EFFECTIVENESS OF THE MALARIA CONTROL PROGRAM IN MALARIA-ENDEMIC PROVINCES UNDER THE GLOBAL FUND PROJECT, THAILAND

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ABSTRACT

An evaluation study was conducted to evaluate the Global Fund Round 7 project. The aim of this study was to assess the effectiveness of the project by comparison the Annual Parasite Incidence (API) and the Malaria Positive Rate (MPR) of 460 malaria-endemic villages. The APIs/MPRs were compared between year 2 (2010) and year 3 (2011). They were separately described by provinces, by the international borders, and overall country. In addition, data were collected by using a questionnaire to ask the health officers who were responsible for the targeted villages. The questionnaire asked about the cooperation of community in terms of malaria prevention and control to determine the correlation with the successful villages.

The results showed that the APIs decreased significantly in four of twenty-eight provinces; Tak, Kanchanaburi, Ratchaburi, and Surin. The APIs in Thai-Myanmar and Thai-Cambodia borders were significantly decreasing. Moreover, the API of overall country was significant decreased ($p=0.044$). For the MPRs, the comparison showed that the MPRs in all levels (provinces, international borders, and overall country) were not significantly decreasing. The relationship between the cooperation of the community and the successful villages were not found significantly.

KEY WORDS: EFFECTIVENESS / MALARIA CONTROL PROGRAM / MALARIA-ENDEMIC / THE GLOBAL FUND

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ประสิทธิผลของการควบคุมโรคมาลาเรียในจังหวัดพื้นที่แพร่เชื้อ ภายใต้โครงการกองทุนโลก
EFFECTIVENESS OF THE MALARIA CONTROL PROGRAM IN MALARIA-ENDEMIC PROVINCES UNDER THE GLOBAL FUND PROJECT, THAILAND

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บทคัดย่อ

การศึกษานี้เป็นการวิจัยประเมินผลโครงการกองทุนโลกด้านมาลาเรีย รอบที่7 โดยมีวัตถุประสงค์เพื่อศึกษาประสิทธิผลของโครงการ โดยใช้วิธีการเปรียบเทียบการเปลี่ยนแปลงอัตราป่วย (Annual Parasite Incidence) และอัตราตรวจพบเชื้อมาลาเรีย (Malaria Positive Rate) ในทุกหมู่บ้านพื้นที่แพร่เชื้อมาลาเรียที่เข้าร่วมโครงการ จำนวน460 แห่ง การเปรียบเทียบมี 2 วิธี คือวิธีแรกการเปรียบเทียบระหว่างอัตราป่วยและอัตราตรวจพบเชื้อมาลาเรียของปีที่2 (พ.ศ.2553) และปีที่3 (พ.ศ.2554) วิธีที่สองคือการเปรียบเทียบระหว่างอัตราป่วยและอัตราตรวจพบเชื้อมาลาเรียของปีที่3 กับเป้าหมายโครงการ โดยแยกอธิบายเป็นรายจังหวัด รายกลุ่มจังหวัดพื้นที่ติดชายแดนและในภาพรวมของประเทศ นอกจากนี้ยังได้เก็บข้อมูลโดยใช้แบบสอบถามเพื่อสอบถามเจ้าหน้าที่ผู้รับผิดชอบดูแลหมู่บ้านโครงการถึงความร่วมมือของชุมชนในการร่วมดำเนินงานป้องกันควบคุมโรคมาลาเรียเพื่อหาความสัมพันธ์กับผลสำเร็จที่หมู่บ้านนั้นสามารถลดอัตราป่วยได้ตามเป้าหมาย

ผลการศึกษาพบว่า อัตราป่วยด้วยโรคมาลาเรียลดลงจำนวน 4 จังหวัดในจำนวนทั้งหมด28 จังหวัดได้แก่ จังหวัดตาก กาญจนบุรี ราชบุรี และสุรินทร์ ส่วนในกลุ่มจังหวัด5 กลุ่ม มีกลุ่มจังหวัดที่ติดชายแดนไทย-เมียนมาร์ และ ชายแดนไทย-กัมพูชา มีอัตราป่วยลดลง และในภาพรวมของประเทศมีอัตราป่วยลดลง ($p = 0.044$) ส่วนผลการศึกษาอัตราตรวจพบเชื้อมาลาเรียพบว่าทั้งการเปรียบเทียบรายจังหวัด รายกลุ่มจังหวัด และภาพรวมทั้งประเทศ อัตราตรวจพบเชื้อมาลาเรียไม่ได้ลดลง ในส่วนของการศึกษาหาความสัมพันธ์ระหว่างความร่วมมือของชุมชนในการป้องกันควบคุมโรคมาลาเรีย กับผลสำเร็จในการลดอัตราป่วย ก็ไม่พบความสัมพันธ์

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LIST OF ABBREVIATIONS

A1	Perennial transmission area, transmission ≥ 6 months per year
A2	Periodic transmission area, transmission < 6 months per year
ACT	Artemisinin-based combination therapy
API	Annual Parasite Incidence (expressed per 1,000 populations)
ARC	American Refugee Committee
BCC	Behavioral Change Communication
BVBD	Bureau of Vector Borne Disease, Department of Disease Control
CCM	Country Coordinating Mechanism
CCP	Coordinated Country Proposal
CHW	Community Health Worker
CI	Confidence Interval, presented as a 95% CI
DDC	Department of Disease Control
DHO	District Health Office
EDCT	Early Diagnosis and Combination Treatment
EDPT	Early Diagnosis and Prompt Treatment
EET	External Evaluation Team
GF	The Global Fund
GFATM-R2	The Global Fund to Fight AIDS, Tuberculosis and Malaria Round 2
GFATM-R7	The Global Fund to Fight AIDS, Tuberculosis and Malaria Round 7
IEC	Information, Education and Communication
IRS	Indoor Residual Spraying
ITN	Insecticide-treated mosquito net
KAP	Knowledge Attitude and Practice
LLIN	Long-lasting insecticide-treated mosquito net
M&E	Monitoring and Evaluation
M1	Immigrants were in Thailand ≥ 6 months, registered migrants
M2	Immigrants were in Thailand < 6 months, unregistered migrants

LIST OF ABBREVIATIONS (cont.)

MAS	Mefloquine-Artesunate (combination therapy)
MAT	Malaria Association of Thailand
MC	Malaria Clinic
MHV	Migrant Health Volunteer
MLO	Migrant Liaison Officer
MMC	Mobile Malaria Clinic
MOPH	Ministry of Public Health
MORU	Mahidol-Oxford Research Unit
MP	Malaria Post
MPR	Malaria Positive Rate
MPW	Malaria Post Worker
PA	Program Assistant
PHO	Provincial Health Office
PR	The Principal Recipient
RDT	Rapid diagnostic test
SDA	Service Delivery Area
SMRU	Shoklo Malaria Research Unit
SR	The Sub-Recipient
SSR	Sub-Sub-Recipient
VBDC	Vector-Borne Disease Control Center
VBDU	Vector Borne Disease Control Unit
VHV	Village Health Volunteer
WHO	World Health Organization

CHAPTER I
INTRODUCTION

1.1 Rationale and justification of the study

Malaria is a life-threatening disease for many decades and causes economic losses in many countries with high level of transmission. The global malaria eradication campaign was launched by World Health Organization (WHO) in 1955. As a result of past decades, there were many countries disappearing malaria cases such as the European Region, Japan, Korea, etc. In these countries could decrease malaria cases, but in the tropical countries still had occurred malaria cases. In World Malaria Report 2010, the number of malaria cases increased from 233 million in 2000 to 244 million in 2005 but decreased to 225 million in 2009 (1). The global number of malaria's deaths was estimated to decrease from 985,000 in 2000 to 781,000 in 2009. The largest percentage of this decline was in America Region (48%). It was estimated that 91% of deaths in 2009 was in the African Region, followed by the South-East Asia (6%) and the Eastern Mediterranean Regions (2%). About 85% of deaths globally were in children under 5 years old. In the Africa Region, approximately a child died with malaria every 45 seconds (2).

In 11 countries of the WHO South-East Asia Region, 10 countries were the malaria-endemic areas and only one country Maldives that had been no indigenous transmission of malaria in the country since 1984 (World Malaria Report 2010, P.50). Approximately 60% of populations in the region were at risk of malaria, with 20% at high risk (in areas with a reported incidence of more than 1 case per 1,000 populations per year).

In 2009, there were about 2.4 million confirmed malaria cases in the WHO South-East Asia Region, and 3,320 deaths were reported. Three countries (India, Myanmar, and Indonesia) accounted for 94% of the reported cases in the Region. There were 4 countries (Bhutan, the Democratic People's Republic of Korea, Sri

Lanka, and Thailand) experienced a decline in the number of malaria cases of more than 50% during 2000-2009, associated with intensive malaria control program.

In Thailand, malaria had been a major health problem for a long time. The government had attempted to eradicate it since the WHO had recommended to eliminate mosquito carrying parasite and to treat patients. However, malaria had still occurred in high risk areas, especially in hilly and forested regions along international borders. The morbidity and mortality of malaria in Thailand had decreased dramatically in the last decade. The total number of reported malaria cases decreased from 63,276 cases in 2006 to 41,780 in 2010. The Annual Parasite Incidence (API) of country in 2010 was 0.36/1,000 populations (3). Approximately 50% of the malaria cases were migrant population. Epidemics of malaria along the border were mainly due to (i) high mobility of migrants and cross-border population (ii) limited access to early diagnosis and treatment of malaria health services among migrants and vulnerable populations, especially the illegal migrants and their followers, and (iii) inadequate resources for early diagnosis and prompt treatment to respond for malaria epidemics resulting from the government organization reform and economic situation of the country. Moreover, high mobility of migrants and cross-border population were also contributed the spread of multi-drug resistance of *P.falciparum* malaria from Thailand-Cambodia border to Thailand-Myanmar border, which might be affected more difficult and more budgets for treatments in the future. Furthermore, the ongoing serious conflict in the south of Thailand was severely compromising the ability of the established health system to provide basic healthcare.

In 2004, the Ministry of Public Health (MOPH) derived the grant from the Global Fund to operate the Global Fund to Fight AIDS, Tuberculosis and Malaria Round 2 (GFATM-R2 project). They targeted 300 villages by setting-up additional Malaria Posts at some malaria-endemic villages (A1: Perennial transmission area $\geq$ 6 months per year). They also provided the Insecticide-treated mosquito nets (ITNs) covering people at high transmission areas. However, the GFATM-R2 project did not plan the insecticide-treated nets and malaria treatment for the vulnerable migrant populations. Therefore, the Global Fund to Fight AIDS, Tuberculosis and Malaria Round 7 or the GFATM-R7 project, which the researcher was going to study, would be ensure maximum coverage of population at risk by 2013. The aims of the GFATM-

R7 project were to reduce transmission and numbers of villages at risk, and to increase vulnerable migrants access to malaria health services. Also, it aimed to set up the partnership to pay more attention for vulnerable groups by specific funding, developing community policies, and increase participation in health insurance systems to protect migrants.

