan or the Elimination of Papuan Malaria in 2028. In the national malaria program policy, malaria elimination is implemented through strengthening the health system in the regions that is integrated based on the principles of Basic Health Services. Health promotion is a very important part of community empowerment. The National Health System refers to the decentralization policy which focuses on the district / city level. Cross-sector cooperation plays an important role in malaria elimination. It is expected that sectors related to the health sector make policies that promote or improve health (Health in All Policies). The government and local governments are fully responsible for achieving malaria elimination given the nature of malaria elimination is public goods. Basic and operational research and development of appropriate technology to support malaria elimination need to be improved. The malaria elimination program must be movement that is consistent and has clear objectives involving all components of the community under the coordination of the head of the provincial / district / city area.

2. MATERIALS AND METHODS

2.1 Types of Research

This type of research is observational which uses the Retrospective Study method with the Case control approach, which compares between groups of people suffering from malaria (cases) with groups of people who do not suffer from malaria (control). The research that will be carried out is an observational study using a case control study. The design was chosen because it was in accordance with the purpose of the study, namely analyzing risk factors that influence the occurrence of a disease. This research was conducted to measure the risk factors that influence the incidence of malaria. The case group includes people who are sick with malaria characterized by the results of a positive blood test (SD). The control group included people who did not get malaria, which was marked by the results of negative blood test (SD).

This group is then compared to the existence of causes or past experiences that may be relevant to the cause of the disease. Case-control studies were chosen with the consideration of offering a number of advantages, namely the costs required were relatively little possible to identify various risk factors in one study, to assess the relationship between exposure to disease. This design can be taken with a high enough level of efficiency over time and cost when compared to using other analytical study approaches.

2.2. Population and Samples

1. Population

a. Population Case:

The case population in this study were all residents in the Arso III Community Health Center, Keerom District, Keerom District who suffered from malaria based on the results of a blood test (SD), which was indicated by the laboratory staff (LAB) finding Plasmodium in the Puskesmas and declared positive (+) malaria.

b. Population Control:

The control population in this study were all residents in the work area of Arso III Health Center in Keerom Regency who did not suffer from malaria but came to the Puskesmas with complaints of other diseases, such as cough and runny nose, fever, heat, shortness of breath, then checked for blood (SD), and negative (-) malaria was indicated by the absence of Plasmodium in the blood by laboratory personnel (LAB).

2. Samples

The sample criteria in this research are

a. Willing to participate in research

b. Residing in the research location.

c. Never lived in an endemic area other than at Arso III Health Center

d. For the case group, the population who had a blood sample (SD) positively contained Plasmodium based on the results of laboratory tests (LAB) at the Arso III Health Center in Keerom Regency by officers.

e. For the control group, there are residents who have negative blood (SD) or no Plasmodium based on the results of laboratory tests at Arso III Health Center.

f. Aged 0 years to> 65 years.

g. Case groups and controls do not live at home.

The sample size is the target population that meets the inclusion criteria which is added to the control group and used as the research subject. To be able to determine the sample group size of the case in this study, it is necessary to have a previous study Odds Ratio value of patients registered as malaria sufferers at Arso III Health Center in Keerom Regency and residing in Arso III Health Center area. The number of samples for control case studies can be calculated is 134.

3. RESULTS

Bivariate Analysis

a. Effect of age on the risk of malaria incidence

Table 1. Effect of Age with Risk of Malaria occurrence at Arso III Health Center in Keerom Regency

No	Age	Malaria occurrence				Number	
		Cases		Control			
		n	%	n	%	n	%
1	> 20 year	40	59,7	49	73,1	89	66,4
2	≤ 20 year	27	40,3	18	26,9	45	33,6
Total		67	100	67	100	134	100
p-value = 0,143; OR = 0,544; CI95%= (0,263 – 1,127)							

Based on Table 1, shows that in the case group of malaria cases the respondents aged> 20 years were 40 people (59.7%) and respondents aged <20 years were 27 people (40.3%). The chi square test results obtained ρ-value = 0.143> 0.05. This means that there is no effect of age on the risk of malaria incidence in Arso III Health Center, Keerom Regency. The odds ratio test results were obtained OR = 0.544; CI95% = (0,263 - 1,127) includes 1 which is interpreted that age is not a risk factor for the incidence of malaria.

