

The Use of Insecticidal Nets in Malaria and Non Malaria Patients at Pesawaran, Lampung, Indonesia

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I. INTRODUCTION

Malaria is an infectious disease caused by *Plasmodium sp.* that transmitted from female *Anopheles* mosquito bites that contain *Plasmodium sp.*[1]. According to WHO (2018) in 2017 there were 219 million cases of malaria with the death of 435,000 people globally. Countries that have been stricken by malaria according to the World Malaria Report 2015 were 106 countries[2].

The morbidity rate of malaria based on Annual Parasite Incidence (API) in Indonesia in 2014 was 0.99 per 1000 inhabitants[3]. Lampung Province has some areas that have the potential for developing malaria such as swamps, brackish puddles by the sea, and unmanaged fishponds. The district that has the highest API in Lampung

Province in 2016 is Pesawaran District, which is 4.63 per 1000 population[4]. There were 1915 cases of malaria in Pesawaran District in 2016. The most positive cases of malaria were found in Hanura Health Center, which was 1738 cases[5].

Long Lasting Insecticidal Nets (LLINs) is an effective way to reduce malaria transmission[6]. World Health Organization recommends LLINs as one of the main strategies in vector control for malaria control and elimination [7]. The strategy developed by the Republic of Indonesia Ministry of Health is routine distribution of LLINs, increasing the use of LLINs through health promotion and increasing distribution of free LLINs to residents in malaria endemic areas[6].

The use of insecticidal nets in several countries in Africa can reduce malaria morbidity by 50%. Child mortality from all causes can reduce by 17% with the use of LLINs compared to no nets. LLINs also reduce the incidence of uncomplicated episodes of *Plasmodium falciparum* malaria by almost a half and reduce the incidence of uncomplicated episodes of *Plasmodium vivax* malaria[8]. Caring for LLINs such as sewing when torn, washing and drying LLINs properly can correctly prevent malaria transmission[6]. How to treat LLINs that are not suitable can reduce the content of insecticides so that the effectiveness of LLINs will decrease in controlling mosquitoes vector malaria and can accelerate the process of resistance to insecticides[9].

According to Lawrence Green behavior can be determined or formed from three factors, namely predisposing factors, reinforcing factors and enabling factors. Predisposing factors are factors that facilitate the behavior of the use and care of Long Lasting Insecticidal Nets (LLINs), such as knowledge of malaria and knowledge of LLINs. The second factor is reinforcing factors. Reinforcing factors are factors that can encourage the behavior of the use of LLINs, such as perceptions of the support of family heads, perceptions of community leaders' support, and perceptions of support of health workers to use and care for LLINs properly. The third factor is the enabling factors, which are factors that can facilitate the behavior of the use of LLINs, such as exposure to information about malaria and the provision of LLINs to prevent malaria[10].

II. MATERIALS AND METHOD

This research is an analytic observational study with cross-sectional survey. This research was conducted at the Hanura Public Health Center in Pesawaran District and respondent's home in the work area of the Hanura Public Health Center in Pesawaran District from October to November 2019.

The population in this study were malaria patients and non-malaria patients who lived at Hanura Public Health Working Area Subdistrict Pesawaran Regency. The sample size was determined by the unpaired categorical formula. The sample of this study are 41 malaria patients and 41 non-malaria patients. The sampling technique used consecutive sampling method. The independent variable in this study is the behavior of the use and treatment of Long Lasting Insecticidal Nets (LLINs) in malaria and non-malaria patients on a categorical scale. The dependent variable in this study were malaria sufferers and non malaria sufferers on a categorical scale.

The inclusion criteria of this research are voluntary respondents who are willing to become the respondent of this research, respondents who are proven to have *Plasmodium sp.* on his or her body, respondents who are proven to not have *Plasmodium sp.* on his or her body, respondents who have Long Lasting Insecticidal Nets (LLINs), lived in Hanura public health working area subdistrict Pesawaran Regency, and aged over 11 years. Whereas the exclusion criteria for this study were respondents who did not collect the questionnaire. In this study, someone who has been proven positive or negative malaria will be asked to fill out a questionnaire independently by first filling out an informed consent sheet of the study.

Research data was processed using a data processing program, then analyzed with univariate analysis and bivariate analysis. The bivariate analysis used was the *Chi square* test to determine difference between the behavioral use and care of Long Lasting Insecticidal Nets (LLINs) in malaria patients and non malaria patients. The study was approved by the Medical Research Ethics Commission of the Faculty of Medicine, University of Lampung with No. 3130 / UN26.18 / PP.05.02.00 / 2019.

III. RESULTS

The results of univariate analysis in this study are shown in Table 1 and Table 2 respectively.

Behavioral use and care of LLINs	Malaria	
	N	%
Good	13	31,7
Not Good	28	68,3

Table 1:- Distribution of behavioral use and care of LLINs in malaria patients

In Table 1, it can be seen that 13 people (31.7%) in malaria patients have good behavior and 28 people (68.3%) have bad behavior in using and caring for LLINs.