The GFATM-R7 project was started in July 2008 and would be finished in June 2013, getting funding support over 5 years from Global Fund (4). The overall goal was to make accelerated progress towards achieving the national welfare goals in Thailand by further reducing the population at risk of malaria by at least 50% and morbidity/mortality rate by at least 50% in 2013. The project impacts by 2013 include: (i) the population at risk in endemic areas would be declined (ii) the API including migrant population would be declined, and (iii) more unregistered migrants would be accessed basic malaria healthcare.

In this study, the purpose was to assess the effectiveness of the malaria control program under the GFATM-R7 namely "Partnership towards malaria reduction in migrant and conflict-affected populations in Thailand" particularly the malaria-endemic village (A1) covering 460 villages in 28 provinces. The purpose was also to evaluate the impact of the project in terms of the API and MPR of malaria compared between year 2 (2010) and year 3 (2011) by village in each province, by international borders and by overall country. Furthermore, the researcher analyzed the variables of malaria preventive activities that might be related to the impact significantly in order to determine whether the impact changes, and whether the changes were associated with malaria control program under the GFATM-R7 or not.

1.2 Research Questions

What are the effects of the malaria control program in malaria-endemic villages under the GFATM-R7 project?

Are the activities of malaria control program under the GFATM-R7 project able to decrease the impact (API and MPR) in malaria-endemic villages (A1)?

1.3 Objectives

1.3.1 General objective

The purpose of this study was to assess the effectiveness of the malaria control program under the GFATM-R7 project in malaria-endemic villages, Thailand

1.3.2 Specific objectives

1.3.2.1 To compare the API of Thais and M1 migrants in malaria-endemic villages between year 2 (2010) and year 3 (2011) by provinces, the international borders, and overall country.

1.3.2.2 To compare the API of Thais and M1 migrants in malaria-endemic villages between year 3 (2011) and the targeted API by provinces, the international borders, and overall country.

1.3.2.3 To compare the MPR of M2 migrants in malaria-endemic villages between year 2 (2010) and year 3 (2011) by provinces, the international borders, and overall country.

1.3.2.4 To compare the MPR of M2 migrants in malaria-endemic villages between year 3 (2011) and the targeted MPR by provinces, the international borders, and overall country.

1.3.2.5 To associate the relationship between variables of villages (characteristics' and community's cooperation) and the successful villages.

1.4 Study hypotheses

1.4.1 The Annual Parasite Incidence and Malaria Positive Rate were different between Year 2 (2010) and Year 3 (2011), assuming the API/MPR of Year 3 would be decreased.

1.4.2 The Annual Parasite Incidence and Malaria Positive Rate were different between Year 3 (2011) and the targeting, assuming the API/MPR of Year 3 would be decreased 10% from year 2 (2010).

1.4.3 There were association between variables (characteristics and cooperation of villages) and the successful villages.

1.5 Scope of study

This study was to evaluate the effectiveness of the malaria control program in malaria-endemic villages under the GFATM-R7 project. The name of this project was "Partnership towards malaria reduction in Migrant and conflict-affected population in Thailand" supported by the Global Fund Round 7 for five years. It started in July 2008 and ended in June 2013. This study was to assess the interim of project, July 2008 - June 2011, for three years of the intervention.

The important indicator was the morbidity. This study used the Annual Parasite Incidence (API) per 1,000 populations of Thais and M1 migrants, excluding M2 migrants (foreigners who reside in Thailand less than 6 months a year) because they were usually infected malaria from outside the villages. Therefore, the study was measured the M2 migrants by Malaria Positive Rate (MPR).

1.6 Definitions

The malaria control program under the Global Fund Round 7: The project was supported by the Global Fund Round 7 to conduct the malaria prevention and control in malaria-endemic villages (A1). The major activities included; diagnosis and treatment for malaria infection, providing the impregnated bed nets, promoting the access to malaria health services, and enhancing the cooperation among stakeholders in targeted villages (see details in Appendix B)

Effectiveness of the project: The positive results that the project could decrease the API and MPR about 10% from Year 2 (2010)

Successful village: Similarly to the effectiveness of project that the village could be decreased the API about 10% from Year 2 (2010)

The project's outcomes: The performance outcomes belong to the GFATM-R7 project such as; the number of people with fever who were examined for malaria infection, number of people who were found malaria, the percentage of households owning at least one ITN, and so on.

Malaria-endemic areas

A1: where referred to the Perennial transmission area, and there were malaria cases reported throughout the year or at least 6 months a year.

A2: where referred to the Periodic transmission area, and there were malaria cases reported less than 6 months a year.

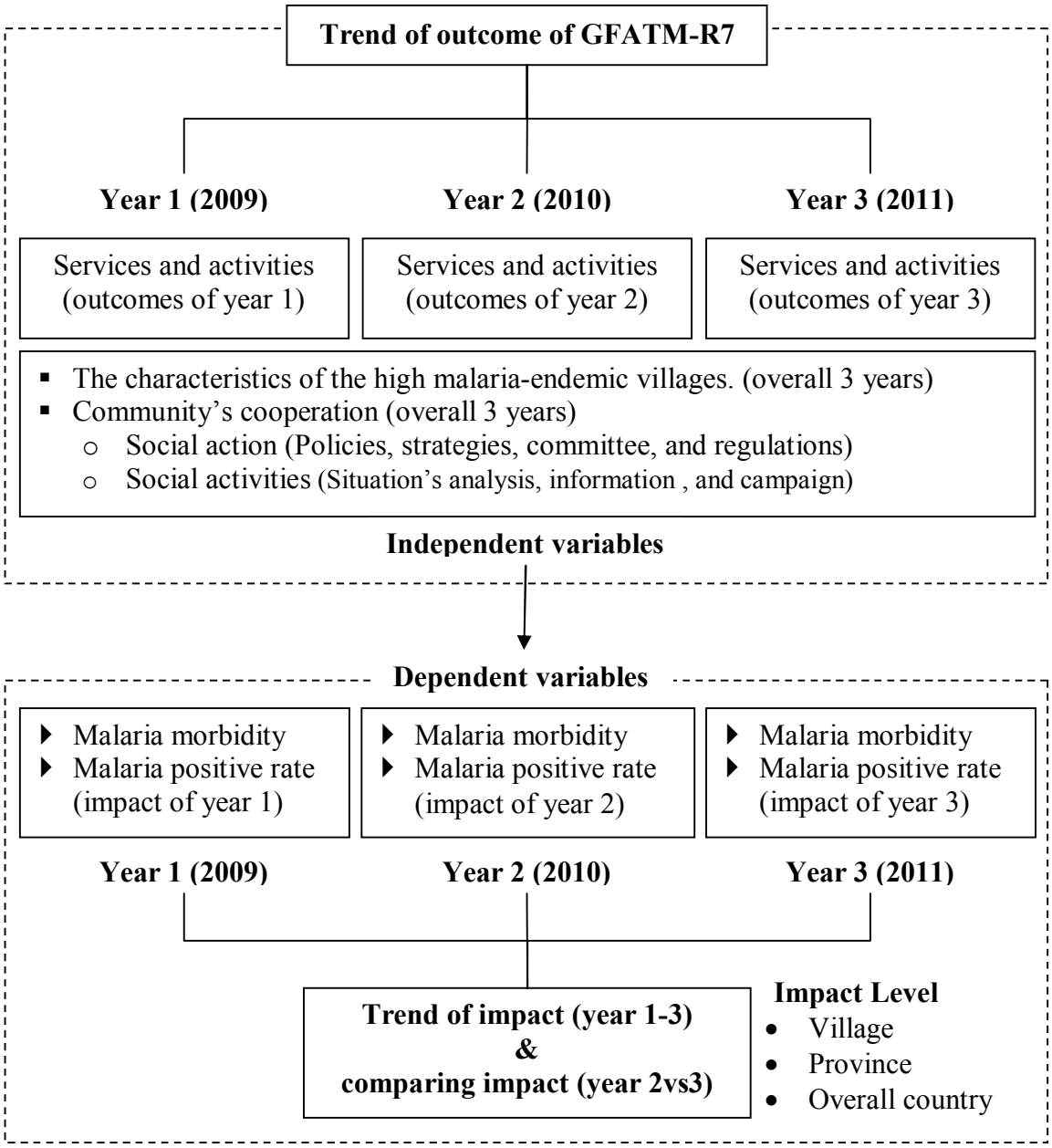
Populations

Thai: Thai citizens

M1: Immigrants were in Thailand more than six months, registered migrants.

M2: Immigrants were in Thailand less than six months, unregistered migrants

1.7 Conceptual framework



CHAPTER II
LITERATURE REVIEW

2.1 Malaria

Malaria is transmitted through the bites of the infected mosquitoes and caused by a parasite called *Plasmodium*. The parasites multiply in the human liver and later infect to red blood cells.

There are four types of human related malaria:

- *Plasmodium falciparum*
- *Plasmodium vivax*
- *Plasmodium malariae*
- *Plasmodium ovale*

The most common types are *P.falciparum* and *P.vivax*. The most dangerous one is *P.falciparum*, but in recent years some malaria cases have occurred with *Plasmodium knowlesi* - monkey malaria that occurred in certain forested areas of South-East Asia (5-9).

There are many symptoms of malaria such as fever, vomiting, and headache, which may occur in 10 to 14 days after the mosquitoes have bitten. If the victims are not treated quickly, malaria can be a life-threatening by disrupting the blood supplies.

The key interventions to control malaria include the EDPT, using the ITN, and the IRS for killing the mosquitoes (2).

2.1.1 Transmission

Malaria is transmitted via the bite of the Anopheles mosquitoes. The intensity of the transmission depends on many factors such as the parasite, vector, human, and the environment (10).

There are 478 recorded species worldwide (11). More 100 species can transmit human malaria, but only 30–40 species commonly transmit parasites of the

genus *Plasmodium* which causes malaria in humans in endemic areas (12). The Anopheles all over the world bites at night. They breed through freshwater like the rice fields and hoof prints. The intensity is high when the places help the mosquitoes to live longer which will help them to complete their development. There is more than 85% of the malaria death in Africa due to the reason that mosquitoes prefer to bite human rather than animals.

Human immunity is also one of the important factors that can fight against malaria (13-16). The immunity is developed over years during that period of development, malaria infection can happen. For this, most death occurs in young children (17-22) where the immune system is under developing. The transmission may also depend on the climate that may kill the mosquitoes such as the temperature or humidity.

