

INTRODUCTION

Malaria is still a burden in many countries around the world, especially in Africa and some Asian countries, including Vietnam. As reported by the World Health organization (WHO), in 2016, there are 91 countries in which malaria is endemic and an estimated 216 million cases of malaria, an increase of 5 million cases compared with 2015. There are 445,650 deaths from malaria, a decrease of 0.11 % compared to 2015.

For many years, the National Malaria Control and Elimination Programme have been trying to access and prevent malaria for mobile migrant populations (MMPs), but are facing many difficulties in applying interventions in areas with uncontrolled migration and areas with large population movements. The main hurdle is MMPs' decentralized living habits as they often live in camps deep in forests, in plantations, where there are no roads or transportation.

Cu Jut and Tuy Duc districts in Dak Nong province bordering Jok Don and Bu Gia Map national parks with large number of MMPs regularly go to plantations and/or into the jungle, and a majority of malaria patients are from this group. The study: "Malaria infection among mobile migrant population in high endemic communes in Dak Nong province, effective of intervention by "Malaria post" (2015 – 2016)" with the following objectives:

1. To describe malaria infection and related factors among mobile migrant population in 4 high endemic communes in Dak Nong province in 2015.
2. To evaluate the effective of intervention by "Malaria post" in study sites in 2016.

NOVELTY, SCIENTIFICITY AND PRACTICALITY

1. Novelty

- Provide epidemiological data about malaria infection among mobile migrant population in high endemic communes in Dak Nong province in 2015-2016.
- Complete details of human resources, equipment and supplies, role and responsibility for “Malaria post” into provide health services for mobile population in areas with high malaria endemic.

2. Scientificity

The study uses standard scientific research methods such as:

- Descriptive epidemiological study with a combination of cross-sectional study and follow up studies to identify malaria situation in mobile populations (goal 1).
- Intervention study (community intervention with control group): Interventions by “Malaria post” to implementing case detection, treatment and case management and evaluation of effectiveness of intervention (goal 2)

3. Practicality

The results from this study provides the National Program for malaria prevention and elimination with evidence on the situation of malaria in mobile population groups in Dak Nong province and the effectiveness of intervention by the “Malaria post” as basis to replicate the model to improve access to malaria prevention and care for mobile populations in areas where the malaria situation is still complicated.

THESIS STRUCTURE

This thesis consists of 124 pages, including: Introduction (2 pages), Chapter 1. Literature review (33 pages), Chapter 2. Subjects and methodology (26 pages), Chapter 3. Results (32 pages), Chapter 4. Discussion (26 pages), Conclusion (2 pages), Suggestion (1 page), 37 tables, 11 figures and 115 references.

Chapter 1

LITTERATURE REVIEW

1.1. Epidemiological overview

Malaria is an infectious disease caused by the Plasmodium parasite. Blood-borne disease, mainly transmitted by Anopheles mosquitoes, presents with typical clinical manifestations: shivering, fever, and sweating. Local endemic diseases can cause epidemics. Malaria in Vietnam is spread year round but usually has 1 to 2 peaks of the transmission season.

The spread of malaria is determined by three factors: Pathogen, vector, and human transmission. The spread of malaria can be affected by many natural, economic and social factors in which factors such as climate, habitat change and environmental protection measures are applied. Play an important role in the spread of disease. Some other factors also affect the spread of diseases such as: population mobility, urbanization, etc.

1.2. Malaria situation worldwide and in Vietnam

1.2.1. Malaria situation worldwide

Malaria is circulating worldwide with different severity depending on the natural conditions, biology and socio-economic factors such as poverty, low education standards, difficult transportation, population movement, development of economic projects such as hydroelectricity, afforestation.

According to the World Health Organization (WHO) report, in 2016 worldwide there were about 216 million cases of malaria, of which 90% occurred in Africa, 7% of cases in Southeast Asian countries and 2% in the Eastern Mediterranean region, the number of malaria cases increased by about 5 million cases compared to 2015. Malaria is currently circulating in 91 countries and territories, of which the prevalence is severe in 15 countries. African families account for about 80% of the cases worldwide.