Table 2 shows the behavioral use and care of LLINs in non-malaria patients. the results obtained are as many as 26 people (63.4%) non-malaria patients have good behavior and 15 people (36.6%) have bad behavior in using and caring for LLINs.

Behavioral use and care of LLINs	Non Malaria	
	N	%
Good	26	63,4
Not Good	15	36,6

Table 2:- Distribution of behavioral use and care of LLINs in non malaria patients

The distribution of questionnaire answers about the behavior of LLINs use and care in malaria and non-malaria patients can be seen in Table 3 and Table 4.

No.	Questions	The Behavior in Malaria Patients	
		Good (N/%)	Not Good (N/%)
1.	Washing time interval	4/12,1	29/87,9
2.	Washing LLINs	19/57,5	14/42,5
3.	Drying LLINs	10/30,3	23/69,7
4.	Use LLINs every night	26/78,7	7/21,3
5.	Age of the LLINs	27/81,8	6/18,2
6.	Tying up LLINs	26/78,7	7/21,3

Table 3:- The distribution of questionnaire answers in malaria patients

No.	Questions	The Behavior in Non Malaria Patients	
		Good (N/%)	Not Good (N/%)
1.	Washing time interval	18/47,3	20/52,7
2.	Washing LLINs	22/57,8	16/42,2
3.	Drying LLINs	16/42,1	22/57,9
4.	Use LLINs every night	37/97,3	1/2,7
5.	Age of the LLINs	34/89,4	4/10,6
6.	Tying up LLINs	36/94,7	2/5,3

Table 4:- The distribution of questionnaire answers in non malaria patients

The results of this study indicate that the majority of respondents still dry LLINs in places directly exposed to sunlight, amounting to 69.7% of malaria patients and 57.9% of non-malaria patients. Respondents mostly still wash LLINs by brushing or using a washing machine, which is 42.5% in malaria patients and 42.4% in non-malaria patients. Respondents also still washed the LLINs more than 3 months or less than 2 months, which is 87.9% in malaria patients and 52.7% in non-malaria patients. There were 21,3% respondents in malaria patients and

2,7% respondents in non malaria patients who did not use LLINs every night. Age of the LLINs is older than 3 years in 18,2% malaria patients and 10,6% non malaria patients. Respondents who were not tying up their LLINs while not in use were 21,3% in malaria patients and 5,3% in non malaria patients.

Data were analyzed using the chi square test because the variables were categorically unpaired and the chi square test requirements were met. The following results of the analysis of the chi square test between the behavior of LLINs use and care in malaria and non-malaria patients can be seen in Table 5.

Behavioral use and care of LLINs	Malaria		Non Malaria		P Value
	N	%	N	%	
Good	13	31,7	26	63,4	0,008
Not Good	28	68,3	15	36,6	
Total	41	100	41	100	

Table 5:- Chi Square Test Results

After bivariate analysis, the p value obtained is 0.008. This means that there is a significant difference between malaria and non malaria patient in using and caring LLINs at Pesawaran, Lampung, Indonesia.

IV. DISCUSSION

Based on Table 3 regarding the behavior of using and maintaining long-lasting insecticidal nets in malaria patients, it was found that there were 31.7% of respondents who had good behavior and 68.3% of respondents who had bad behavior. In the case of non-malaria patients, 63.4% of respondents have good behavior and 36.6% of respondents have bad behavior. This shows that more malaria patients have bad behavior than non-malaria patients. Most malaria patients and non malaria patients hang the Long Lasting Insecticidal Nets (LLINs) in a place that is directly exposed to sunlight, do not wash the LLINs once every 2-3 months and wash the LLINs by rubbing, brushing or using a washing machine.

According to the Indonesian Ministry of Health (2011), Long Lasting Insecticidal Nets (LLINs) is washed only by dipping it in a detergent solution then rinsing a maximum of three times. LLINs should not be rubbed, brushed or washed using a washing machine so it is not easily damaged and reduce the effectiveness of LLINs to control *Anopheles* mosquitoes[6].

As many as 30 respondents (42.2%) of this study washed Long Lasting Insecticidal Nets (LLINs) by rubbing, brushing or using a washing machine for several reasons. Respondents who have known how to wash LLINs well but still wash it by brushing or using a washing machine mostly feel that the LLINs is not clean enough if washed only by dipping it. Some respondents also felt the LLINs were too large if they were washed by hand, hence they chose to wash them with a washing machine. There

are some respondents who have not known yet how to wash LLINs by simply dip it repeatedly so they still wash the LLINs improperly.

Long Lasting Insecticidal Nets (LLINs) can be washed regularly every 2-3 months. LLINs improper washing can reduce the content of insecticides in LLINs so that its effectiveness in controlling *Anopheles* mosquitoes is reduced and can accelerate the process of resistance to insecticides[9]. A total of 49 respondents (69%) in this study did not wash LLINs every 2-3 months. Respondents who wash LLINs once a month are 26 respondents (36.6%) and those who wash LLINs more than 3 months are 23 respondents (32.4%).