2.1.2 Symptoms

Malaria is an acute illness. The symptoms usually appear seven days or more (10-14 days) after the bite. The first symptoms are fever, headache, and vomiting. If the victims are not treated well within 24 hours, it may lead to death. The children in endemic areas with severe disease usually develop one or many more of the syndromic presentations, severe anaemia or cerebral malaria.

2.1.3 Diagnosis and treatment

The early diagnosis and prompt treatment of the malaria can prevent death (23). They also reduce the malaria transmission (24). One of the best treatments for preventing malaria is the “artemisinin-based combination therapy (25). At present, the medics give patients ACT for 3 days.

WHO recommended that all malaria cases should be confirmed by parasite-based diagnosis before they were prescribed for treatment. Practically, the results of parasitological confirmation can take for few minutes. Malaria solely treatment is considered from the basis of symptoms that should be careful when a parasitological diagnosis is not possible.

2.1.4 Drug resistance

The growing of antimalarial medicines has spread rapidly through malaria control efforts. When the victim is treated with artemisinin-base therapy, the victim may stop the continuing treatment early following by the rapid clearance of malaria symptoms. If the resistance of artemisinin develops and spread widely, the public health may become dire since there are no alternative medicines.

2.1.5 Prevention

The vector control is the major public health prevention for reducing the malaria transmission (26). Having this control may help endemic areas with the high rate of transmission reducing from high to become zero. There are two forms of vector control of which the first example is by having ITNs. This is one of the most recommended solutions that may help to prevent mosquitoes from entering rooms and the areas that are well protected by the bed net (27-29). The second vector control is the Indoor Residual spraying which is one of the fastest ways to reduce the transmission of malaria. The spray will be effective for 3-6 months depending on the type of sprays and level of transmission.

2.1.6 Economic impact

Malaria can cause economic losses and may decrease gross domestic product by as much as 1.3% in certain countries with high transmission (2). The health cost of malaria includes both the public and individual expenditures on the prevention or the treatment. Malaria may have a huge impact on the poor who cannot afford treatment and have limited healthcare access.

2.1.7 Elimination

Previously, many countries have successfully eliminated malaria. Although many countries eliminated malaria but some did not due to economic factors. With these modern days' strategies, it is recommended that most countries should follow the strategies in order to decrease the transmission of malaria.

Large-scale use of WHO-recommended strategies, currently available tools, strong national commitments, and coordinated efforts with partners, will enable

more countries particularly those where malaria transmission is low and unstable to progress towards malaria elimination.

2.1.8 WHO response for malaria

The WHO Global Malaria Program is responsible for the strategy formulation, technical assistance, capacity building malaria surveillance, monitoring and evaluation and globally efforts to fight malaria. WHO is an organization that was built to fight against malaria and help the world to reduce the level of transmission of malaria (2).

2.2 Malaria in Thailand

2.2.1 Malaria control program in Thailand

The National Malaria Control Program (NMCP) aims to promote and support the malaria services at all levels of healthcare system. The Bureau of Vector Borne Diseases, the Department of Disease Control (DDC), Ministry of Public Health (MOPH) acts as the National Program Manager for the NMCP.

At the regional level, there are 12 Offices of Disease Prevention and Control that will be the focal unit for malaria and other vector-born disease prevention and control, with the support of 39 vector-borne disease control centers at provincial level and 302 vector-borne disease control units at district level. In addition, 526 malaria clinics scattering in all malaria endemic areas throughout the country provide malaria services at sub-district level. Of this number, 340 malaria clinics are located in border provinces. In the remote areas along the international borders, 460 community-based malaria posts operated by villagers use a package of rapid diagnostic tests (RDTs) and a combination drug in order to serve hard-to-reach people and migrants.

2.2.2 Malaria Situation in Thailand

Malaria remained a major cause of morbidity in Thailand for many decades. For malaria control program in Thailand during the past five decades, the trend of malaria had been decreasing in malaria incidences of the country.

Nevertheless, malaria epidemics still perennially occurred in high malaria-endemic areas, particularly along the international border of Thailand-Myanmar.

Table 2.1 Malaria Situation in the international borders, 2006 – 2010

Border Area	Year									
	2006		2007		2008		2009		2010	
	Thai	Non Thai	Thai	Non Thai	Thai	Non Thai	Thai	Non Thai	Thai	Non Thai
Thai-Myanmar (10 Provinces)	16,679	32,566	13,994	21,380	13,725	24,707	14,489	24,411	14,431	19,283
Thai-Laos (10 Provinces)	840	99	643	90	513	10	675	20	336	9
Thai-Cambodia (6 Provinces)	3,654	1,172	1,886	834	1,925	832	3,205	924	1,845	614
Thai-Malaysia (4 Provinces)	6,592	171	13,556	175	7,625	173	2,955	50	3,992	135
Non-border	0	1,503	0	1,238	0	1,153	0	925	0	1,135
Total	27,765	35,511	30,079	23,717	23,788	26,875	21,324	26,330	20,604	21,176

Source: Bureau of Vector Borne Diseases, Department of Disease Control

Malaria situation in 2010 had a gradual decreasing trend. The API of the country in 2010 was 0.36/1,000 population. However, malaria is considered to be a re-emerging disease with its high incidence that can be observed along the international borders (30). Approximately 50% of the cases are migrant population. Epidemics of malaria along the borders are mainly due to i) high mobility of migrants and cross-border population (31), ii) limited access to early diagnosis and treatment of malaria services among migrants and vulnerable populations, particularly illegal migrant with their families, iii) insufficient resources for prompt and effective responses to malaria epidemics resulted from the government organization reform and economic situation of the country. Furthermore, high mobility of migrants and cross-border population also leads to the spread of multi-drug resistance (32) which poses more difficulties and more budgets for the treatment of malaria (33).

2.2.3 Malaria epidemic in Thailand

Malaria cases were collected monthly at district and provincial level. Thereafter, they were sent to the national level, Bureau of Vector Borne Disease,

Department of Disease Control, Ministry of Public Health. The trend of malaria in the past decade showed the decrease in both mortality and morbidity rates.

Figure 2.1 Malaria Mortality Rate, 1965-2010 (per 100,000 populations)

Source: Bureau of Vector Borne Diseases, Department of Disease Control

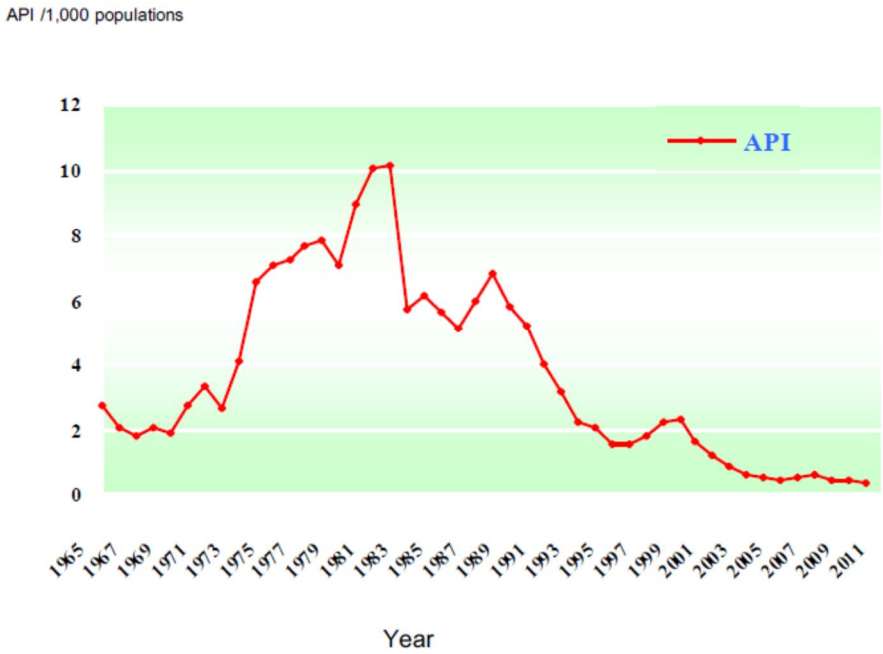


Figure 2.2 Annual Parasite Incidence (API), Thailand. 1965-2010

Source: Bureau of Vector Borne Diseases, Department of Disease Control

2.3 Related research

Supawadee Konchom (34) studied the pattern and trend of the malaria incidence in malaria-endemic provinces along the international borders of Thailand during 1991-2001. The international borders were divided into four parts; Thailand-Myanmar border (10 provinces), Thailand-Cambodia border (6 provinces), Thailand-Laos border (10 provinces), and Thailand-Malaysia border (4 provinces). The aim of study was to describe the pattern and trend of the malaria incidence in the high transmission areas along the international borders. The study found that the pattern and trend of the malaria distribution had shifted from the infection of *Plasmodium falciparum* to *Plasmodium vivax*, which was found along the borders of Thailand-Myanmar, Thailand-Laos, and Thailand-Cambodia. However, Thailand-Malaysia border the pattern and trend of malaria incidence had shifted from the infection of *Plasmodium vivax* to *Plasmodium falciparum* since 1997. The study also found significant differences of malaria incidence between the border districts and non-border districts in Thailand-Myanmar border and Thailand-Cambodia border. The researchers suggested that all of border districts should pay more attention to malaria preventing and controlling activities of the malaria surveillance system. In addition, monitor and evaluation of malaria control programs in Thailand should be conducted continuously, including some areas even the few malaria cases.

Supawadee Konchom (33) studied the events of the malaria epidemics in Thailand during 1980-2000. The former events of malaria outbreaks were reviewed from the surveillance reports of the National Malaria Control Program. The literature review found that there were four outbreak periods. All of these events were found in the province and district located along the international borders. Malaria epidemics were caused by various factors such as the movement of migrant population, low immune status of population, malaria-drug resistance, lack of knowledge of residents to protect themselves for a mosquito bite, and the return repeated outbreaks in areas where malaria had disappeared for a long time. These factors that could be led the outbreak of malaria throughout the country. Evidence relating to this discovery could lead to review of the causal factors that would be useful in future research.

