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## RESEARCH ARTICLE

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## The Effectiveness of The Malaria Cadres on Drug Intake Supervision, The Use of Mosquito Net and Environmental Modification on Malaria Sufferers at Malaria Endemic Area of Public Health Center of Waipukang, Lembata District, Nusa Tenggara Timur Province, Indonesia

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## ABSTRACT

Malaria was a disease that caused many mortalities in developing countries. In solving this problem, it was needed a focused and directed mentoring continuously. This study aimed to determine the effectiveness of malaria cadres on drug intake supervision, the use of mosquito net and environmental modification on malaria sufferers at Public Health Center of Waipukang. This research was analytic observational research with cross sectional study design. The results showed that the average knowledge of malaria cadres was still low. Malaria cadres in Public Health Center of Waipukang were less effective in monitoring the consuming of malaria drugs, mosquito nets usage, and environmental modification in their areas. Furthermore, there were 78% of people who used mosquito net properly and 54% of families obediently did environmental modification efforts.

**Keywords:** Malaria, Malaria cadre, Drug intake supervision, Environmental development, Mosquito net

## INTRODUCTION

Malaria was a disease that caused many mortalities in developing countries, and the children and pregnant women were the most vulnerable groups. About half of the world's population had risk of malaria and it was estimated 225 millions of malaria cases with 781,000 mortalities in 2009<sup>(1)</sup>.

In Indonesia, 50 percent of population suffered malaria, especially in rural areas and among the poor society. The most malaria-prone areas were located in the outside of Java island, especially in Eastern Indonesia, such as Nusa Tenggara Timur, Maluku and Papua Province. The areas in Sumatra, Kalimantan and Sulawesi had moderate rates of malaria transmission, and some areas had very low transmission rates, Jakarta and Bali had malaria spread between zero to low<sup>(2)</sup>. Basic Health Research in 2010 reported that there were five provinces with the highest new cases of malaria. Those were Papua (261.5 %), Papua Barat (253.4 %), Nusa Tenggara Timur (117.5 %), Maluku Utara (103.2 %) and Bangka Belitung Islands (91.9 %)<sup>(3)</sup>.

Data from the General Director of Disease and Environmental Health Control, Ministry of Health (2013), reported that malaria cases in 2013 were 93.2%. From the data, the highest confirmation of malaria cases were Papua Province 42.64%, Papua Barat Province 38.44% and Nusa Tenggara Timur Province 16.37%<sup>(4)</sup>. The confirmation total of malaria cases in Nusa Tenggara Timur by blood test were 16.37%<sup>(4)</sup>.

Anopheles sp mosquitoes that had been confirmed as malaria vector in Nusa Tenggara Timur Province were *An. sundaicus*, *An. subpictus* and *An. barbirostris*<sup>(5)</sup>. Lembata, Nusa Tenggara Timur was a district with High Incidence Area which showed Annual Parasite Incidence percentage of 165.39% in 2012, 132.09% in 2013 and 102.74% in 2014. The highest malaria cases in Lembata in 2014 were 863 cases and it was found in Lembata General Hospital = 262 cases, Damian Hospital = 185 cases, Waipukang Public Health Center = 151 cases, Hadakewa Public Health Center = 83 cases<sup>(6)</sup>.

Based on preliminary survey that was conducted by Kristina et al in October 2016 in Lembata, the number of malaria cases at Lewoleba Public Health Center were 29 cases from 600 people who were screened, and at

Waipukang Public Health Center were 555 cases from 574 people who were screened. This data showed that positive malaria cases were still very high. Another factor that also contributed to the high incidence of malaria was drug consuming behavior in the community. Many malaria patients did not obediently consume malaria drugs. In other words, drugs were not drunk thoroughly and completely. This caused the parasite in the patient's body persisted for long time (malaria vivax), or in the blood and caused new infection (malaria fallciparum).