Although malaria has decreased compared to previous years, the prevention and elimination of malaria in countries still faces great difficulties and challenges such as: Access to public health to be diagnosed and regulated. timely treatment is low, especially in African countries; Malaria is increasing in many areas where

conflicts or political disputes occur in endemic areas, asylum seekers, migrants and miners; Climate change is often di; Drug-resistant malaria parasites, mosquito-resistant chemicals kill; and a lack of funding for the Malaria Control and Prevention Program.

1.2.2. Malaria situation in Vietnam

Malaria in Vietnam in recent years has decreased, in 2016, the number of malaria patients decreased 80.61% (10,446 / 53,867), malaria deaths also decreased 85.71% (3/21) when compared to 2010. The uniform application of measures from early detection, diagnosis and treatment of cases, prevention of vectors by impregnating mosquito nets, residual spraying, provide impregnated mosquito nets and covered hammocks combined with behavior change communication has been effective. However, malaria is still complicated in some localities, especially in the Central Coastal Region - Central Highlands and Mekong river basin, where these provinces have a large number of mobile migrants, border exchanges and people's customs and habits related to forests and plantations and the habit of not using mosquito nets, the spread of drug-resistant parasites and chemicals resistant mosquitoes, especially in southern provinces.

1.3. Mobile migrant population

According to the 2014 Census of General Statistics Office of Population and Housing, out of over 83 million people aged 5 and over as of April 1, 2014, in the 5 years before the census. 7% or 1.4 million are in-district migrants; 2.0% or 1.6 million inter-district migrants; 3.1% or 2.6 million inter-provincial migrants and a very small percentage of 0.1% or 65.7 thousand are international migrants.

According to World Health Organization, migrants and mobile migrants are groups of people who change their residence, legal and illegal migrant workers, seasonal workers, people along the border, residents of the forest, tourism, students, soldiers and other groups. Do that Organization WHO recommends c incense national process should be clearly defined groups of people have the highest risk for malaria.

1.4. Malaria situation among mobile migrant population

According to a 2013 World Migration Organization report, malaria is still the leading disease burden affecting public health and the fifth leading cause of death in the world. In Africa, malaria is the second leading cause of death for MMP communities.

Increased risk of malaria and drug-resistant malaria in border areas due to migrant workers, people crossing the border with malaria not treated early, untreated treatment is the cause of outbreaks drug-resistant malaria and drug-resistant malaria.

In areas where malaria is endemic, people are most likely to go to the forest, sleep in the forest or people who sleep regularly at the field. The national case survey report for 2017-2018 showed that 82.87% of malaria parasites were caused by going to forest or sleeping fields.

1.5. Resolution of “Malaria post”

“Malaria post” is brief name of the combine intervention method including: Case detection, diagnosis, treatment and management, is considered as an initiative to fill the gap in grassroots healthcare in remote, isolated and border areas. This model was used to provide early diagnosis and treatment services for malaria patients to migrants, forest people, sleeping fields and cross-border exchanges. This model has been tested in Thailand since 2001 and in large scale as of 2009-2016. Malaria points are located in the villages near the forests and the Thailand - Myanmar, Thailand - Cambodia borders. Each malaria site has 1 volunteer member from the village who is trained in the use of rapid diagnostic tests, treatment of uncomplicated malaria patients, and assistance in transferring severe patients to commune and district health centers. These malaria sites have contributed to increasing the coverage of health services for malaria in remote and isolated areas and focused on migrants and mobile migrants.

In Myanmar, malaria post was also established concentrated in border areas of Myanmar - Thailand, where there are enormous amounts of Myanmar people went to work in Thailand. The basic principle of malaria points is that points officers are trained; quick diagnostic test quality; and effective anti-malarial medicine. Malaria

posts are located where people can easily access them (walking distance of less than 15 minutes).

1.6. Malaria situation in Dak Nong province and 2 districts of Cu Jut and Tuy Duc in 2010-2014

Dak Nong is one province in the Central Highlands region with complicated mobile population situation. According to statistics on malaria situation in Dak Nong province, malaria in Tuy Duc and Cu Jut districts is most complicated due to shared border with Cambodia, where migrants concentrated, move freely, exploiting forest products, practicing slash and burn and sleeping in the forest, most malaria patients mainly related to these MMPs.