Verena Ilana Carrara (24) studied the deployment of Early Diagnosis and Combination Treatment (EDCT) of *Plasmodium falciparum* malaria in Thailand; the Tak Malaria Initiative (TMI). The purpose was to assess the impact of EDCT on malaria in the TMI project. The study found that EDCT with Mefloquine-Artesunate combination therapy (MAS) could reduce the transmission of *P.falciparum* and halt the progression of mefloquine resistance for people in temporary refugee's shelter along the Thailand-Myanmar border. Moreover, the study also found that seasonal and low transmission areas could halt multidrug-resistant *P.falciparum*. The TMI extended the EDCT strategy to five border districts, covering 450,000 populations. The project trained village volunteers to use rapid diagnostic tests (RDT) and to treat positive malaria cases with MAS. The study found that *P.falciparum* cases fell by 34% (95% CI, 33.5-34.4) of all sites, and in hospitals the *P.falciparum* fell by 39% (95% CI, 37.0-39.9) during the TMI project period, but for *P.vivax* remained constant. The mortality reduced after the TMI, a 51.5% (95% CI, 39.0-63.9), that the reduction compared to the average of the previous 3 years. The study conducted cross-sectional surveys that indicated *P.vivax* to become the predominant species in Thai villages, but not in populations living along Thailand-Myanmar border. In the displaced persons living in temporary shelter, where the original deployment took place 7 years before the TMI, the transmission of *P. falciparum* continued to be eradicated. The authors recommended that in the malaria-endemic remote border area should run the EDCT by trained village volunteers in order to use rapid diagnostic tests and treat with MAS. It was feasible and reduced the morbidity and mortality of multidrug-resistant *P.falciparum*.

In 2009, the Global Fund assigned the External Evaluation Team; Mr. Trairat Banchong-Aksorn, Dr. Piyarat Butraporn, Dr. Robert Vryheid and Dr. Jaranit Kaewkungwal (35). This team assessed the outcomes and impacts of the GFATM-R7 (phase 1; July 2009 - September 2009), the same study that the researcher would assess. They had evaluated the nine Service Delivery Areas (SDA), and reviewed the implementation of the Principal Recipient (PR), some Sub-Recipients (SRs), and some Sub-Sub-Recipients (SSRs), through Quarter 5 (1 July 2009 - 30 September 2009). The external evaluation team collected the information from site visits, organizations' reports and presentations, interviews and observations with staffs

and villagers, both quantitative and qualitative data. They gave the overall rating of the project at the end of Quarter 5 by rating-grade as grade A2, and classified 9 indicators as two indicators for grade A1, four indicators for grade A2, two indicators for grade B2 and one indicator for grade C. The criterion for the rating is as follows,

A1 = Exceeding Expectation = 90+%; A2 = Expected = 80-89%

B1 = Adequate = 70-79%; B2 = Inadequate but potential demonstrated = 60-69%

C1 = Inadequate and no potential demonstrated = 50-59%; C2 = Unacceptable = Less than 50%

CHAPTER III
METHODS

3.1 Study design

This was an evaluation research based on the information from the GFATM-R7 project under the coordination of Bureau of Vector Borne Disease (BVBD), Department of Disease Control and twenty-eight Provincial Health Offices (PHOs), Ministry of Public Health, Thailand.

3.2 Population and sample size

3.2.1 Population

The populations were the malaria-endemic villages (A1) covering 460 villages in 28 provinces. They were divided into five groups as shown in table 2. The reason to separate village groups was that there was the relative homogeneity of the demographic and geographical characteristics along Thailand borders. The border groups were as follows,

- Thailand-Myanmar border consists of 9 provinces; Chiang Mai, Mae Hong Son, Tak, Kanchanabuli, Ratchaburi, Phetchaburi, Prachuap Khiri Khan, Chumphon, and Ranong.

- Thailand-Cambodia border consists of 5 provinces; Surin, Srisaket, Sa Kaew, Chanthaburi, and Trat.

- Thailand-Malaysia border consists of 3 provinces; Yala, Songkhla, and Narathiwat.

- Thailand-Laos border consists of 2 provinces; Mukdahan, and Ubon Ratchatani.

- Non-border provinces which are not adjacent to the international border consist of 9 provinces ; Chonburi, Rayong, Suphanburi, Uthaitani, Phang Nga, Phrae, Nakhon Sri thammarat, Krabi, and Suratthani.

3.2.2 Sample size

The researcher uses sample size formula for comparing means in order to calculate the required sample size for a Paired t test model. Two observations are related (before and after for the same village). Sample size required for estimating the mean difference when estimating μ with 95% confidence, 80% power can be determined with:

$$n = \frac{(Z_{\alpha/2} + Z_{\beta})^2 \cdot 2\sigma_D^2}{\mu_D^2}$$

n = Number of sample

μ_D = Mean difference

σ_D = Standard deviation of difference

$Z_{\alpha/2}$ = Alpha (significance level of test)

Z_{β} = Power (probability of significant result if alternative hypothesis is true)

Mean and SD were obtained from the impact of the GFATM-R2 project and the API data from 9 provinces; Mae Hong Son, Tak, Kanchanaburi, Prachaub Khiri kan, Chumporn, Ranong, Trat, Yala, and Suratthani (36).

Before the GFATM-R2 (2003): mean of API= 6.40 with SD=6.64
After the GFATM-R2 (2008): mean of API= 4.75 with SD=4.42
Mean difference of API = 1.65 with Standard deviation of difference = 4.34

$$n = \frac{(1.96 + 0.842)^2 \cdot 2(4.34)^2}{(6.40-4.75)^2}$$

n = 108.64 or 109 villages

For the possibility of losing some sample size and missing some response items in the replied questionnaires, the study needed to increase sample sizes more than this calculation. The response rate of questionnaires was expected to be around 50%. Then the questionnaires were sent to all malaria-endemic villages (460 villages), and they were sent back about 250 samples that are shown in Table 3.1.

Table 3.1 Number of population and sample size grouped by the international borders

International borders	No. of population	No. of samples	Percentage
1. Thailand-Myanmar	310	171	55.2
2. Thailand-Cambodia	47	32	68.1
3. Thailand-Malaysia	41	22	53.7
4. Thailand-Laos	15	13	86.7
5. Non-border provinces	47	12	25.5
Total	**460**	**250**	**54.3**

3.3 Data collection and instrument

The data were collected from both of the primary and secondary resources. The secondary data were derived from the BVBD and the Principal Recipient; PR such as the performance outcome reports of the GFATM-R7 project. For the primary data, they were derived from the respondents who answered the questionnaires. The collected instruments in this study were developed from the indicator report forms of the GFATM-R7 and the previous literature. The questionnaire was approved by the expertise in order to test validity. Then the questionnaires were sent to the health officers who were responsible for each village under the GFATM-R7. After all health officers had received the questionnaire (Appendix A), they were asked to complete all items about the village's characteristics, community's compliance, and project's outcomes. Thereafter, they were asked to send the questionnaires back directly to the researcher by mail.

3.3.1 Instruments for data collection

The instrument in this study was the questionnaire which consists of 3 parts as follows:

Part 1 Characteristics of villages: This part consists of the questions about characteristics of villages such as type of the adjacent international borders, the number of households and populations, the distance from villages to the nearest hospital, the majority of villagers' occupation, etc.

Part 2 Cooperation of community: This part consists of the question of two sub-groups (18 items). One contains 10 items about community's cooperation. The other contains 8 items about the information of malaria surveillance, prevention, and control.

Part 3 The performance outcomes of GFATM-R7 project: This part includes the outcomes which were derived from the performance framework of GFATM-R7 for three year (July 2008 – June 2011) such as number and percentage of malaria cases, number of malaria cases who had received antimalarial treatment within 24 hours of onset, number of households owning at least one ITN, etc.

3.3.2 Measurements

The study was classified the measurement of the API and MPR into three levels as follows;

Village level

The API of village level was calculated by using the number of malaria cases (Thais and M1 migrants) multiplied by 1,000 and divided by the number of Thais and M1 migrants that reside in the village at that year.

$$\text{API} = \frac{\text{No. of malaria cases (Thais and M1 migrants) x 1,000}}{\text{No. of Thais and M1 migrants in village at that year}}$$

The MPR of village level was calculated by using the number of malaria cases of M2 migrants, then multiplied by 100 and divided by the number of M2 migrant cases who were tested for malaria infection at that year.

$$\text{MPR} = \frac{\text{No. of malaria cases of M2 migrants x 100}}{\text{No. of M2 migrants tested for malaria at that village}}$$

Province level

The API of province level was calculated by using the number of malaria cases (Thais and M1 migrants) from all of malaria-endemic villages in each province, then multiplied by 1,000 and divided by the number of Thais and M1 migrants who resided in all villages of each province at that year.

$$\text{API} = \frac{\text{No. of malaria cases (Thais and M1 migrants) x 1,000}}{\text{No. of Thais and M1 migrants in province at that year}}$$

The MPR of province level was calculated by using the number of malaria cases of M2 migrants in all malaria-endemic villages, then multiplied by 100 and divided by the total number of M2 migrant cases who were tested for malaria infection of all villages in each province at that year.

$$\text{MPR} = \frac{\text{No. of malaria cases of M2 migrants x 100}}{\text{No. of M2 migrants tested for malaria in each province}}$$

Country level

The API of country level was calculated by using the number of malaria cases (Thais and M1 migrants) from all of malaria-endemic villages in all provinces, then multiplied by 1,000 and divided by the number of Thais and M1 migrants who resided in all villages of all provinces at that year.

$$\text{API} = \frac{\text{No. of malaria cases (Thais and M1 migrants) x 1,000}}{\text{No. of Thais and M1 migrants of all provinces at that year}}$$

The MPR of country level was calculated by using the total number of malaria cases of M2 migrants in all malaria-endemic villages, then multiplied by 100 and divided by the total number of M2 migrant cases who were tested for malaria infection of all villages under the GFATM-R7 project at that year.

$$\text{MPR} = \frac{\text{No. of malaria cases of M2 migrants x 100}}{\text{No. of M2 migrants tested for malaria of all provinces}}$$

3.4 Data analysis

All of information was analyzed with the 95% confident interval. The following statistical analyses were used:

3.4.1 Descriptive statistics; frequency, percentage, mean and standard deviation were used to describe the characteristics and cooperation of villages, and number of performance outcomes of the GFATM-R7 project.

3.4.2 Wilcoxon signed-rank test was used for comparison of the API and MPR between year 1 and year 3 by village in each province, by the international border group, and by overall country. Moreover, the statistical test was used to compare the API and MPR between year 3 and targeted API/MPR which were targeted to decrease about 10% from year 2.

3.4.3 Binary Logistic Regression statistics were analyzed to find the relationship between the variables (characteristics, cooperation of villages) and the successful village variables in order to determine whether the API was changed significantly and whether the API changes were associated with the malaria control program under the GFATM-R7 project.