Currently, malaria eradication program was still done separately, according to program needs and implemented by each related program. One of the program's weaknesses was the absence of continuous mentoring in malaria eradication program, either mentoring for malaria drug consuming or mentoring in malaria eradication activities. The needed mentoring was continuous, directed, and focused partisipative mentoring to the patients and community within a sufficient period of time in order to change behavior and the environment. Mentoring for controlling malaria followed very essential concept of community empowerment, utilizing the community itself as a companion for malaria. Their functions were to conduct, to accompany and to mobilize communities in malaria endemic area. The personnel considered suitable as a companion was a health cadre.

However, in order to find out the effectiveness of malaria cadres, what were done as malaria cadres both in supporting malaria treatment for the patients and advocating malaria patients about clean and healthy life to avoid malaria, and other preventive activities, it was needed to do a study especially in Waipukang Public Health Center which had high malaria cases.

## METHODS

This research was an observational analytic research with cross sectional study design. This study was conducted in Lembata, Waipukang Public Health Center, that was a malaria endemic area. This location was taken because it was a region with High Incidence Rate. The study was conducted in April - June 2017. The population were village malaria cadres, malaria patients and family members of malaria patients in 17 villages of Lembata, Waipukang Public Health Center. Sample size was calculated based on purposive sampling. Moreover, malaria cadres were 15 people, malaria sufferers were 80 people and family members were 80 people. The collected data is categorical so that it is presented in the form of frequency and percentage<sup>(7)</sup>, then the hypothesis is tested using Chi square test.

## RESULTS

### Description of Location



Figure 1. Waipukang Public Health Center areas

This research was conducted in malaria endemic area of Waipukang Public Health Center, Lembata, East Nusa Tenggara.

Based on the map of Waipukang Public Health Center area, Waipukang Public Health Center was adjacent to:

- 1) The north was bordered to Petuntawa
- 2) The east was bordered to East Ile Ape
- 3) The south was bordered to Laranwutun
- 4) The west was bordered to Kolontobo

Description of malaria spread based on annual parasite incidence (API) in Waipukang Public Health Center could be seen in Figure 2.