b. Sex influence with the risk of malaria incidence

Table 2. The Influence of Gender and the Risk of Malaria at Arso III Health Center in Keerom Regency

No	Sex	Malaria occurrence				Number	
		Cases		Control			
		n	%	n	%	n	%
1	Female	30	44,8	43	54,2	73	54,5
2	Male	37	55,2	24	35,8	61	45,5
Total		67	100	67	100	134	100
p-value = 0,037; OR = 0,453; CI95%= (0,226 – 0,906)							

Based on Table 2, it shows that in the case group of malaria cases there were 30 female respondents (44.8%) and 37 respondents (55.2%). Chi square test results obtained ρ-value = 0.037 <0.05. This means that there is a gender influence with the risk of malaria incidence in Arso III Health Center, Keerom Regency. The odds ratio test results were obtained OR = 0.453; CI95% = (0.226 - 0.906) does not include 1 which is interpreted that gender is a protective factor against the incidence of malaria.

c. Effect of low education factors on the risk of malaria incidence

Table 3. Effect of Education on the risk of malaria incidence at Arso III Health Center in Keerom Regency

No	Education level	Malaria occurrence				Number	
		Cases		Control			
		n	%	n	%	n	%
1	Low (< SMA)	32	47,8	26	38,8	58	43,4
2	High (≥ SMA)	35	52,2	41	61,2	76	56,7
Total		67	100	67	100	134	100
p-value = 0,383; OR = 1,442; CI95%= (0,726 – 2,864)							

Based on Table 3, it shows that in the case group of malaria cases the respondents of low education level were 32 people (47.8%) and respondents who were highly educated were 35 people (52.2%). The chi square test results obtained ρ-value = 0.383> 0.05. This means that there is no influence on the level of education with the risk of the incidence of malaria in the Arso III Health Center in Keerom Regency. The odds ratio test results were obtained OR = 1,442; CI95% = (0,726 - 2,864) with a lower value does not include 1 which is interpreted that the level of education is a protective factor against the incidence of malaria.

d. Effect of socio-economic factors on the risk of malaria incidence

Table 4. Socio-Economic Influence with the Risk of Malaria at Arso III Health Center, Keerom Regency

No	Social economy	Malaria occurrence				Number	
		Cases		Control			
		n	%	n	%	n	%
1	Low	30	44,8	33	49,3	63	47
2	Enough	37	55,2	34	50,7	71	53
Total		67	100	67	100	134	100
p-value = 0,729; OR = 0,835; CI95%= (0,424 – 1,648)							

Based on Table 4 it shows that in the case group of malaria cases there were 30 people (44.8%) who were less socioeconomic and 37 respondents (55.2%) who were socioeconomic. The chi square test results obtained ρ-value = 0.729> 0.05. This means that there is no socio-economic influence with the risk of malaria incidence in the Arso III Health Center in Keerom Regency. The odds ratio test results were obtained OR = 0.835; CI95% = (0,424 - 1,648) does not include 1 which is interpreted that socio-economic is not a risk factor for the incidence of malaria.

e. Effect of habitual factors using mosquito repellent with the risk of malaria incidence.

Table 5. The effect of the habit of using mosquito repellent with the risk of malaria incidence in Arso III Health Center, Keerom Regency.