CHAPTER IV
RESULTS

The purpose of this evaluation study was to assess the effectiveness of the malaria control program under the GFATM-R7 project. The collected data were derived by the coordination among the Bureau of Vector Borne Disease (BVBD), the Principal Recipient (PR), and twenty-eight Provincial Health Offices (PHOs). The 250 questionnaires were from respondents, who were in charge of health service for people in those malaria-endemic villages. Furthermore, the number of the performance outcomes of 460 villages such as the number of malaria cases, number of LLINs distributed to people, etc., which were derived from BVBD and PR. The results of the analysis are presented in 5 parts as follows;

Part 1 Characteristics of villages
Part 2 Cooperation of communities
Part 3 Number of performance outcomes of the GFATM-R7 project
Part 4 Comparison of the APIs and MPRs categorized by provinces, international borders, and overall country
Part 5 Association between variables of the characteristics/cooperation of villages and the successful villages

4.1 Characteristics of villages

After 250 questionnaires had been received and verified, they were grouped by provinces, and finally grouped into five international borders; Thai-Myanmar, Thai-Cambodia, Thai-Malaysia, Thai-Laos, and non-border provinces. The number and percentage of respondents are shown in Table 4.1.

Table 4.1 Number and percentage of the respondents by provinces and the international borders

International borders/ Provinces	No. of villages	Respondents	Percentage
1. Thailand-Myanmar	**310**	**171**	**55.2**
- Chiang Mai	10	10	100.0
- Mae Hong Son	50	16	32.0
- Tak	90	90	100.0
- Kanchanaburi	65	14	21.5
- Ratchaburi	20	18	90.0
- Phetchaburi	18	11	61.1
- Prachuap Khiri Khan	37	8	21.6
- Chumphon	14	0	0.0
- Ranong	6	4	66.7
2. Thailand-Cambodia	**47**	**32**	**68.1**
- Surin	5	0	0.0
- Srisaket	4	2	50.0
- Sa Kaeo	4	0	0.0
- Chanthaburi	30	30	100.0
- Trat	4	0	0.0
3. Thailand-Malaysia	**41**	**22**	**53.7**
- Yala	22	22	100.0
- Songkhla	5	0	0.0
- Narathiwat	14	0	0.0
4. Thailand-Laos	**15**	**13**	**86.7**
- Mukdahan	3	1	33.3
- Ubon Ratchatani	12	12	100.0

Table 4.1 Number and percentage of the respondents by provinces and the international borders (cont.)

International borders/ Provinces	No. of villages	Respondents	Percentage
5. Non-border provinces	**47**	**12**	**25.5**
- Chonburi	2	0	0.0
- Rayong	3	0	0.0
- Suphanburi	2	2	100.0
- Uthaitani	4	4	100.0
- Phang Nga	3	1	33.3
- Phrae	4	2	50.0
- Nakhon Sri thammarat	3	0	0.0
- Krabi	3	3	100.0
- Suratthani	23	0	0.0
Total	**460**	**250**	**54.3**

Table 4.1 shows the number and percentage of the total samples. There were 250 villages; Thailand-Myanmar border 68.4% (n=171), Thailand-Cambodia border 12.8% (n=32), Thailand-Malaysia border 8.8% (n=22), Thailand-Laos border 5.2% (n=13), and non-border provinces 4.8% (n=12) respectively. The samples were obtained from eighteen of twenty-eight provinces. The provinces that gave the all questionnaire back (100%) were Chiang Mai, Tak, Chanthaburi, Yala, Ubon Ratchatani, Suphanburi, Uthaitani, and Krabi.

Table 4.2 Number and percentage of characteristics of sample villages in malaria-endemic area under the GFATM-R7 project

Characteristic	Number	Percentage
1. Villages locate along the international borders		
- Thailand-Myanmar	171	68.4
- Thailand-Cambodia	32	12.8
- Thailand-Malaysia	22	8.8
- Thailand-Laos	13	5.2
- Non-border provinces	12	4.8
2. Villages adjacent to the international borders		
- Yes	100	40.0
- No	150	60.0
3. Villages have M2 migrants in and out villages		
- Yes	73	29.2
- No	177	70.8
4. Number of households		
- ≤ 100 household	65	26.0
- 101 – 200 households	80	32.0
- 201 – 300 households	59	23.6
- > 300 households	46	18.4
5. Number of population (Thais and M1)		
- ≤ 400 persons	71	28.4
- 401 – 700 persons	75	30.0
- 701 – 1,000 persons	46	18.4
- > 1,000 persons	58	23.2
6. The distance to the nearest hospital (km.)		
- ≤ 15 km.	57	25.4
- 16 – 26 km.	55	24.6
- 27 – 40 km.	61	27.2
- > 40 km.	51	22.8

Table 4.2 Number and percentage of characteristics of sample villages in malaria-endemic area under the GFATM-R7 project (cont.)

Characteristic	Number	Percentage
7. Spending time to the nearest hospital		
- ≤ 30 minutes	87	37.3
- 31 – 60 minutes	58	24.9
- 61 – 120 minutes	46	19.7
- > 120 minutes	42	18.0
8. The majority of villagers' ethnic		
- Thai-Karen	118	47.2
- Thais	85	34.0
- Thai-Muslim	21	8.4
- Thai-Myanmar	6	2.4
- Thai-Cambodia	4	1.6
- Others (Suay, Hmong, etc.)	16	6.4
9. The majority of villagers' occupation		
- Crop-farming	148	59.2
- Rubber or fruit plantation	53	21.2
- Rice-farming	36	14.4
- Laborer	13	5.2
10. If the villagers get malaria, they usually go to		
- Malaria Post under GFATM-R7 project	210	84.0
- Malaria clinic	23	9.2
- Hospitals	14	5.6
- Health Center	3	1.2

Table 4.2 illustrates the characteristics of the 250 villages in malaria-endemic area. The great majority of villages located along the international border (95.2%) while under half of them were close to the border (40%). Overquarter of villages had M2 migrants moving in and out of the villages (29.2%). There were 52,039 households in total. The average was208 households per village (SD = 166.6)

and the range was from 18 to 1,511. The number of Thais and M1 migrants was 205,248 while the number of M2 migrants was 8,307. For the distance from villages to the nearest hospital, the average was 32.2 km. The distance ranged from 1 km. to 141 km. The shortest time to the nearest hospital was 3 minutes while the longest time was 2 days. Almost half of villagers' ethnics were Thai-Karen (47.2%). The majority of the villagers worked in agricultural sector; crop-farming (59.2%), rubber/fruit plantation (21.2%), and rice-farming (14.4%) respectively. When most of villagers had got malaria, they usually went to the Malaria Post under the GFATM-R7 project (84%).

4.2 Cooperation of community

Table 4.3 Number and percentage of community's cooperation in malaria-endemic villages under the GFATM-R7 project

Community's cooperation	Number	Percentage
1. Villages have the operational plans for malaria prevention and control supported by local government		
- Yes	113	45.2
- No	137	54.8
2. Villages have the responsible committee for malaria prevention and control		
- Yes	190	76.0
- No	60	24.0
3. The committee have a regular meeting		
- At least 3 months each	104	41.6
- Between 3 and 6 months each	55	22.0
- Between 6 and 12 months each	59	23.6
- More than 1 year each	6	2.4
- Never	26	10.4

Table 4.3 Number and percentage of community's cooperation in malaria-endemic villages under the GFATM-R7 project (cont.)

Community's cooperation	Number	Percentage
4. How often the meeting's issues were recorded?		
- Always	147	58.8
- Sometimes	57	22.8
- Never	46	18.4
5. What issues do they talk about and how often?		
5.1 The malaria situation analysis		
- Always	158	63.2
- Sometimes	65	26.0
- Never	27	10.8
5.2 Monitoring and evaluation the malaria activities in their village		
- Always	139	55.6
- Sometimes	78	31.2
- Never	33	13.2
5.3 Consider the ways to solve the problems		
- Always	129	51.6
- Sometimes	90	36.0
- Never	31	12.4
6. The villages have a regulation for malaria prevention and control		
- Yes	20	8.0
- No	230	92.0
7. For the regulation, the villages' regulation can be enforced in the real practice		
- Yes	18	90.0
- No	2	10.0

Table 4.3 presents the cooperation of community which supported the strength for malaria prevention and control. By the local government, they had the operational plans in order to support the malaria prevention and control (45.2%). Additionally, almost all of villages had the responsible committee for these actions at 76.0% even no supported plans by local government. The village's committee had a regular meeting at least 3 months for41.6%. They always did the meeting records at 58.8%. According to the meeting records, they always talked about the malaria situation analysis in 63.2%, monitoring and evaluation the malaria activities in their village in 55.6%, and making the decision for solving problems in 51.6%. However, when the questionnaire asked about the regulations that they had for malaria prevention and control, they answered "NO" at 92.0%. For the answers "YES", the village's regulations could be enforced actually at 90.0%. For example, the villagers must sleep in ITN overnight and when someone goes to jungle, he or she must bring the ITN with them and use it overnight. If they do not comply to the suggestion, they would be punished by social rules.

Table 4.4 Number and percentage of villages' operation for malaria prevention and control in malaria-endemic areas under the GFATM-R7 project

Activities	Number	Percentage
1. There is the malaria information at the Malaria Posts;		
1.1 The number of malaria cases shows monthly report and cumulative on board	229	91.6
- Yes	21	8.4
- No		
1.2 Graphs or charts show trend of malaria situation	121	48.4
- Yes	129	51.6
- No		
1.3 Maps illustrate malaria cases or eventual areas	231	92.4
- Yes	19	7.6
- No		

Table 4.4 Number and percentage of villages' operation for malaria prevention and control in malaria-endemic areas under the GFATM-R7 project (cont.)

Activities	Number	Percentage
2. Villages did the malaria campaign in 2009		
- Yes	231	92.4
- No	19	7.6
3. Village did the malaria campaign in 2010		
- Yes	238	95.2
- No	12	4.8
4. Village did the malaria campaign in 2011		
- Yes	241	96.4
- No	9	3.6
5. How often did the villagers join the campaign?		
- All of the activities	185	74.0
- Some of the activities	64	25.6
- Never	1	0.4
6. Villages did the evaluation of the campaign		
- Yes	185	74.0
- No	65	26.0
7. How often did the villages do the IRS?		
- At least 6 months each	91	36.4
- Between 6 and 12 months each	103	41.2
- More than 1 year each	32	12.8
- Never	24	9.6

Table 4.4 represents the activities that the MPWs and all of villagers worked together with malarial surveillance, prevention, and control in their communities. At their Malaria Posts, there was the malaria information such as the number of malaria cases (91.6%), graphs or charts showing trend of malaria situation

(48.4%), maps demonstrating malaria cases or areas (92.4%). The majority of villages did the malaria campaign in 2009-2011 at 92.4%, 95.2%, and 96.4%, respectively.

According to the malaria campaign, most of villagers participated in some malaria activities (74.0%), and most of villages did the evaluation of campaign (74.0%). For the IRS during 2009 and 2011, almost half of villages did the IRS at least once a year in 77.6%, more than once a year in 12.8%, and never done in 9.6%.