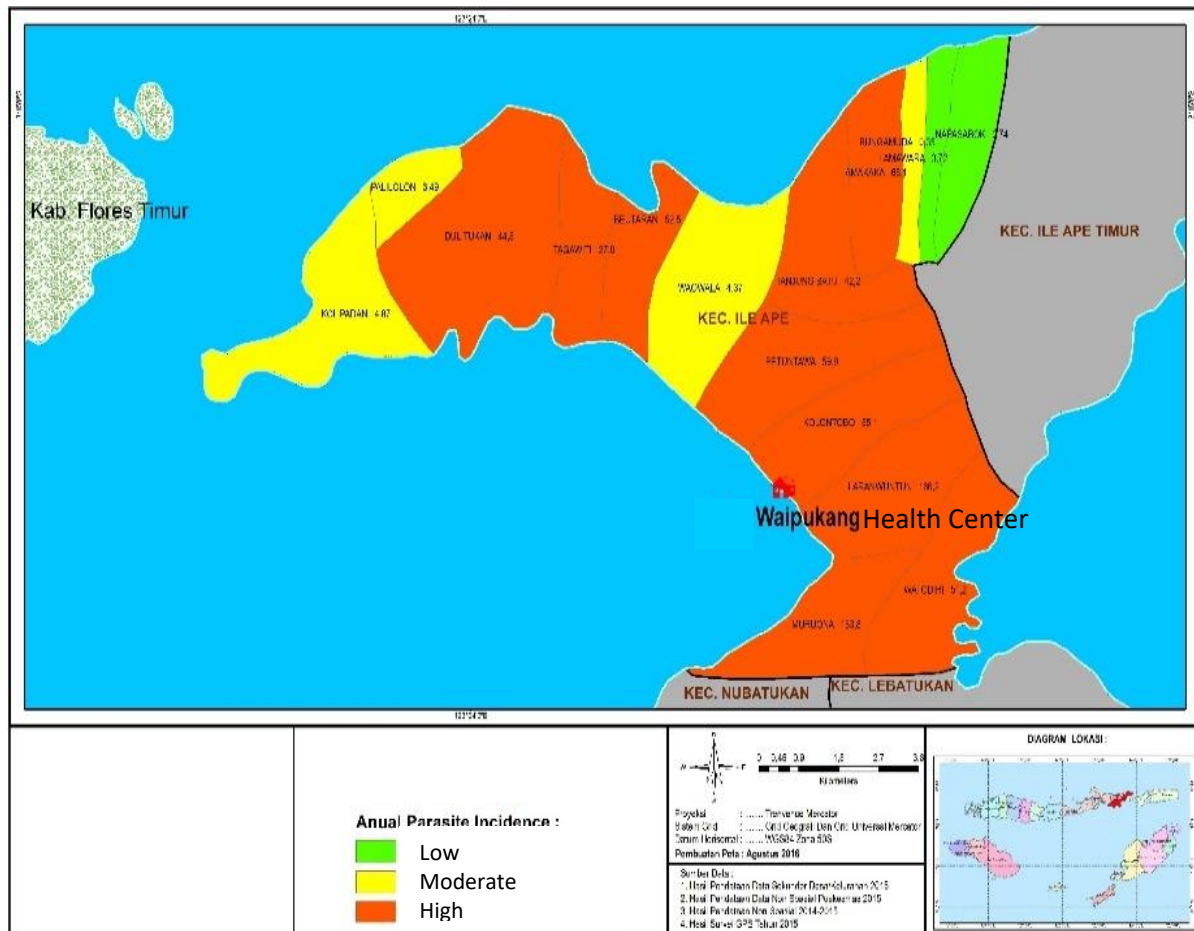


Figure 2. Map of malaria cases spread (annual parasite incidence) of Waipukang Public Health Center area, Lembata in 2016

From the Figure 2, it showed that Ile Ape, Waipukang Public Health Center area had high incident rate (API  $\geq 5$  %).

### Characteristics of Malaria Cadres in Waipukang Public Health Center

#### Educational Background, Age and Sex of Malaria Cadres

Based on the results, the characteristics of malaria cadres in Waipukang Public Health Center were as followed.

Table 1. Description of malaria cadres in malaria endemic area of Waipukang Public Health Centre, Lembata District, Nusa Tenggara Timur Province, Indonesia

Characteristic	Total (n)	%
1. Educational background		
a.Senior High School	6	40%
b.Elementary/ Junior High School	9	60%
2. Age (years)		
a.21-35	8	53%
b.36-50	6	40%
c.51-65	1	7%
3. Sex		
a.Female	15	100%
b.Male	0	0

From the table above, it could be seen that malaria cadres who had high school education level were only 40%, while, the cadres with elementary and junior high school educational background were 60%. Most cadres were 21-35 years old (relatively young) and all cadres were female.

#### Knowledge of Malaria Cadres

Based on the research result, the knowledge level of malaria cadres in Waipukang Public Health Center as followed.

Table 2. Knowledge level of malaria cadres in malaria endemic area of Waipukang Public Health Center, Lembata District, Nusa Tenggara Timur Province, Indonesia

No	Knowledge level	Total (n)	%
1.	Good	4	27%
2.	Sufficient	7	46%
3.	Less	4	27%
	Total	15	100%

Malaria cadres in working area of Waipukang Public Health Center who had good knowledge level were 27%, sufficient knowledge level were 46%, less knowledge level were 27%.

#### Attitude of Malaria Cadres

Based on the results, the attitude of malaria cadres in Waipukang Public Health Center as followed.

Table 3. Malaria cadres' attitude in malaria endemic area of Waipukang Public Health Center, Lembata District, Nusa Tenggara Timur Province, Indonesia

No.	Attitude	Total (n)	(%)
1.	Good	7	47%
2.	Less	8	53%
	Total	15	100%

Malaria cadres in the working area of Waipukang Public Health Center who had good attitude were 47% and cadres who had less attitude were 53%.

#### Action/ Skill of Malaria Cadres

Based on the results, malaria cadres' action/ skill in the Waipukang Public Health Center as followed.