No	using mosquito repellent	Malaria occurrence				Number	
		Cases		Control			
		n	%	n	%	n	%
1	Not	42	62,7	23	34,3	65	48,5
2	Yes	25	37,3	44	65,7	59	51,5
Total		67	100	67	100	134	100
p-value = 0,002; OR = 3,214; CI95%= (1,585 – 6,516)							

Based on Table 5, it shows that in the case group of malaria cases the respondents who did not have the habit of using mosquito repellent were 42 people (62.7%) and respondents who used malaria mosquito repellent were 25 people (37.3%). The chi

square test results obtained ρ-value = 0.002 <0.05. This means that there is the influence of the habit of using malaria mosquito repellents with the risk of malaria incidence in Arso III Health Center, Keerom Regency. The odds ratio test results were obtained OR = 3.214; CI95% = (1,585-6,516) which was interpreted that respondents who did not use malaria anti-mosquito drugs were at risk of malaria incidence at 3,214 times higher than respondents who used malaria mosquito repellent.

f. Proving the factor of using insecticide-treated bed nets with the risk of malaria incidence

Table 6. Effect of the use of insecticide-treated bed nets on the risk of malaria incidence at Arso III Health Center in Keerom Regency

No	use of insecticide -treated bed nets	Malaria occurrence				Number	
		Cases		Control			
		n	%	n	%	n	%
1	Not	48	71,6	24	35,8	72	53,7
2	Yes	19	28,4	43	64,2	62	46,3
Total		67	100	67	100	134	100
p-value = 0,000; OR = 4,526; CI95%= (2,183 – 9,384)							

Based on Table 6, it shows that in the case group of malaria cases the respondents who did not use insecticide-treated nets were 48 people (71.6%) and the respondents using insecticide-treated bed nets were 19 people (28.4%). Chi square test results obtained ρ-value = 0,000 <0,05. This means that there is an influence on the use of insecticide-treated bed nets with the risk of malaria incidence at Arso III Health Center in Keerom Regency. The odds ratio test results were obtained OR = 4,526; CI95% = (2,183 - 9,384) which was interpreted to mean that respondents who did not use insecticidal methamphetamine were at risk of malaria occurring at 4,526 times higher than respondents who used bed nets.

g. Effect of factor on the use of wire mesh on ventilation with the risk of malaria incidence

Table 7. The Effect of Using Wire Mesh with the Risk of Malaria Events at Arso III Health Center in Keerom Regency.

No	Using Wire Mesh	Malaria occurrence				Number	
		Cases		Control			
		n	%	n	%	n	%
1	Not	47	70,1	28	41,8	75	56
2	Use	20	29,6	39	58,2	59	44
Total		67	100	67	100	134	100
p-value = 0,002; OR = 3,273; CI95%= (1,603 – 6,683)							

Based on Table 7, it shows that in the case group of malaria cases the respondents who did not use wire mesh were 47 people (70.1%) and respondents whose houses used wire mesh were 20 people (29.60%). The chi square test results obtained ρ-value = 0.002 <0.05. This means that there is an influence on the use of wire mesh with the risk of malaria incidence in Arso III Health Center, Keerom Regency. The odds ratio test results were obtained OR = 3.273; CI95% = (1,603-6,683) which was interpreted that respondents who did not use wire netting at their home were at risk of malaria incidence 3,273 times higher than respondents who used wire netting at their home.

4. DISCUSSION

4.1. Effect of age on malaria incidence

Age is life time (Handayani, 2012). The more people age, the more their soul will mature in doing everything and the older they will become wiser and the more information they will find and the more things they will do (Hurlock, 2009). The older a person is, the better his mental development process, but at a certain age, the increase in mental development process is not as fast as when he was a teenager, thus it can be concluded that age factors will affect the level of knowledge a person will experience at age certain and will decrease the ability to accept or remember things as you get older. The results obtained in the case group of malaria in respondents aged >20 years as many as 59.7% and respondents aged <20 years were 40.3%. This shows the existence of the same risk as the incidence of malaria and the results of statistical tests stated no effect of age with the risk of the incidence of malaria in the Arso III Health Center in Keerom Regency. In line with the research conducted by Atikoh (2014) in Purbalingga Regency which suggested that age did not affect the incidence of malaria in the age group.