The respondents of this study washed the Long Lasting Insecticidal Nets (LLINs) once a month because they felt that their LLINs are smelly and dusty so the nets had to be washed frequently. Frequent washing can degrade both the physical and chemical integrity of LLINs[11]. Respondents washed LLINs more than 3 months because they were lazy thus they often delayed washing LLINs and prefer to wash their nets when they are dirty[12][13]. Washing the LLINs every more than 3 months will make the effectiveness of the LLINs reduced because dust attaches to the LLINs prevents the insecticide from directly contacting mosquitoes on the surface of the LLINs. Washing LLINs can remove surface dust so that insecticide migration will occur from inside the LLINs' fiber to the surface[14]. The majority of the respondents do not know how often they have to wash the LLINs in a month to keep the LLINs effective in preventing malaria.

The results of this study indicate that as many as 56 respondents (78.8%) dried the Long Lasting Insecticidal Nets (LLINs) under direct sunlight. According to the Indonesian Ministry of Health (2011) LLINs must be dried in the shade or not directly exposed to sunlight. Drying LLINs in direct sunlight can potentially eliminate insecticides faster because some insecticides will evaporate at a certain temperature[6]. Respondents assume that LLINs must be dried in places exposed to direct sunlight so they will dry quickly and reusable e used again soon. In addition, respondents do not have any other shady places for drying LLINs other than where they are used to dry clothes, which is a place that is directly exposed to sunlight. Some respondents also assumed LLINs dried in the shade will feel damp when used. Some respondents did not know that LLINs must be dried in a place indirectly exposed to sunlight.

There were 8 respondents (9,7%) who did not use LLINs every night. The use of LLINs is related to the incidence of malaria. People who don't use LLINs are more likely to get malaria[15]. The use of LLINs during sleep can prevent the risk of malaria, but mosquito nets will be meaningless if not followed by routine use every night[16].

Based on guidelines for the use of Long Lasting Insecticidal Nets (LLINs) according to the Republic of Indonesia Ministry of Health 2011, after 3 years LLINs

will no longer be effective. There were 10 patients (12.1%) in this study who had LLINs that were older than 3 years. According to Andronesu et al. (2019) older LLINs were associated with higher rates of *Plasmodium falciparum* in young children, which may indicate that insecticide concentrations play a larger role in infection prevention than the physical barrier of LLINs[17].

1 Tying up LLINs or storing them in a safe space while not in use during the day prevents physical damage. There were 9 patients (10.9%) who were not tying up their LLINs while not in use. Tying up LLINs may also increase the amount of time a net appears clean, which may lead to less frequent washing. Tying up nets, removing the net and storing it in a safe space during the day is a best practice for preventing damage, and also a good practice particularly when children are likely to pull on hanging nets[18].

In Table 5, the p value is 0.008. This means that there is a significant difference between malaria and non malaria patient in using and caring LLINs at Pesawaran, Lampung, Indonesia. These results are in line with the research conducted by Arsin (2013) showing that there is a relationship between LLINs usage and care behavior and malaria incidence in East Halmahera Regency[19].

There are three factors that can determine and shape a person's behavior, namely predisposing factors, reinforcing factors and enabling factors. Predisposing factors are factors that can facilitate the behavior of the use and care of Long Lasting Insecticidal Nets (LLINs), such as knowledge of malaria and knowledge of LLINs. The results of this study indicate that some respondents who have bad behavior in using and caring for LLINs do not know how to use and care for LLINs properly so that LLINs remain effective in preventing malaria[10].

The second factor is reinforcing factors. Reinforcing factors are factors that can encourage or reinforce the behavior of the use and care of Long Lasting Insecticidal Nets (LLINs), such as perceptions about the support of family heads, perceptions of community leaders' support, and perceptions about support health workers to properly use and care for LLINs. The working area of the Hanura Health Center has a malaria cadre whose job is to assist the Hanura Health Center program in dealing with malaria prevention. But there are not many malaria cadres yet and are not distributed evenly. Of the 10 villages in the working area of the Hanura Health Center, there are only 2 malaria cadres in Sukajaya Lempasing Village.

The third factor is enabling factors, which are factors that enable or facilitate the behavior of using Long Lasting Insecticidal Nets (LLINs), such as exposure to information about malaria and providing LLINs to prevent malaria.¹¹ Counseling about malaria has been done several times at the Malaria Post through an activity called Sekolah Malaria but this activity has only been carried out in Sukajaya Lempasing Village. Counseling on how to use and care for LLINs has also been a routine when distributing LLINs in

Posyandu. Unfortunately, not all invited people come so that those not present will get LLINs through the local RT head and are not exposed to information on how to properly use and care for the LLINs. Free distribution of LLINs from the Hanura Health Center has been routinely carried out every 6 months to once year so that the LLINs are spread throughout the villages in the work area of the Hanura Health Center, especially villages that have many cases of malaria.

V. CONCLUSION

There is a significant difference between malaria and non malaria patient in using and caring LLINs. The good behavioral use and care of LLINs in non malaria patients are higher than in malaria patients at Pesawaran, Lampung, Indonesia.

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