Table 4. Malaria cadre's action in malaria endemic area of Waipukang Public Health Center, Lembata District, Nusa Tenggara Timur Province, Indonesia

No	Action	Total (n)	%
1	Good	4	27%
2	Sufficient	7	46%
3	Less	4	27%
Total		15	100%

Based on table 4 above, it could be seen that malaria cadres who did good action/ skills were 27% and the others (sufficient and less action/skill) were 73% cadres who still had less skilled in doing their activities.

### **The Compliance of Drug Consuming, Mosquito Net, and Environmental Modification by Malaria Sufferers in Waipukang Public Health Center, Lembata, East Nusa Tenggara**

#### Malaria Sufferers' Compliance in Drug Consuming

Based on the result of the research, malaria sufferers' compliance in consuming drug at Waipukang Public Health Center as followed.

Table 5. Malaria Sufferers' Compliance in Consuming Malaria Drug at Malaria Endemic Area of Waipukang Public Health Center, Lembata District, Nusa Tenggara Timur Province, Indonesia

No	Category	Total (n)	%
1	Obedient	24	30%
2	Disobedient	56	70%
Total		80	100%

From the table 5, it could be seen that patients who obediently consumed malaria drugs were 30%, while, patients who disobeyed consumed drug were 70%.

#### Malaria Sufferers' Compliance in Using Mosquito Net

Based on the result of the research, the compliance in using mosquito net as followed.

Table 6. Malaria sufferers' compliance in using mosquito net at malaria endemic area of Waipukang Public Health Center, Lembata District, Nusa Tenggara Timur Province, Indonesia

No	Category	Total (n)	%
1	Obedient	62	78%
2	Disobedient	18	23%
Total		80	100

From the table 6, it could be seen that malaria patients who obediently used mosquito net were 78%, while, the others were disobedient in using mosquito net (23%).

#### Compliance of Patient's Family in Environmental Modification

Based on the research, the patient's compliance of environmental modification was as followed.

Table 7. Compliance of patient's family to modify the environment at malaria endemic area of Waipukang Public Health Center, Lembata District, Nusa Tenggara Timur Province, Indonesia

No	Category	Total (n)	%
1	Obedient	43	54%
2	Disobedient	37	46%
Total		80	100

From the table above, it could be seen that patients who obediently modified their environment were 54%, while, who disobediently modified their environment were 46%.

### Effectiveness of Malaria Cadres in Controlling Drug Consumption, Mosquito Net Usage, and Environmental Modification

The effectiveness of malaria cadres in controlling drug consumption, mosquito net usage, and environmental modification was conducted by assessing the correlation strength (Odds Ratio) of cadre's activities with drug consumption, mosquito nets usage, and environmental modification compliance.

#### Correlation between Cadre's Knowledge and Compliance of Drug Consuming for Malaria Patients

Relationship between cadre's knowledge and drug taking compliance of malaria cadre could be seen in the table 8.

Table 8. Relationship between cadre's knowledge and drug taking compliance of malaria patients in Waipukang Public Health Center, Lembata District, Nusa Tenggara Timur Province, Indonesia

Cadre's Knowledge	Drug taking compliance				Total		OR (95% CI)	P-value
	Obedient		Disobedient					
	n	%	n	%	n	%		
Good	2	25%	6	75%	8	100%	0.133 (0.013 – 1.318)	0.132
Less	5	71.4%	2	28.6%	7	100%		
Total	7	46.67%	8	53.33%	15	100%		

The analysis result of cadre's knowledge and malaria sufferers' compliance in consuming drug showed that in the cadres who had good knowledge, the incidence of drug consuming compliance was 25%, while, the cadres who had less knowledge, the incidence of drug consuming compliance was 71.4%. The statistical test obtained  $p = 0.132$  and it could be concluded that there was no significant different proportion of drug consumption compliance between well-knowledgeable cadres and less-knowledgeable cadres (no significant correlation between cadre's knowledge and drug consumption compliance).

#### Correlation between Cadre's Knowledge and Malaria Sufferers' Compliance in Using Mosquito Net

Correlation between cadre's knowledge and malaria sufferers' compliance in using mosquito net could be seen in table below.