The absence of influence of age was conveyed by Gunawan (2000) in Harijanto

(2012), that in general all people could potentially be infected with malaria, the difference in malaria prevalence according to age was related to the level of immunity due to variations in exposure to mosquito bites. Immunity obtained by babies from their mothers provides protection against malaria. Babies usually get more protection from mothers for mosquito bites, so they are rarely found in infants. But if there are cases in infants, it is indicated the high rate of malaria transmission in the area. While at the age of children it is very susceptible to infection with malaria, this is because the anti-body in children has not been formed properly while the immunity of the mother continues to decline. The incidence of malaria in children often occurs because in general children do not know the causes of malaria so they do not prevent mosquito bites. In this condition the role of parents in protecting children from malaria infection by providing clothes that can protect children from mosquito bites, protecting children while sleeping with mosquito nets, is very necessary to prevent malaria transmission in children.

At the age of adolescents and adults is an age susceptible to malaria infection because it has a high activity both during the day and at night, including doing work. Teenagers usually hang out on the roadside, around coffee shops or in other open places that allow exposure to mosquito bites. However, adolescents are able to protect themselves from mosquito bites by wearing clothing that is good or repellent as a mosquito repellent. While in the natural age of the body anti-body has been formed both from previous infections or the state of individual nutrition. But adults with high activity in connection with the work done tend to not pay attention and ignore mosquito bites while working. High-risk occupations contracting malaria such as farmers, livestock rising, labourers are the cause of the high incidence of malaria.

4.2. Sex influence with malaria incidence

The results of the study showed that in the case group of malaria the respondents who were female were 30 people (44.8%) and male respondents were 37 people (55.2%). The results of statistical tests stated that there was influence of sex with the risk of malaria incidence in Arso III Community Health Center in Keerom Regency and from the odds ratio test results obtained OR = 0.453; CI95% = (0.226 - 0.906) interpreted that gender is not a risk factor for malaria incidence.

There were 12 malaria cases in respondents at Arso III Community Health Center who were pregnant, which caused gender to be a confounding factor. This was revealed by Lestari and Salamah (2014), revealing that gender does not have an influence on the incidence of malaria, but pregnant women are more susceptible to malaria compared to non-pregnant women and overall population. Apart from being easily suffering from malaria, pregnancy can cause recurrent infections, severe complications and can cause miscarriage, premature birth, low birth weight, congenital infections and death in infants and mothers. This is because when pregnant, the mother experiences a decrease in immunity in dealing with malaria parasite infections. Whereas the malaria parasite can replicate the placenta.

According to Tjitra et al., (2008) stated that there was no significant ratio in Plasmodium falciparum patients between men and women but there was a significant dominance of Plasmodium vivax in women compared to men in adults; this is because after adolescence early hemoglobin is lower in women than men, so women especially in pregnancy tend to suffer greater anemia in response to Plasmodium vivax, while sex hormones, including dehydroepiandro-sterone (DHEAS), can reduce the risk of Plasmodium falciparum infection, but that difference does not occur in children.

The results of this study are in line with the research conducted by Manumpa, (2016) in the Moru NTT Health Center stating that there were no statistically significant differences between the sexes with malaria incidence. Women especially

pregnant women are more vulnerable to malaria infections. Pregnant women have twice the risk of infection compared to non-pregnant women (Harijanto, 2012). The researcher argues that gender has the same risk of malaria and a greater risk for women if they experience pregnancy and are a confounding factor.

4.3. Effects of education on malaria

The results showed that there was no effect of education on the risk of malaria incidence in Arso III Health Center, Keerom Regency. Respondents in the case group of malaria cases in respondents with low education level were 47.8% and respondents who were highly educated were 52.2%. The statistical test results obtained there was no effect of education on the incidence of malaria. This shows that low or high education has the same risk opportunity as malaria. The results of the study are in line with those carried out by Sudarsono (2014) at Arso Barat Community Health Center, Arso District, Keerom District, revealing that there was no effect of education on malaria incidence. This is due to the fact that the level of education actually does not have a direct effect on the incidence of malaria but generally affects the type of work and health behavior of a person.

Education means guidance given by someone to other people in order to understand something. It cannot be denied that the higher a person's education, the easier it is for them to receive information, and in the end the more knowledge they have. Conversely, if someone has a low level of education, it will hinder the development of the attitude of the person towards the acceptance of information and newly introduced values (Mubarak, 2011). Another study conducted by Delil in Ethiopia in 2016, said that the incidence of malaria is still the main source of death compared to fever. Poor levels of knowledge, not using clean beds, and endemic areas close to standing water are the causes of malaria. Therefore, the need for intervention, education, information dissemination, and prevention and control of malaria.