Dak Wil, Knia communes of Cu Jut district, Quang Truc, Dak Buk So communes of Tuy Duc district are communes have some similar characteristics such as have borders with Cambodia, bordering National parks (Dak Wil and Quang Truc communes); Cu Knia and Dak Buk So communes are adjacent to these two communes and all business activities are related to upland farming in the National Park buffer zone, forest product exploitation and cross-border exchanges. From 2010 -2014 statistics data found that in Quang Truc and Dak Wil, having the most malaria patients of the districts always related to immigration, forest goers and plantations.

Chapter 2

SUBJECTS AND METHODOLOGY

2.1. Subjects, time and study site

2.1.1. Subjects

- Mobile migrant population: Go/slept in farm field, forest goers, Cross border, seasonal workers.
- Age: ≥ 16 .
- Malaria infection.
- Willing to participate in the study.

2.1.2. Time

From 2015 to 2016.

2.1.3. Study site

Select 8 villages of 4 communes in Cu Jut and Tuy Duc districts.

- Cu Jut: Village 5, 9 Dak Wil commune and Village 9, 10 Cur Knia commune.
- Tuy Duc: Bu Gia, Bu Krak villages in Quang Truc commune and Bu Nung, village 9 Dak Buk So commune.

2.2. Study design

- Epidemiology discription:
- + Cross-sectional study: To identify malaria prevallance and relate factors in 2015.
- + Follow up study: Monitor MMPs, active case detection, diagnosis, treatment and follow up.
- Community intervention: Apply “Malaria post” in 4 village in 2 communes of Cu Jut district (intervention group) and 4 villages in 2 commune of Tuy Duc district for control group.
- Epidemiology analysis: Analyse the factors related to malaria infection and effective of intervention.

2.3. Sample size and sample collection

- Sample for cross-sectional study (apply 1 time in 2015 and reapead in 2016): Measure Knowledge, Attitute and Practice of responce regarding malaria control and identify malaria prevallance:

$$n = Z_{1-\alpha/2}^2 \frac{p(1-p)}{(p\varepsilon)^2}$$

Trong đó:

n: Minimun sample; p: Estimate prevallance among MMPs in commuity, $p = 0,062$ (Ho Van Hoang – 2010); $Z_{1-\alpha/2} = 1,96$.
 $\varepsilon = 0,28$.

Sample size computed is 742, to avoid the shortage, we collect 760 samples for this study. Thus, the average of sample is 95 per village.

- Sample for follow up study:
- + MMP with confirmed malaria infection in 2015-2016.
- + MMP in study sites.

Table 2.1. Mobile migrant population in study sites

Group	Forest farm field	Forest goers	Cross border	Total
4 village in Cu Jut	1.305	620	30	1.955
4 village in Tuy Duc	1.162	608	55	1.825

2.4. Study content

- Cross-sectional study: Cross-sectional survey including KAP interview and take blood smears were conducted in 8 villages of 4 communes according to the sample size selected.
- Follow up study: Tracking was conducted for all mobile people in 8 villages of 4 research communes.
 - + Determine the current status of malaria in MMPs.
 - + Interview, collect information about knowledge, attitudes and practices in malaria prevention and control measures.
 - + Analysis of a number of factors related to malaria in MMP groups.
- Evaluate the effective of “Malaria post”.

2.5. The techniques used in the study

- Clinical examination technique: Measure armpit temperature with mercury thermometer in 3-5 minutes time.
- The blood smear test technique complies with the procedure of microscopic malaria parasite examination of the National Institute of Malariology, Parasitology and Entomology (NIMPE.HD 07.PP.01).
- Technical tests to quickly diagnose malaria.
- Direct interview technique.

2.6. Data entry and analysis

Use Stata 12.0 software for data entry and analysis.

2.7. Ethical

Strictly follow ethical issue approved by NIMPE.