Table 9. Correlation between cadre's knowledge and malaria sufferers' compliance in using mosquito net at malaria endemic area of Waipukang Public Health Center, Lembata District, Nusa Tenggara Timur Province, Indonesia

Cadre's Knowledge	Compliance in using mosquito net				Total		OR (95% CI)	P-value
	Obedient		Disobedient					
	n	%	n	%	n	%		
Good	5	62.5%	3	37.5%	8	100%	1.25 (0.158 – 9.917)	1.000
Less	4	57.1%	3	42.9%	7	100%		
Total	9	60%	6	40%	15	100%		

The correlation analysis result between cadre's knowledge and compliance in mosquito net usage showed that in good-knowledgeable cadre, the incidence of mosquito net usage compliance was 62.5%, whereas, in less-knowledgeable cadre, the incidence of mosquito net usage compliance was 57.1%. The statistical test obtained  $p = 1.000$ , it could be concluded that there was no significant different proportion of mosquito net usage compliance between good-knowledgeable cadre and less-knowledgeable cadre (no significant correlation between cadre's knowledge and patient's compliance of mosquito net usage).

#### Correlation between Cadre's Knowledge and Environmental Modification of Malaria Patients

The correlation between cadre's knowledge and environmental modification of malaria patients could be seen in table below.

Table 10. Correlation between cadre's knowledge and environmental modification of malaria patients in malaria endemic area of Waipukang Public Health Center, Lembata District, Nusa Tenggara Timur Province, Indonesia

Cadre's Knowledge	Sufferers' compliance of environmental modification				Total		OR (95% CI)	P-value
	Obedient		Disobedient					
	n	%	n	%	n	%		
Good	3	37.5%	5	62.5%	8	100%	0.45	0.619
Less	4	57.1%	3	42.9%	7	100%		
Total	7	46.67%	8	53.33%	15	100%		

The correlation analysis between cadre's knowledge and environmental modification compliance showed that in good-knowledgeable cadres, the incidence of environmental modification compliance was 37.5%, while, in less-knowledgeable cadres, the incidence of environmental modification compliance was 57.1%. Furthermore, statistical test obtained  $p = 0.619$ , thus, it could be concluded that there was no significant different proportion of environmental modification compliance between good-knowledgeable cadre and less-knowledgeable cadre (no significant correlation between good-knowledgeable cadre and environmental modification compliance).

#### Correlation between Cadre's Action/ Skill and Malaria Sufferers' Compliance in Consuming Drug

The correlation between cadre's actions/ skills and malaria sufferers' compliance in consuming drug was illustrated in following table.

Table 11. Correlation between cadre's action/ skill and malaria sufferers' compliance in consuming drug at malaria endemic area of Waipukang Public Health Center, Lembata District, Nusa Tenggara Timur Province, Indonesia

Cadre's Action	Sufferers' compliance in consuming drug				Total		OR (95% CI)	P-value
	Obedient		Disobedient					
	n	%	n	%	n	%		
Yes	5	45.5%	6	54.5%	11	100%	0.833 (0.084-8.24)	1.000
No	2	50%	2	50%	4	100%		
Total	7	46.67%	8	53.33%	15	100%		

The correlation analysis of cadre's action and compliance in consuming drug obtained that in cadre who did an action, the incidence of drug consuming compliance was 45.5%, whereas, in cadre who did not do an action, the incidence of drug consuming compliance was 50%. The statistical test obtained  $p = 1.000$ , then, it could be concluded that there was no significant different proportion of drug consuming compliance between cadre who did an action and who did not take an action (there was no significant correlation between cadre's action and malaria sufferers' compliance in consuming drug).

#### Correlation between Cadre's Action and Mosquito Net Usage

The correlation of cadre's action and mosquito net usage could be in the table 12.