Education which is not a risk factor for malaria incidence is caused by malaria being an endemic malaria disease, so that people already know about the causes of malaria. In addition, health promotion on malaria has been disseminated by local health institutions in making prevention, so that community behavior has a strong influence on malaria prevention.

4.4. Socio-economic influence with the risk of malaria incidence

Poverty plays a role in the spread of infectious diseases from various types of infectious diseases, this is due to poverty absolute is determined based on the inability to meet minimum basic needs such as food, clothing, health, housing and education that are needed to be able to live and work (Indonesian Central Bureau of Statistics, 2008). Malaria is associated with poverty as well as causes and consequences. Malaria greatly affects the condition of poor people in remote areas far from the health service environment.

The results showed that there was no socio-economic influence with the risk of malaria incidence in Arso III Community Health Center, Keerom District, namely in the case group of malaria in respondents who were less socioeconomic as much as 44.8% and respondents who were socioeconomic were 55.2%. This shows that the high and low socio-economic does not affect the risk of malaria incidence. This research is in line with what was done previously by Sukiswo (2014) revealing that there is no socio-economic influence and risk for the incidence of malaria.

Poor people tend not to pay attention to clothing and shelter needs, this is due to difficulties in meeting daily food needs. Thus the condition of poor homes is only made of cheap materials that cause mosquitoes to enter the house and infections occur in the house. So that even though nighttime activities are only done at home, malaria infection continues. Poverty also causes unmet nutritional needs in a balanced manner so that the body's resistance to

malaria is low so it is susceptible to malaria. Although malaria sufferers in the work area of Arso III Health Center in Keerom Regency have higher incomes but the incidence of malaria remains high this shows that there is no willingness of the community to use part of their income in trying to prevent or minimize contact with mosquitoes such as buying wire or mosquito repellent. Economic status will affect the incidence of malaria but it does not underlie changes in health behavior if it is not accompanied by the implementation of preventive measures (Notoatmodjo, 2011).

4.5. Effect of the habit of using mosquito repellent with malaria

The results of the study showed that there was an effect of the habit of using malaria mosquito repellents with the risk of malaria incidence in Arso III Health Center, Keerom Regency. In the case group of malaria in respondents who did not have the habit of using mosquito repellent as much as 62.7% and respondents who used malaria mosquito repellent were 37.3%. The use of malaria anti-mosquito drugs proved and had a large risk with malaria incidence of 3,214 times higher than respondents who did not use anti-malaria drugs. This is because respondents who have walls made of boards and act on gauze, but using malaria mosquito repellent can prevent the bite of malaria mosquitoes. Research conducted by Wibowo (2017) at the puskesmas Cikeusik Subdistrict, Pandeglang Regency revealed that there was an influence of the habit of using mosquito repellent with malaria incidence with a risk of malaria incidence of 9.27 times in respondents who did not use mosquito repellent.

The activity of spraying liquid mosquito repellent sprayed into the room can kill mosquitoes in the short term, but houses that are not installed wire netting and dindin made of boards make it easier for mosquitoes to re-enter.

The main action is an individual preventive measure of how someone can avoid mosquito bites, in the majority of respondents stated that they use anti-mosquito cream rubbed in the body area which is at risk of mosquito bites. Respondents who did not use anti-mosquito drugs were caused by respondents who did not like the smell and smoke from the mosquito repellent and judging from the lack of public awareness about the dangers of malaria so that malaria was not a dangerous disease so the use of mosquito repellents was not important to use. Besides the use of cream is rarely done by respondents except for respondents who have a habit of going out at night.

4.6. Effect of the use of insecticide-treated bed nets with the incidence of malaria

The insecticides used in bed nets are safe for humans and have been used by many countries. The insecticide-treated mosquito net program is an alternative to controlling malaria vectors in areas with the behavior of biting mosquitoes in homes and regions with rejection of Indoor Residual Spraying (IRS). The use of insecticide-treated bed nets as an effort to prevent malaria transmission by using insecticide-treated bed nets (Faradila 2014).