Chapter 3

RESULT OF THE STUDY

3.1. Malaria infection among mobile migrant population and related factors

3.1.1. Malaria infection among MMPs in 2015

3.1.1.1. Malaria infection through cross-sectional study

Table 3.3. Malaria infection through cross-sectional survey (n=760)

Commune	No. examination	Clinical cases	Confirmed cases	<i>Pf</i>	<i>P.v</i>	PH	% of clinical cases	% confirmed cases
Dak Wil	198	2	0	0	0	0	1,01	0
Cu Knia	204	3	1	0	1	0	1,47	0,49
Quang Truc	182	1	0	0	0	0	0,54	0
Dak Buk So	176	1	0	0	0	0	0,56	0
Total	760	7	1	0	1	0	0.92	0.13

Results from cross-sectional survey in November 2015 showed that there were 7 clinical cases accounting for 0.92% and detected 1 confirmed *P.vivax* case by both RDT and slide, accounting for 0.13%.

3.1.1.2. Malaria incidence through follow up

Table 3.4. Malaria incidence at 8 villages in 2015

Study site	MMPs	Confirmed cases	%
4 villages in Cu Jut	1.955	22	1,13
4 villages in Tuy Duc	1.825	14	0,77
Cộng	3.780	36	0,95

In 2015, total of 36 confirmed cases detected in 8 villages. Of which, all 36 cases were MMPs with age from 16 or higher.

The cumulative incidence in 2015 was 0,95%.

Table 3.5. Distribution of malaria incidence by MMP groups

Commune	Forest goer			Farm field			Cross-border		
	No. people	Parasite	%	No. people	Parasite	%	No. people	Parasite	%
Dak Wil	270	4	1,48	755	5	0,66	7	0	0
Cu Knia	350	7	2,00	550	5	0,91	23	1	4,35
Quang Truc	233	5	2,15	532	7	1,32	16	1	6,25
Dak Buk So	375	0	0	630	1	0,16	39	0	0
Total	1,228	16	1,30	2,467	18	0,73	85	2	2,35

Malaria incidence was high among cross border group, accounting for 2,35%, then forest goer with 1.30% and farm field with 0,73%.

3.1.2. Factors related to malaria infection among MMPs

In order to analyze the relationship between malaria infection and related factors, we used the total of malaria infection in 2015 including 1 case detected in cross-sectional survey and 35 cases detected via follow up, all these persons were interviewed to collect related information. Thus, total of sample become to 795 people.

Table 3.17. Relationship between malaria with gender and schooling

Factor	Disease	Undisease	Total	OR, CI 95%, p value
Male	31	392	423	OR=5,80 CI: 2,20-19,29 p=0,0001
Female	5	367	372	
Cộng	36	759	795	OR=4,74 CI: 2,12-11,61 p=0,0001
No schooling	27	294	321	
Schooling	9	465	474	
Cộng	36	759	795	

Result showed that malaria infection among male is higher 5,80 folds when compared with female with $p < 0,01$.

No schooling infected malaria 4,74 folds higher than those studied in the school event thought Primary or high school with $p < 0,01$.

Table 3.19. Relationship between malaria infection with other factors

Factor	Disease	Undisease	Total	OR, CI 95%, p value
Don't know mosquito transmit malaria	30	249	279	OR=10,24 CI: 4,11-30,40 p=0,000
Know	6	510	516	
Total	36	759	795	
Don't know malaria can prevent	30	282	312	OR=8,45 CI: 3,39-25,10 p=0,000
Know	6	477	483	
Total	36	759	795	
Unregular sleep under bednet	24	191	215	OR=5,94 CI: 2,78-13,28 p=0,000
Regular sleep under bednet	12	568	580	
Total	36	759	795	

For those who don't understand mosquito transmit malaria have risk for malaria infection 10,24 folds when compared with people who know with $p < 0,01$.

Malaria infection among those who don't know malaria can prevent is higher 8,45 folds when compared with people know about that with $p < 0,01$.

Unregular sleep under bednet infected malaria higher 5,94 folds when compared with people regular sleep under bednet with $p < 0,01$.

Table 3.22. Relationship between malaria and forest goers and working in the farm field

Factor	Disease	Undisease	Total	OR, CI 95%, p value
Forest goer	28	90	118	OR=26,01 CI: 11,04 -67,62 p=0,000
Don't go to forest	8	669	677	
Total	36	759	795	
Working/sleeping in farm field	36	727	763	$\chi^2=1,58$ p=0,22
Don't working in farm field	0	32	32	
Total	36	759	795	

Malaria infection among forest goers is higher 26,01 folds when compared with people don't go to forest with $p < 0,01$.