4.3 Number of performance outcomes of the GFATM-R7 project

The performance outcome records under the GFATM-R7 project were derived from the BVBD and PR-DDC where collected plenty of data from twenty-eight provinces. The collected data of 460 villages were included in this study. However, the study just the completed data for 2 years (2010 and 2011). The results are shown in Table 4.5.

Table 4.5 Number of the performance outcomes of the GFATM-R7 project of year 2 and year 3 by areas

Items	Thai-Myanmar	Thai-Cambodia	Thai-Malaysia	Thai-Laos	Non-border	total
1. Number of Thai citizen and M1 migrants in the village	227,194	42,258	41,789	12,365	46,188	**369,794**
2. Number of Thai and M1 migrants with fever who were examined for malaria infection						
- Year 2 (2010)	87,695	7,817	19,096	2,311	7,023	**123,942**
- Year 3 (2011)	60,254	5,551	16,963	1,424	6,410	**90,602**
3. Number of malaria cases (Thai and M1)						
- Year 2 (2010)	9,373	296	734	88	456	**10,947**
- Year 3 (2011)	7,928	204	613	81	384	**9,210**
4. API per 1,000 pop.						
- Year 2 (2010)	41.3	7.0	17.6	7.1	9.9	**29.6**
- Year 3 (2011)	34.9	4.8	14.7	6.6	8.3	**24.9**

Table 4.5 Number of the performance outcomes of the GFATM-R7 project of year 2 and year 3 by areas (cont.)

Items	Thai-Myanmar	Thai-Cambodia	Thai-Malaysia	Thai-Laos	Non-border	Total
5. Number of Thai and M1 were treated by antimalarial treatment within 24 hrs.						
- Year 2 (2010)	4,692	61	641	58	28	**5,480**
- Year 3 (2011)	2,025	61	435	0	74	**2,595**
6. Percentage of treatment within 24 hours						
- Year 2 (2010)	50.1	20.6	87.3	65.9	6.1	**50.1**
- Year 3 (2011)	25.5	29.9	71.0	0	19.3	**28.2**
7. Number of M2 migrants were examined for malaria						
- Year 2 (2010)	12,394	992	0	6	131	**13,523**
- Year 3 (2011)	10,458	520	0	13	123	**11,114**
8. Number of M2 migrants were found having malaria						
- Year 2 (2010)	2,773	18	0	0	15	**2,806**
- Year 3 (2011)	2,828	12	0	0	19	**2,859**
9. MPR						
- Year 2 (2010)	22.4	1.8	0	0	11.5	**20.7**
- Year 3 (2011)	27.0	2.3	0	0	15.4	**25.7**
10. Number of households	46,402	11,273	10,697	3,494	11,763	**83,629**
11. Number of households owning at least one ITN	46,047	9,108	10,090	3,351	8,406	**77,002**
12. Percentage of ITN per household	99.2	80.8	94.3	95.9	71.5	**92.1**

Table 4.5 illustrates the performance outcomes of the GFATM-R7 project. The total number of the outcomes was summarized from the 460 malaria-endemic villages under this project. There were 369,794 Thai citizens and M1 migrants in total. The majority of population was at Thailand-Myanmar border (61.4%), and the minority of population was at Thai-Laos border (3.3%). In year 2 (2010), Thais and

M1 migrants were examined for malaria infection around 123,942 cases, and they were found to be infected by the parasites at 10,947 cases (API = 29.6). The highest API in the country was at Thai-Myanmar border (API = 41.3). Patients were treated by antimalarial treatment (Artemisinin-based combination therapy; ACT) within 24 hours after the onset of the malaria symptoms at 50.1%. Noticeably, Thai-Cambodia border received themalaria treatment within 24 hours for just 20.6% and the non-border provinces receiving for just 6.1 %.

In year 3 (2011), Thais and M1 migrants had blood examination about 90,609 cases, and they got malaria in 9,210 cases (API = 24.9). Similarly to year 2, most of malaria cases were at Thai-Myanmar border (34.9%), and receiving the antimalarial treatment within 24 hours was 28.2% by average.

For testing malaria of M2 migrants in year 2, 13,523 cases were examined, and the parasites were found in 2,806 cases (MPR = 20.7). The majority of cases were at the Thai-Myanmar border, but not found any case in both Thai-Malaysia and Thai-Laos borders. The total number of M2 migrants in year 3 (2011) tested for malaria infection was 11,114 cases, and the number of M2 migrants getting malaria was 2,859 cases (MPR = 25.7). Similar to year 2, almost all of cases were at the Thai-Myanmar border (98.9%), and cases in M2 migrant at both Thai-Malaysia and Thai-Laos borders were not found at all.

Regarding the number of households owning the ITN, 92.1% of 83,629 households had at least one ITN in their families. These figures were 99.2% in the Thai-Myanmar border, 80.8% in the Thai-Cambodia border (80.8%), 94.3% in the Thai-Malaysia border, 95.9% in the Thai-Laos border, and 71.5% in the non-border provinces.

Unfortunately, there were some performance outcomes that the study were not derived from the BVBD such as the KAP survey because the existing records could not identify for each village and they were blinded for analytical process.

Table 4.6 The API and MPR of the GFATM-R7 project compared to the API/MPR of the country

Items	GFATM-R7 Project	Nationwide Country	Percent
1. Number of Thai and M1 migrants with fever who were examined for malaria			
- Year 2 (2010)	123,942	1,763,231	7.0
- Year 3 (2011)	90,602	1,392,489	6.5
2. Number of malaria cases (Thais and M1 migrants)			
- Year 2 (2010)	10,947	24,847	44.1
- Year 3 (2011)	9,210	15,396	59.8
3. API per 1,000 population			
- Year 2 (2010)	29.6	0.53	
- Year 3 (2011)	24.9	0.35	
4. Number of M2 migrants were examined for malaria infection			
- Year 2 (2010)	13,523	170,283	7.9
- Year 3 (2011)	11,114	170,080	6.5
5. Number of M2 migrants were found having malaria			
- Year 2 (2010)	2,806	14,198	19.8
- Year 3 (2011)	2,859	11,489	24.9
6. MPR			
- Year 2 (2010)	20.7	8.34	
- Year 3 (2011)	25.7	6.76	

Source: Bureau of Vector Borne Diseases, Department of Disease Control

Table 4.6 represents the comparing number and percentage of the malaria examination between the GFATM-R7 project and nationwide country. The number of Thais and M1 migrants examined for malaria infection in the GFATM-R7 project was

under 10% of the country's (7.0% in 2010, 6.5% in 2011). Nevertheless, the number of malaria cases detected in the GFATM-R7 project was a half when it was compared to the country's malaria cases (44.1% in 2010, 59.8% in 2011). Thus, API of this project was higher than the API of country.

Similarly the number of M2 migrants who were examined for malaria infection of this project was under 10% of the country's (7.9% in 2010, 6.5% in 2011). The number of M2 migrants who were found having malaria in this project was under a quarter of the country's (19.8% in 2010, 24.9% in 2011). The MPR of project was higher than MPR of the country, varying between 3-folds to 4-folds.

4.4 Comparison of the APIs and MPRs categorized by provinces, the international border groups, and the overall country

The majority of the APIs and MPRs of all levels had non-normal distribution; therefore, the nonparametric statistical procedure was used in this study to compare the central tendency. An appropriate procedure was the Wilcoxon signed-rank test, which was used to test the significant difference of the APIs and MPRs. Table 4.7 - 4.12 show the results of the comparisons.

Table 4.7 Comparison the APIs between year 2 and 3 by Wilcoxon signed-rank test and grouped by provinces

Variables	API of year 2	API of year 3	p-value
1. Mae Hong Son	24.7	32.7	.024**
2. Tak	84.8	71.1	.008*
3. Kanchanaburi	43.0	30.1	.005*
4. Prachuap Khiri Khan	6.3	5.5	.781
5. Chumphon	39.6	38.1	.638
6. Surat Thani	7.9	9.6	.811
7. Ranong	81.4	52.1	.917
8. Trat	3.0	2.1	.715

Table 4.7 Comparison the APIs between year 2 and 3 by Wilcoxon signed-rank test and grouped by provinces (cont.)

Variables	API of year 2	API of year 3	p-value
9. Yala	14.5	12.3	.396
10. Songkhla	0.8	0.3	1.000
11. Narathiwat	30.3	24.8	.249
12. Chanthaburi	0.6	0.4	.798
13. Chonburi	2.7	0.0	.317
14. Sa Kaeo	0.3	0.5	.371
15. Rayong	0.0	0.0	1.000
16. Suphanburi	3.8	12.2	.180
17. Phetchaburi	37.3	44.7	.112
18. Ratchaburi	12.8	8.7	.035*
19. Ubon Ratchathani	9.3	8.6	.799
20. Surin	17.8	4.5	.043*
21. Srisaket	50.8	40.6	.465
22. Mukdahan	0.9	0.6	1.000
23. Uthaitani	1.1	0.6	.317
24. Chiang Mai	2.2	4.8	.068
25. Phrae	0.0	0.8	.317
26. Phang Nga	124.3	61.1	.180
27.Nakhon Si Thammarat	0.0	1.0	.180
28. Krabi	3.9	2.6	.593

Table 4.7 illustrates the comparison of the APIs between Year 2 and Year 3 by Wilcoxon Signed Ranks Test. There were four of twenty-eight provinces that the APIs significantly decreasedwhich were Tak (p-value = 0.008), Kanchanaburi (p-value = 0.005), Ratchaburi (p-value = 0.035), and Surin (p-value = 0.043). On the other hand, Mae Hong Son province had significantly increasing API (p-value = 0.024).

Table 4.8 Comparison the APIs between year 2 and 3 by Wilcoxon signed-rank test and grouped by the international borders and the overall country

Variables	API of year 2	API of year 3	p-value
1. Thailand-Myanmar	41.3	34.9	.017*
2. Thailand-Cambodia	7.0	4.8	.027*
3. Thailand-Malaysia	17.6	14.7	.124
4. Thailand-Laos	7.1	6.6	.650
5. Non-border provinces	9.9	8.3	.797
Overall country	**29.6**	**24.9**	**.044***

*p < 0.05

Table 4.8 depicts the comparison of the APIs between Year 2 and Year 3 among the international borders and the overall country. The study found that there were significantly decreasing APIs in Thai-Myanmar border (p-value = 0.017), Thai-Cambodia border (p-value = 0.027), and the overall country (p-value = 0.044).