Table 12. The correlation between cadre's action and mosquito net usage for the malaria sufferers at endemic area of Waipukang Public Health Center, Lembata District, Nusa Tenggara Timur Province, Indonesia

Cadre's action	Sufferers' compliance in using mosquito net				Total		OR (95% CI)	P-value
	Obedient		Disobedient					
	n	%	n	%	n	%		
Yes	6	54.5%	5	45.5%	11	100%	0.4	0.604
No	3	75%	1	25%	4	100%		
Total	9		6		15			

The correlation analysis test result showed that on cadre who did an action, the incidence of mosquito net usage compliance was 54.5%, whereas, in cadre who did not do an action, the incidence of mosquito net usage compliance was 75%. The result of statistical test showed  $p = 0.604$ , thus, it could be concluded that there was no significant different proportion of mosquito net usage compliance between cadre who did an action and cadre who did not do an action (there was no significant correlation between cadre's action and patient's compliance of mosquito net usage).

#### Correlation between Cadre's Action and Environmental Modification Compliance for Malaria Sufferers

Correlation between cadre's action and environmental modification compliance could be seen in the following table.

Table 13. Correlation between Cadre's Action and Environmental Modification Compliance at Endemic Area of Waipukang Public Health Center, Lembata District, Nusa Tenggara Timur Province, Indonesia

Cadre's Action	Sufferers' compliance of environmental modification				Total		OR (95% CI)	P-value
	Obedient		Disobedient					
	n	%	n	%	n	%		
Yes	4	36.4%	7	63.6%	11	100%	0.19	0.282
No	3	75%	1	25%	4	100%		
Total	7		8		15			

Result of correlation analysis showed that in cadre who did an action, the incidence of environmental modification compliance was 36.4%, whereas, in cadre who did not do an action, the incident of environmental modification compliance was 75%. The result of statistical test obtained  $p = 1.000$ , therefore, it could be concluded that there was no significant different proportion of environmental modification compliance between cadre who did an action and cadre who did not do an action (there was no significant correlation between cadre's action and environmental modification compliance).

## DISCUSSION

### Knowledge, Attitude, and Action Level of Malaria Cadre

From table 2, it showed that malaria cadre's knowledge level in good category was 27%, while, in low category was 73% (sufficient and less). This low level of knowledge was in line to the level of education, which 60% of cadres were elementary and junior high graduated and only 40% was high school graduated. While, none of the cadres was undergraduate (S1).

In table 3, the description of cadre's attitude was indicated by attitude scale of strongly agree, agree, disagree and strongly disagree. The results showed that cadres who had good attitude (strongly agree and agree) were 47% and less attitude (disagree and disagree strongly) were 53%.

Table 4 illustrated that skilled malaria cadres were 27%, while, less skilled cadres were 73%. Based on the results above, it could be seen that knowledge, attitude, and action of the malaria cadres did not give any positive contribution against malaria program.

### The Effectiveness of Malaria Cadres

The effectiveness of malaria cadres was shown by the obedient malaria patients in consuming drug activity, mosquito net usage, and environmental modification compliance of malaria patient's family.

The results could be seen in table 8. The correlation of cadre's knowledge in drug consuming compliance showed the strength of the correlation (OR) 0.133 (0.013-1.318) with  $P = 0.0132$ . It could be concluded that there was no significant correlation between cadre's knowledge and drug consuming compliance for malaria patients. In Table 9, the correlation of cadre's knowledge and mosquito net usage for patient and family obtained  $OR = 0.25$  (0.015-9.917) with  $p = 1.0$ , thus, it could be concluded that there was no significant correlation between cadre's knowledge and mosquito net usage for malaria patients.

In Table 10, the correlation analysis between cadre's knowledge and environmental modification also had the similar description,  $OR = 0.45$  with  $P = 0.61$ . This result also showed no significant correlation between cadre's knowledge and environmental modification compliance for patient's family.



Correlation of cadre's action (skill) and drug consuming for malaria patient could be seen in table 11. The results obtained OR = 0.83 and P = 1.00 indicating no significant correlation between cadre's action / skill and drug consuming compliance for malaria patients.

In table 12, the correlation between cadre's action and mosquito net usage obtained OR = 0.4 and P = 0.64. This result also had no significant correlation between cadre's action / skill and mosquito net usage compliance for malaria patient.

Similarly, an analysis of the correlation between malaria cadres' actions and environmental modification of patient's family members that could be seen in table 13 obtained OR = 0.19 and P = 0.282. It meant that there was no significant different proportion between cadre's actions and environmental modification, or no significant correlation between cadre's actions and environmental modifications for the family members.