There is no infected case among those who don't work in the farm field, therefore, there is no relationship between malaria and group working in the farm field with $p > 0,05$.

3.2. Effective of intervention by “Malaria post”

3.2.1. Implementation of “Malaria post”

There are 4 vollumtees work at 4 malaria post. All of them are young, age rank from 21-24 years old, male is equa female with 50%.

There are 3 persons who have graduated Medial Coleguge, 1 is Health care school. This is indicated that all of them can be well implementing requires malaria activities.

3.2.1.1. Result for implementing “Malaria post”

In 2016, among 4 “Malaria post” doing thier task including active case detection, diagnosis, treatment and management by active take blood slide for suspected people, doing RDT for those who have fever, monitor mobile person and doing behavior change communication.

There were 1.987 round of people exammin, of which, 9 malaria cases detected, all these case were treated with animalarial drug after consults with Commune Health Center.

Regarding monitor mobile population, volumtees regular visit households in the village and at the site to set up post. Results showed that total 1.172 round of person go to forest, 3.734 sleep in the farm field and 30 person cross border. All these person were taken blood slide and RDT when they went back to the village.

Health education was also implementing through household visit. In 2016, there were 1.249 times to conduct communication with 4.935 rounds of person received malaria messages.

In Dak Wil commune, 2 posts conducted examination for 867 person, detect 3 malaria confirmed cases, slide positive rate is 0,34%. In Cu Knia, exammin 1.120 person, detect 6 parasite and slide positive rate is 0,53%.

All malaria cases were treated by volumtees after consult with Commune Health Center (make decision, provide antimalarial drug) and follow up with D3. All results from D3 were negative.

3.2.2. Evaluate the effective of “Malaria post”

In order to evaluate the effective of “malaria post”, besides of follow up study, we conducted cross-sectional survey in November, 2016 to measure changing of knowledge, attitude and practice among mobile people. The subjects in this survey are the same with survey in 2015.

3.2.2.1. Result from cross-sectional survey in 2016

Table 3.30. Malaria infection through cross-sectional survey (n=794)

Group	Examina-tion	Clinic al case	Confirme d cases	% clinical cases	% confirmed case
Intervention group	384	3	0	0,78	0
Control group	410	0	0	0	0
Total	794	3	0	0,37	0

Total of 794 blood slide collected from this survey. Of which, there were 3 clinical cases detected at intervention group, accounting for 0,78%. But in both groups, we did not detected any parasite.

3.2.2.2. Result from follow up study

Table 3.31. Malaria incidence in study site, 2016

Group	MMPs	Confirmed case	Percentage (%)
Intervention group	1.977	9	0,46
Control group	1.846	27	1,46
Total	3.823	36	0,94
P value	p=0,001		

Result showed that malaria culmulative incidence among MMPs in intervention group is 0,46%. Besides, in control group, this rate is 1,46%, higher than intervention group. There is significant different with $p < 0,01$.

Bảng 3.33. Distribution of malaria infection by MMP groups

Group	Forest goer			Working in the farm field			Cross-border		
	No.	Confirm-ed case	%	No.	Confirm-ed case	%	No.	Confirm-ed case	%
Intervention group	620	8	1,29	1.327	1	0,08	30	0	0
Control group	608	24	3,95	1.183	3	0,25	55	0	0
Cộng	1.228	32	2,61	2.510	4	0,16	85	0	0
P value	0,04			0,26					

Among forest goer, malaria infection rate in control group is 3,95% and higher than in intervention group (1,29%) and significant different between two groups with $p < 0,01$.

Incidence rate among people working in the farm field in control group is 0,16% and higher than intervention group. However, the different is not significant with $p > 0,05$

3.2.2.3. Evaluate the effective of intervention via malaria reduction

Effective of intervention by malaria prevallance via cross-sectional survey

Table 3.34. Evaluate malaria prevallance via cross-sectional survey

Time	Control group			Intervention group		
	No. of exam	Parasite	%	No. of exam	Parasite	%
2015	358	0	0	402	1	0,25
2016	410	0	0	384	0	0

In the intervention group, in 2015 detected 1 confirmed case accounting for 0,25%. There was no case detected in 2016.