Table 4.9 Number and percentage of the successful villages with the decreasing APIs by provinces and the international borders

International borders/ Provinces	Total of villages	No. of villages		Percentage
		Success	Failure	
1. Thailand-Myanmar	**310**	**159**	**151**	**51.3**
- Chiang Mai	10	5	5	50.0
- Mae Hong Son	50	16	34	32.0
- Tak	90	53	37	58.9
- Kanchanaburi	65	40	25	61.5
- Ratchaburi	20	13	7	65.0
- Phetchaburi	18	5	13	27.8
- Prachuap Khiri Khan	37	19	18	51.4
- Chumphon	14	6	8	42.9
- Ranong	6	2	4	33.3

Table 4.9 Number and percentage of the successful villages with the decreasing APIs by provinces and the international borders (cont.)

International borders/ Provinces	Total of villages	No. of villages		Percentage
		Success	Failure	
2. Thailand-Cambodia	**47**	**36**	**11**	**76.6**
- Surin	5	5	0	100.0
- Srisaket	4	3	1	75.0
- Sa Kaeo	4	2	2	50.0
- Chanthaburi	30	23	7	76.7
- Trat	4	3	1	75.0
3. Thailand-Malaysia	**41**	**23**	**18**	**56.1**
- Yala	22	10	12	45.5
- Songkhla	5	4	1	80.0
- Narathiwat	14	9	5	64.3
4. Thailand-Laos	**15**	**5**	**10**	**33.3**
- Mukdahan	3	2	1	66.7
- Ubon Ratchatani	12	3	9	25.0
5. Non-border provinces	**47**	**27**	**20**	**57.4**
- Chonburi	2	2	0	100.0
- Rayong	3	3	0	100.0
- Suphanburi	2	0	2	0.0
- Uthaitani	4	3	1	75.0
- Phang Nga	3	2	1	66.7
- Phrae	4	3	1	75.0
- Nakhon Sri thammarat	3	1	2	33.3
- Krabi	3	2	1	66.7
- Suratthani	23	11	12	47.8

Table 4.9 shows the number and percentage of the successful villages that the APIs of year 3 decreased byat least 10% of year 2. The Thai-Cambodia border was the greatest percentage at 76.6%.

Table 4.10 Comparison the MPRs between year 2 and 3 by Wilcoxon signed-rank test and grouped by provinces

Variables	MPR of year 2	MPR of year 3	p-value
1. Mae Hong Son	10.5	15.9	.161
2. Tak	24.9	31.9	.030**
3. Kanchanaburi	20.5	19.8	.637
4. Prachuap Khiri Khan	17.3	63.9	.085
5. Chumphon	11.1	11.9	.515
6. Surat Thani	15.3	26.8	.465
7. Ranong	24.3	29.2	.917
8. Trat	-	-	-
9. Yala	-	-	-
10. Songkhla	-	-	-
11. Narathiwat	-	-	-
12. Chanthaburi	2.1	1.8	.553
13. Chonburi	3.6	5.7	.655
14. Sa Kaeo	0.7	1.6	.317
15. Rayong	-	-	-
16. Suphanburi	-	-	-
17. Phetchaburi	25.6	25.0	.465
18. Ratchaburi	30.3	31.8	.575
19. Ubon Ratchathani	-	-	-
20. Surin	0.0	40.0	.180
21. Srisaket	0.0	100.0	.317
22. Mukdahan	-	-	-
23. Uthaitani	-	-	-
24. Chiang Mai	5.2	30.6	.068
25. Phrae	-	-	-
26. Phang Nga	16.7	25.0	.317
27.Nakhon Si Thammarat	-	-	-
28. Krabi	-	-	-

Table 4.10 shows the comparison of the MPRs between Year 2 and 3. There were not found the significantly decreasing MPRs. On the other hand, Tak province had significantly increasing MPR (p-value = 0.030).

Table 4.11 Comparison the MPRs between year 2 and 3 by Wilcoxon signed-rank test and grouped by the international borders and the overall country

Variables	MPR of year 2	MPR of year 3	p-value
1. Thailand-Myanmar	22.4	27.0	.014**
2. Thailand-Cambodia	1.8	2.3	.075
3. Thailand-Malaysia	-	-	-
4. Thailand-Laos	-	-	-
5. Non-border provinces	11.5	15.4	.237
Overall country	**20.7**	**25.7**	**.003****

**MPR of Year 3 greater than Year 2 or negative outcome

Table 4.11 shows the comparison of the MPRs between Year 2 and Year 3 grouped by the international borders and the overall country. Neither the results of the border groups nor the overall country had significantly decreasing MPRs. On the contrary, the Thailand-Myanmar border and the overall country had significantly increasing MPRs (p-value = 0.014 and 0.003, respectively).

Table 4.12 Number and percentage of the successful villages with the decreasing MPRs by provinces and the international borders

International borders/ Provinces	Total of villages	No. of villages		Percentage
		Success	Failure	
1. Thailand-Myanmar	**310**	**159**	**151**	**51.3**
- Chiang Mai	10	6	4	60.0
- Mae Hong Son	50	30	20	60.0
- Tak	90	35	55	38.9
- Kanchanaburi	65	35	30	53.8

Table 4.12 Number and percentage of the successful villages with the decreasing MPRs by provinces and the international borders (cont.)

International borders/ Provinces	Total of villages	No. of villages		Percentage
		Success	Failure	
- Ratchaburi	20	15	5	75.0
- Phetchaburi	18	16	2	88.9
- Prachuap Khiri Khan	37	31	6	83.8
- Chumphon	14	10	4	71.4
- Ranong	6	2	4	33.3
2. Thailand-Cambodia	**47**	**36**	**11**	**76.6**
- Surin	5	3	2	60.0
- Srisaket	4	3	1	75.0
- Sa Kaeo	4	3	1	75.0
- Chanthaburi	30	25	5	83.3
- Trat	4	-	-	-
3. Thailand-Malaysia	**41**	**23**	**18**	**56.1**
- Yala	22	-	-	-
- Songkhla	5	-	-	-
- Narathiwat	14	-	-	-
4. Thailand-Laos	**15**	**5**	**10**	**33.3**
- Mukdahan	3	-	-	-
- Ubon Ratchatani	12	-	-	-
5. Non-border provinces	**47**	**27**	**20**	**57.4**
- Chonburi	2	1	1	50.0
- Rayong	3	-	-	-
- Suphanburi	2	-	-	-
- Uthaitani	4	-	-	-
- Phang Nga	3	2	1	66.7
- Phrae	4	-	-	-
- Nakhon Sri thammarat	3	-	-	-
- Suratthani	23	19	4	82.6

4.5 Association between variables of the characteristics, cooperation of villages and the variables of the successful villages

The relationship among many factors was tested by Binary Logistic Regression statistics of the SPSS program. This section is to find out the variables that correlated with the successful villages which are defined by the targeted impact of the API in year 3decreasing by at least 10% of API of year 2.

Table 4.13 Binary Logistic Regression between variables of the characteristics/ cooperation of villages and the successful villages

Variables	Success/ failure	OR (95% CI)	p-value
1. Villages adjacent to the borders			
- Yes	52/48	0.6 (0.3-1.1)	0.100
- No	91/59	Reference	
2. Villages have M2 migrants moving in-out villages	49/24	2.0 (0.9-4.4)	0.108
- Yes	94/83	Reference	
- No			
3. The distance to the nearest hospital	33/24	0.9 (0.2-3.3)	0.838
- ≤ 15 km.	40/15	2.5 (0.7-8.4)	0.140
- 16 – 26 km.	31/30	0.8 (0.3-2.1)	0.594
- 27 – 40 km.	25/26	Reference	
- > 40 km.			
4. Spending time to the nearest hospital	59/28	1.3 (0.3-5.8)	0.749
- ≤ 30 minutes	31/27	0.7 (0.2-2.6)	0.556
- 31 – 60 minutes	23/23	0.9 (0.3-2.6)	0.804
- 61 – 120 minutes	25/17	Reference	
- > 120 minutes			
5. The majority of villagers' ethnic	68/50	0.6 (0.1-3.2)	0.551
- Thai-Karen	53/32	1.7 (0.1-20.5)	0.687
- Thais			

Table 4.13 Binary Logistic Regression between variables of the characteristics/ cooperation of villages and the successful villages (cont.)

Variables	Success/ failure	OR (95% CI)	p-value
5. The majority of villagers' ethnic (cont.)			
- Thai-Muslim	9/12	1.1 (0.2-5.5)	0.878
- Thai-Myanmar	4/2	0.1 (0.0-2.3)	0.129
- Thai-Cambodia	2/2	0.2 (0.0-2.4)	0.189
- Others (Suay, Hmong, etc.)	7/9	Reference	
6. The majority of villagers' occupation			
- Crop-farming	86/62	0.2 (0.0-1.3)	0.089
- Rubber or fruit plantation	31/22	0.4 (0.1-2.4)	0.278
- Rice-farming	16/20	1.0 (0.1-8.6)	0.988
- Laborer	10/3	Reference	
7. If the villagers get malaria, they usually go to			
- Malaria Post under GFATM-R7	110/100	0.1 (0.0-0.5)	0.006*
- Malaria clinic	19/4	0.4 (0.1-3.4)	0.387
- Hospitals, Health Center	14/3	Reference	
8. Villages have the operational plans for malaria prevention and control			
- Yes	63/50	1.2 (0.5-2.8)	0.761
- No	80/57	Reference	
9. Villages have the responsible committee for malaria prevention and control			
- Yes	110/80	1.1 (0.4-3.0)	0.816
- No	33/27	Reference	
10. The malaria situation analysis was done			
- Always	89/69	2.6 (0.1-48.7)	0.518
- Sometimes	38/27	1.8 (0.1-33.1)	0.701
- Never	16/11	Reference	

Table 4.13 Binary Logistic Regression between variables of the characteristics/ cooperation of villages and the successful villages (cont.)

Variables	success/ failure	OR (95% CI)	p-value
11. The committee have a regular meeting			
- At least 3 months each	53/51	0.3 (0.0-3.5)	0.345
- Between 3 and 6 months each	37/18	0.8 (0.1-9.5)	0.844
- Between 6 and 12 months each	33/26	0.3 (0.0-3.3)	0.333
- More than 1 year each	4/2	0.6 (0.0-13.0)	0.760
- Never	16/10	Reference	
12. Consider to solve the problems			
- Always	75/54	1.4 (0.2-12.3)	0.770
- Sometimes	50/40	1.1 (0.1-10.1)	0.906
- Never	18/13	Reference	
13. The villages have a regulation for malaria prevention and control			
- Yes	13/7	1.6 (0.4-6.0)	0.524
- No	130/100	Reference	
14. Villages did the evaluation of campaign			
- Yes			
- No	105/80	0.9 (0.3-3.0)	0.906
15. How often did the villages do the IRS?	38/27	Reference	
- At least 6 months each			
- Between 6 and 12 months each	48/43	0.5 (0.2-1.8)	0.308
- More than 1 year each	60/43	0.6 (0.2-2.0)	0.396
- Never	19/13	1.3 (0.3-5.5)	0.731
16. How often did villagers join the campaign?	16/8	Reference	
- All of the activities			
- Some of the activities	106/79	1.0 (0.5-2.4)	.931
	37/28	Reference	

Table 4.13 illustrates the significant associations among variables (characteristics and cooperation of villages) and the successful villages which is defined by the targeted impact API in year 3 decreased by at least 10% of year 2. For the results, the significant negative association was found between the health service (MP) and the successful village variable (p-value = 0.006). For the villages adjacent to the border, there was no significant association (p-value = 0.100). The variable of M2 migrants moving in-out of the villages were also not significantly associated as well (p-value = 0.108). There was not significant association between in distance and spending time in transportation to the nearest hospital at all levels. For the villages' cooperation, all malaria preventing and controlling activities were not found to be significantly associated at all.