From the analysis of the six variables above, it could be concluded that the malaria cadre's knowledge and action variables had no significant correlation with malaria patients' compliance, either compliance in consuming drug, using mosquito nets, and having environmental modification. The description above could give conclusion that malaria cadres were not effectively carrying out the activities of malaria program. Some possible things that caused malaria cadres to be ineffective were as followed;

- 1) The average of malaria cadre's education level was still low that was in line with the cadre's knowledge level which was also still low.
- 2) Malaria cadres had never given training interventions of malaria programs in villages, such as training, mentoring, workshops and efforts to improve knowledge, attitudes, and actions.
- 3) Cadre had to perform multiple tasks with his/her role as other health cadres (nutrition cadres, MCH cadres)
- 4) The average incentive that was accepted by the cadres was still low and it was in accordance with local village regulations that the cadre's task was not structural.

### The Compliance of Consuming Drug, Using Mosquito, and Environmental Modification

Based on data from Table 5 it can be seen that patients who obediently take malaria drugs as much as 30%, whereas patients who do not adhere to take medicine as much as 70%. This shows that some malaria sufferers in the working area of Waipukang Health Center do not obey to take complete malaria medicine. The results of this research is also reinforced by the results of in-depth interviews conducted by researchers with some malaria sufferers in the Waipukang Community Health Center.

#### Researcher:

... "Do you take malaria medicine until it complete?" ...

#### Mother A (malaria sufferer):

... "I have been taking medication until the end ..."

#### Researcher:

... "How many drugs do you drink ... still remember? Is it true? "...

#### Mother A:

... "I forgot and I do not know ..."

#### Researcher:

... "Mother, I also got malaria ... I was given prescription medicine 1 package, honestly I do not take the medicine until it runs out because the medicine is bitter ... then I throw away or keep the mat so it will not catch my husband at that time" ...

#### Mother A:

... "Yes Mother. I also like you too. Because I want to say but I am ashamed .... I also do not drink until it runs out ..."

#### Researcher:

... "Well ... well you are honest with me ... why do not you drink it out?" ... ..

#### Mother A:

... "I think my face is dizzy if I drink ... it's a dark green medicine (darmaplexx / DHP) ... make me dizzy ... I drink until the second day .... Then all the rest I stop ... "

#### Researcher:

... .. "Heemmm, okay Mother".....

Based on the results of this study, the problems found above cause malaria to be a difficult health problem eradicated. The possible cause of the problem above was there was no continuous mentoring in controlling whether the patient consumed drug at home or not. While, mosquito net usage and environmental modifications that could be seen in table 6 and table 7 showed that the average community was obedient in using mosquito nets and improving the environment. However, it was found that there were new breeding places (*Anopheles sp.*

mosquitoes) which was soil excavation holes with square shape to collect the water that was used to make red brick in which it was most people's livelihood there. This condition led to the existence of large holes approximately 5 x 4 m<sup>2</sup> that became breeding place for Anopheles Sp mosquitoes. This could be seen in the attached pictures.

### CONCLUSION

1. The average knowledge level of malaria cadres was still low (less) supported by a low level of education that caused cadres unable to contribute positively to the malaria program in the village.
2. Malaria cadres in Waipukang Public Health Center were less effective in controlling malaria drugs consuming, mosquito nets usage, and environmental modifications in their areas.
3. Most of the patients did not obediently consume malaria drug that caused high incidence of malaria.
4. Most patients and communities obediently used mosquito nets, approximately 78% of people used mosquito nets properly.
5. Only the majority of families (54%) were obediently modified their environment against mosquito's breeding place by cleaning the mosquito nest on the disposal of wastewater around their homes.
6. From the research result, it was found that breeding places for malaria mosquito at Public Health Center of Waipukang area were: soil excavation holes with square shape in average size of 5 x 4 m<sup>2</sup> that was used for collecting water for the material in making red brick in which it was new source of people's livelihood there for their daily needs. The total of location for making red brick was quite many (several places around Public Health Center of Waipukang area). This became one of several causes of high malaria cases in this area.

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