Effective of intervention by malaria culmulative incidence via follow up study

Table 3.35. Effective of reduction of malaria incedence via follow up

	Control group			Intervention group		
	No. person	Confirmed case	%	No. person	Confirmed case	%
2015	1.825	14	0,77	1.955	22	1,13
2016	1.846	27	1,46	1.977	9	0,46
p value	0,047			0,018		
Effective rate	-92,68%			59,55%		
Intervention effective rate	152,23%					

Malaria incidence rate among MMPs in intervention group was reduced from 1,13% in 2015 down to 0,46% in 2016, effective rate is 59,55%. While incidence rate in control group was increased from 0,77% in 2015 to 1,46% in 2016. Thus, the intervention effective rate when applied “Malaria post” is 152,23%.

3.2.2.4. Effective of change knowledge, attitude and practice on malaria

Table 3.37. Change knowledge about malaria can prevent

	Control group			Intervention group		
	No. of person	Correct answer	%	No. of person	Correct answer	%
2015	358	231	64,53	402	246	61,19
2016	410	345	84,15	384	369	96,09
p value	0,06			0,0005		
Effective rate	30,40%			57,04%		
Intervention effective rate	26,63%					

The rate of understand malaria can prevent among intervention group was increased from 61,19% to 96,09% with $p < 0,01$.

In control group, this rate was also increased from 64,53% to 84,15% with $p > 0,05$. Intervention effective rate is 26,63%.

3.2.2.5. Change behavior sleep under bednet

Table 3.38. Change practice sleep under bednet

	Control group			Intervention group		
	No. of person	Regular sleep under bednet	%	No. of person	Regular sleep under bednet	%
2015	358	272	75,98	402	297	73,88
2016	410	364	88,78	384	370	96,35
p value	0,14			0,011		
Effective rate	16,85%			30,41%		
Intervention effective rate	13,57%					

After 1 year of intervention, the rate of people regular sleep under bednet among intervention group was increased from 73,88% to 96,35%. In control group, this rate was also increased, but lower than intervention group, from 75,98% to 88,78%. Intervention effective rate is 13,57%.

3.2.2.6. Budget for maintain “Malaria post”

Average fund per month for first year was computed as 3.440.000 VND, including incentive, training fee, equipment and surveillance fees. For other things as slide, lancet, RDT... support by National Malaria Programme.

Most budget supply for malaria post is incentive, accounting for 81,40%; paper, forms, printing fees were 3,20%.

3.2.2.7. Community acceptance

There were 95,05% respondent rely that they know about “Malaria post, of which, 91,67% used to contact with volunteers and received malaria services.

90,89% resonsed that need to maintain “Malaria post” in order provide health service to mobile population in remote areas.

Chapter 4. **DISCUSSION**

4.1. Some characteristics of malaria infection in 4 study communes in Dak Nong province

Dak Nong province is a border province of Vietnam and Cambodia, which is in the highly endemic malaria area, with a complex border, difficulties in malaria management, so over the years malaria situation in this area is very complicated. Ethnic minorities often cross the border, Cambodians also cross the border, creating complex mobile movements in this border area.

In 4 study communes, 2 communes borders two of the biggest National Parks in Dak Nong: Jok Don and Bu Gia Map, 2 other communes not directly adjacent to the National parks but people often farm and frequent the forest. Some often go to the forest borders with Cambodia. People crossing the border do not go through the border gates and checkpoints but follow paths in the forest and stay in the forest so the risk of malaria is very high.

4.1.1. Malaria infection in study sites

The results of the cross-sectional survey in 2015 showed that when the survey was conducted in November, when the number of parasites began to increase, the survey subjects were all mobile migrants, but at this time, only 1 *P. vivax* was detected, accounting for 0.13%.

Results of a follow up study in 2015 found that only the number of cumulative new cases differs between communes, the malaria incidence of MMPs in the study sites in 2015 was 1,07% per year.

In 2015, the malaria was detected mainly during January, February, March and October, November, December with the highest peak in January. In the Central Highlands region, including Dak Nong, there are two seasons: dry and rainy seasons. The dry season starts from November to April, the rainy season is from May to October. The time for mosquitoes to thrive is usually in the

transitional months, especially at the end of the rainy season. Besides, the last month of the year is often the main harvest season so people often stay and sleep in their plantation/forest. Thus, the data in the four research communes is also consistent with the general transmission season of the Central Highlands region.