The results of the study showed that there was an influence on the use of mosquito nets with the risk of malaria incidence in Arso III Health Center, Keerom Regency. In the case group of malaria in respondents who did not use insecticide-treated mosquito nets as much as 71.6% and respondents using insecticide-treated nets as much as 28.4% and odds ratio test results that respondents who did not use methamphetamine were at risk of malaria incidence of 4.526 times higher than respondents who do not use mosquito nets.

This research is also in line with previous research conducted by Lestari and Salamah (2014) in West Nusa Tenggara, East Nusa Tenggara, Maluku, North Maluku, Papua and West Papua. Based on Rahmadiliyani's research results (2018), the use of insecticide-treated bed nets is very effective in reducing number of events or in the prevention of malaria. Factory-made insecticide-treated nets are expected to maintain biological activity to a minimum.

The use of mosquito nets proved to be meaningful by reducing the risk of malaria incidence. This is because respondents who do not use the mosquito net, even though they have used wire netting and walls made of walls, mosquitoes can enter through the door gap that is often opened, so that the presence of malaria mosquitoes can enter the room and bite if not sleeping using a mosquito net.

4.7. Effect of Using Wire Mesh with the risk of malaria incidence

The results showed that there was an effect of using wire mesh with the risk of malaria incidence at Arso III Health Center in Keerom Regency. In the case group of malaria cases the respondents who did not use wire netting were 70.1% and respondents whose houses used wire mesh were 29.9%. The odds ratio test results were interpreted that respondents who did not use wire netting at their homes were at risk of malaria incidence 3.273 times higher than respondents who used wire netting at their home. This research is in line with the previous one conducted by Sudarsono (2014) in West Arso Health Center, Keerom District, which revealed that the use of ventilated wire mesh affected the incidence of malaria, where 10.8 times the risk of malaria in homes that were not installed wire mesh.

Houses with ventilation conditions are not installed mosquito / strimin, will make it easier for mosquitoes to enter the house to bite humans and to rest. Respondents who were installed with wire nets suffering from malaria were caused by the installation of partially installed gauze, and there were also installed but there were holes. With no mosquito gauze in home ventilation, it will make it easier for the Anopheles spp mosquito to enter the house at night. This means that it will facilitate contact between residents of the house and mosquitoes that transmit malaria, so that it will increase the risk of malaria transmission being higher than the house with a mosquito net installed. Efforts to repair wire mesh on ventilation need to be repaired periodically and cleaned, considering the high risk of malaria.

5. CONCLUSION

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

1. There is no influence of age on the risk of malaria incidence in Arso III Puskesmas Keerom District (ρ-value = 0.143; OR = 0.544; CI95% = (0.263 - 1,127)
2. There is gender influence with the risk of malaria incidence in Arso III Health Center in Keerom Regency (ρ-value = 0.037; OR = 0.453; CI95% = (0.226 - 0.906).
3. There is no influence on the level of education with the risk of malaria incidence in Arso III Puskesmas Keerom Regency (ρ-value = 0.203; OR = 1.962; CI95% = (0.807 - 4.766).
4. There is no socio-economic influence with the risk of malaria incidence in Arso III Puskesmas Keerom District (ρ-value = 0.729; OR = 0.835; CI95% = (0.424 - 1.648).
5. There is the influence of the habit of using malaria mosquito repellents with the risk of malaria incidence in Arso III Health Center in Keerom Regency (ρ-value = 0.002; OR = 3.214; CI95% = (1.585 - 6.516).
6. There is an influence on the use of insecticide-treated bed nets with the risk of malaria incidence in Arso III Puskesmas Keerom Regency (ρ-value = 0,000 OR = 4,526; CI95% = (2,183 - 9,384).
7. There is the effect of using wire mesh with the risk of malaria incidence in Arso III Health Center in Keerom Regency (ρ-value = 0.002; OR = 3.273; CI95% = (1,603 - 6,683).

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