According to Tran Quang Hao, malaria rates in border areas of Dak Nong province are highest by the end of the rainy season (6.72%), followed by mid-season of 5.76% and lowest in the dry season with 1.52%. The overall prevalence of malaria parasites in the whole border area of Dak Nong province is 4.42 %, which is quite high compared to the currently endemic malaria areas and compared to other border regions. Other studies of Ho Van Hoang (2009) in Vietnam - Cambodia border commune showed parasite prevalence rate is 4.22 %, significantly higher than our research.

Comparing the incidence among MMP groups showed cross-border exchange group has the highest rate of 2.35%, followed by forest goers with 1.30% while farm field groups was 0.73%. Although there are less border exchange sample, the higher incidence shows that this is the group with very high risk and the National Program for prevention and elimination of malaria should pay more attention to this group.

The data also shows that there are no cases in the villages. This proves that malaria in the villages where people live is gradually no longer a serious problem, but that malaria control measures must target MMPs and preventive treatment. The source of infection is people who often return to the forest, go to the field or return to the border.

Research by Tran Quang Hao (2016) shows that up to 45.69% of people infected with malaria parasites cross the border by official and unofficial border crossing. However, the issue of cross-border exchanges is very difficult to identify. Although there are border gates in Dak Nong, the number of people who go through official border crossings is very small, most people go by trails, open paths or cross the forest to cross the border.

The above figures show that the cross-border nature and some other forms are very complicated and common in border districts. This exchange situation makes the risk of malaria very high and difficult to control malaria situation.

Of the 36 malaria parasites detected in 2015 in 4 studied communes, the prevalence of *P. vivax* malaria was dominant at 61.11 %. Thus, radical treatment needs to be focused. In other words, when treated with primaquin, daily monitoring is required during the 14-day treatment course.

Although prevalence of *P. falciparum* in 2015 is not high, *P. falciparum* risk remains a concern in areas with forest related inhabitants. Other studies have showed that in an area with a high incidence of *P. falciparum* malaria, there is a high probability of malaria transmission and a high risk of *P.falciparum* malaria infection among people with jobs in the forest, this finding is also consistent with the previous research results of Nguyen Xuan Xa and Pham Vinh Thanh.

4.1.2. Factors related to malaria infection

In this study, malaria infection among male with 86,11%. Male is ones who often go to forest farm field as well as deep forest for planning, havour and hunting or forest related works in the remote areas.

Other studies in recent years were also indicated that malaria infection mainly in male such as Nguyen Van Quan (2018) in Gia Lai and Binh Phuoc, malaria infected in male was 70,73% or Nguyễn Xuân Xã in Gia Lai is 56,41%.

Results show that the risk for malaria infection among male is more higher 5,80 times when compare with female, no schooling is more higher 4,74 times when compared with schooling, people who don't know mosquito can transmiss malaria get malaria 10,24 times and don't know malaria can be prevent get malaria 8,45 times higher than people who have corrected understand. Don't sleep under bednet get malaria infection 5,94 times higher than those who regular sleep under bednet. Forest goer get malaria infection 26,01

times higher than who did not go with $p < 0,01$. Our result is also confirmed the risk factors including education, gender, knowledge about malaria, behavior sleep under bednet and forest goer.

4.2. Effective of intervention by “Malaria post”

4.2.1. The implementation of “Malaria post”

This is first time applied “Malaria post” in Viet Nam. Results from this study is indicated the effective of this model, the post has supplied malaria services to community in remote areas especially in mobile migrant population.

Through household visit, health staff can be know the movement of household members, manage and follow up with those who went to forest, cross border and conduct active case detection among these group.

In 2016, manage and follow up with average 409 MMP, of which, 98 person regularly slept in the forest, 311 slept in forest farm field and 30 cross border. Currently, managed the MMPs is most difficulty that the health system is can not cover. Therefore, manage the MMPs in these areas is most effective of the malaria post.

Slide positive rate among malaria post is 0,45%, this is high rate when compared with other areas in the country. This rate nationwide in 2016 is 0,20% and in Đắk Nông province is 0,35%. This is indicated that the health staff at malaria post have play importance role in active case detection among MMPs.

Routine communication to villagers and MMPs to change knowledge, attitude and practice is done by health staff. Three main MMPs are people sleep in the forest farm field, forest goer and cross border. Result from survey showed that the knowledge, attitude and practice are increase after 1 year intervention.

4.2.2. Effectiveness of intervention by “Malaria post”

4.2.2.1. Reduce malaria infection

Malaria incidence rate among intervention group has been reduced 59,55% after intervention, in control group, this rate increased 92,68%. Intervention effectiveness is 152,23%.

The study of Tran Quang Hao (2018) in Dak Nong, when intervention by using cooperation of Civil - Military in border communes showed that the effectiveness of malaria incidence rate is 37,58%. Nguyễn Quang Thiệu (2009-2012) when applied intervention by strengthening role and activity of village health workers in border communes in Quang Tri was showed the incidence rate among intervention group reduced from 2,67% to 0,17%, intervention effectiveness was 93,6%.

Study of Nguyen Van Quan (2018) was applied IRS and supply repellance for mobile migrant population in Gia Lai and Binh Phuoc provinces showed that the malari prevellance rate reduced 94,60% when compared before and after intervention.

4.2.2.2. Effective of change knowledge, attitude and practice in malaria

Results from cross-sectional study before and after intervention showed the significant changed on knowledge about malaria of respondents. Knowledge about mosquito can transmiss malaria increased from 65,92% to 96,09% among intervention group, effectiveness rate is 45,77%, 2 times higher increased knowledge among control group and intervention effectiveness is 23,31%.

Behavior changed is also indicated in sleep under bednet. The rate of regulary sleep under bednet among intervention group is increased from 73,88% to 96,35%; among control group, this rate is increase from 75,98% to 88,78%. Intervention effectiveness is 13,57%.

Changing behavior among intervention group has in fact to reduce the risk for malaria infection. This result is same as study of Lê Xuân Hùng in Gia Lai and Ha Giang (2008).

CONCLUSION

1. Malaria situation among mobile migrant population in high endemic commune in Dak Nong province, 2015.

- Cross-sectional survey showed that percentage of clinical cases is 1,94%, confirmed cases is 0,13%.
- Longitudinal study showed that the incidence rate per year is 1,07%. Of which, incidence rate among sleep in the forest farm field is 1,30%; Forest goer is 0,73% and cross-border is 2,35%.

2. Factor related to malaria infection

- The rick for malaria infection among male is 5,8 folds higher than female. No schooling has 4,74 folds higher than schooling.
- Those who misundertand mosquito can transmit malaria have rick for malaria infection with 10,24 folds higher than those undertand. Risk for infection among those misundertand malaria can be prevent is 8,45 folds higher than who correct undertand. People who didnot regular slept under badnet get malaria infection 5,94 folds higher than who slept regularly. And forest goer has risk 26,01 folds higher than who never go to forest.

3. Effectiveness of intervention by malaria detection, treatment and case management post in 2016.

- The malaria post have been managed and follow up with average 409 MMP per month, of which, 23,96% often sleep in the forest, 76,03% sleep in the forest farm field. Detected 9 confirmed cases, all these case have treated and follow up to ensure that all cases completed therapy.
- Effectiveness of intervention by cross-sectional study showed malaria prevallance in 2015 is 0,25% down to 0% in 2016.
- Effectiveness of intervention by longitudinal study showed in intervention group, malaria incidence reduce from 1,13% to

- 0,46%; in control group, incidence rate increase from 0,77% to 1,46%. Intervention effectiveness is 150,24%.
- Knowledge about mosquito can transmiss malaria also increase from 65,92% to 96,09% among intervention group. Intervention effectiveness is 23,31%;
 - Behavior of sleep under bednet in intervention group increase from 73,88% to 96,35%. Intervention effectiveness is 13,57%.
 - Fund for maintain a malaria post is average 3.440.000 VND/month.
 - There was 90,89% of respondents requested malaria post is very nessesary for not only MMP but also for community as well.

RECOMENDATION

1. Expand and maintain malaria post in areas with high MMPs.
2. Enhance the communication at community focus on MMPs.