CHAPTER V
DISCUSSIONS

The GFATM-R7 project was the great coordination among the Bureau of Vector Borne Disease (BVBD), the Principal Recipient (PR), and twenty-eight Provincial Health Offices (PHOs), all of which were under the Ministry of Public Health, Thailand. The GFATM-R7 project started in July 2008 and planed to finish in June 2013. The main objective of the GFATM-R7 was to make accelerated progress towards achieving the national welfare goals in Thailand by reducing the population at risk of malaria by at least 50% as well as morbidity/mortality rate by at least 50% in 2013.

The purpose of this evaluation study was to assess the effectiveness of the malaria control program under the GFATM-R7 project in malaria-endemic provinces. This study assessed the interim of project, July 2008 - June 2011, as part of the full five years of implementation. The purpose was also to evaluate the impact of this project in terms of the API and MPR compared between year 2 and year 3, and compared between year 3 and the targeted API/MPR which had to be decreased by 10% from year 2. Furthermore, this investigation analyzes the association among the variables to determine whether the successful villages were influenced by the GFATM-R7 project.

5.1 Characteristics of villages

According to the result chapter, there were 250 samples or villages that almost all of them were located along the international borders. This means that the GFATM-R7 project paid more attention for people residing and cross-passing the borders particularly in the ethnic or tribe groups in remote areas that the project had established the Malaria Posts for the malaria early diagnosis and prompt treatment (EDPT). The majority of ethnic groups in this study were Thai-Karen, they often

resided near the border where was far away from a hospital. Interestingly, over quarter of villages had the M2 migrants moving in and out of the villages, they always crossed the border to seek jobs and healthcares. They were likely to spread the malaria parasites to residents in those villages. Consequently, the GFATM-R7 project had to establish the Malaria Post for people in remote areas so that they could access to it quickly when they got malaria. In long term, the project expects the morbidity and mortality of malaria to decrease.

5.2 Cooperation of community

The community's cooperation was very important and essential part to help reducing malaria transmission by supporting resources and co-planning particularly the local government who had roles and responsibilities to serve the facilities for residents in their locations. It was necessary that the local government should cooperate with the GFATM-R7 project to overcome malaria problems. This study found that the local government had the co-planning and co-funding for malaria prevention and control while almost all of villages had the responsible committee for these plans. The village's committee in this intervention had a regular meeting at least for 3 months interval, but some villages had meeting more than three months even one year each. In a place where there was the regular meeting, they always did the meeting by talking about malaria situation analysis, monitoring and evaluation the malaria activities in their village, and making the decision for solving the problem. Moreover, the villages had the social rules for malaria prevention and control that could be really enforced the people to cooperate. For example, if someone goes to the jungle, he or she must take the ITN and use it overnight while sleeping. If anyone does not comply to the rules, he or she would be punished by social rules (i.e. do not get support of the additional rations and other advantages).

Regarding the activities of the GFATM-R7 project in villages, there were activities that the MPWs and all villagers work together for the malaria surveillance, prevention, and control. At the Malaria Posts in targeted villages, there was the malaria information such as the number of malaria cases, graphs or charts showing trend of malaria situation, map demonstrating malaria cases or areas, etc. Besides,

almost all of villages did the malaria campaign every year. If these co-activities of villages were continued throughout the project period, it would possibly bring the targeted achievement to their villages after full five years of GFATM-R7 project.

5.3 Number of performance outcomes of the GFATM-R7 project

According to the research results, most of performance outcomes of the GFATM-R7 project were summarized from the 460 malaria-endemic villages. In year 2 (2010), the API of Thais and M1 migrants in malaria-endemic villages was 29.6 per 1,000 population while the same figure in year 3 (2011) was 24.9. The API of the GFATM-R7 project was likely to decrease by about 15.9%. It corresponds to the country's API that decreased from 0.53 in 2010 to 0.35 in 2011. Unfortunately, since there were the outcomes for only two years, the study could not demonstrate the trend of APIs which should be at least 3 years to predict the malaria situation of this project. However, the existing APIs were likely to decrease in all parts; Thai-Myanmar 15.5%, Thai-Cambodia 36.4%, Thai-Malaysia 16.5%, Thai-Laos 7.0%, and non-border 16.2%.

For antimalarial treatment within 24 hours, the study found that the percentage of treatment was just 50.1% in year 2. Both Thai-Cambodia border and the others had the treatment lower than half (20.6% and 6.1%, respectively). Moreover, in year 3 the study found that the treatment within 24 hours was lower than year 2 (treatment of year 3 = 28.2%). It is very serious situation that the antimalarial treatment was lower than the target (50% for year 2 and 60% for year 3). If the fact that the patients delay getting starting the treatment, it might cause fatal complications, and spread parasite to others. Consequently, the rest of two years should increase the proportion of treatment in all sectors as possible.

The MPR of M2 migrants in malaria-endemic villages was 20.7% in 2010. Nevertheless, the following year (2011) was increased to 25.7%. It did not correspond to the country's MPR that decreased from 8.34% in 2010 to 6.76% in 2011. The study indicated that MPR was not decreased, because it was probably affected by the movement of migrant people to seek jobs and healthcares in the targeted villages under the GFATM-R7 project.

For the number of households owning at least one ITN, the overall number was more than 90% that means the people had ITN adequately. That was not a serious problem for first three years because the ITNs would be provided to residents throughout five years. This indicator was successful for targeting in the first phase.

5. 4 Comparison of the APIs and MPRs

According to the research result to compare the APIs by provinces between year 2 and year 3, the APIs in four of twenty-eight provinces (Tak, Kanchanaburi, Ratchaburi, and Surin) was significantly decreasing. Consequently, the large number of these provinces affected Thai-Myanmar and Thai-Cambodia borders to have the APIs decreasing as well. Lesson learn from this point, if we strongly conduct the malaria control program in the large malaria areas of these endemic provinces, it would be decreased the malaria numbers of country.

Obviously, almost all of provinces and few international borders, the APIs did not significant decrease in first three years. The reason might be resulted from shorter period of implementation and the project's assessment should be measured again at the end of full five years. Noticeably, the results of this study were not corresponded with the study of Carrara (24), which found that the total number of *P.falciparum* cases was reduced by a third one year after the deployment of EDPT, and at the end of two years the reduction of cases was 53%. Although her study was somewhat similar to this study, the meaning of this result implied the effect of the intervention's duration. For example, when the duration of this study was compared with Carrara's, the effect of results was different in the opposition way.

Regarding the Malaria Positive Rate, the study found that the MPRs in all of the provinces under the GFATM-R7 project were significantly decreasing between year 2 and year 3. On the other hand, some provinces had significantly increasing MPRs. As the results, the effect of the increasing MPRs in the province level possibly affected the MPRs of all levels. This finding could be explained that at the beginning of the GFATM-R7 project the program's announcement for testing malaria was accessed by all Thai people and migrants. Then they came to have the blood exam for

the malaria parasites more than usual, and consequently a lot of cases were detected. Therefore, this might cause the increase in the MPRs in first three year of the project.

Interestingly, some of the provinces had the deceasing API, but the MPR was increased. The measures of the two rates were completely different. API was measured for Thais and M1 migrants, but MPR was measured for the M2 migrants. This study found this discrepancy in many villages, especially the villages adjacent to the border and having the M2 migrants moving in-out of the villages. For the explanation, the Malaria Posts could detect M2 migrant malaria patients, then Thais and M1 migrants were less infected from parasites. This is the great usefulness of the establishment the malaria healthcare services in those villages along the borders.

5.5 Association between variables of the characteristics, cooperation of villages and the successful villages

According to the research results, the significant association was found between the health services (MP) and the successful village variables, but it was the negative association. This means that the Malaria Posts, which were located in the villages, significantly increased patients from the previous year. The effect might explain that the new, convenient malaria services were set up in villages resulting in more convenience for the patients to seek medical treatment than usual. It might cause the impact significant increased at the first three years. However, it might be indicated that many people utilized the Malaria Post for malaria treatment.

Interestingly, when the study took the variable of M2 migrants moving in and out of the villages to compare with the successful village variable by Bivariate Correlation analysis, it found that the variables were statistically significant associated. This means that moving in and out of the villages of the M2 migrants were likely to cause malaria problem in those villages. Practically, we could not forbid the M2 migrants to move in-out of the villages, but we could recommend them to get examination for the malaria infection whenever they feel unwell or suspect to get malaria. The EDPT was one of the strategies for malaria control program of the GFATM-R7, whoever gets malaria they should come quickly to the Malaria Posts.

Limitations

There were several limitations and weakness in this study. Among the limitations was a shorter intervention period that might affect the impact of the project or morbidity being not changed so much. For example, the APIs and MPRs were statistically significant changed in a few of twenty-eight provinces, but almost all of them were still not changed throughout the first three years of the GFATM-R7 project. This effect might happen at the beginning of the intervention period because people knew the establishment of the new health service (Malaria Post) for testing malaria in their villages. Then they came there for testing the malaria throughout the entire year instead of going to the other services which probably were far away from their villages. This was likely to result in more malaria patients and therefore the APIs and MPRs in those villages were increasing.

Another limitation was the lack of the performance outcomes of the project at the first year. At the beginning of the GFATM-R7 project, many functions and structures of the intervention were set up such as establishing the MPs in all targeted villages, recruiting and training some staffs (MPWs, MLOs, CHWs, MHVs, etc.), and orientating the project's details to responsible officers to understand this intervention, and so on. Furthermore, the program might delay purchasing the equipment for malaria diagnostic tests and malaria preventing materials (35). Consequently, the performance outcomes of the project in the first year were not fully completed in the collected data. The lack of the data in year 1 caused the comparison with the data in year 3 impossible; therefore the study needed to be replaced with the data of year 2 that was presented in result chapter.

CHAPTER VI
CONCLUSIONS

Four major conclusions can be made from this study. The first conclusion is that using the cooperation of community may accelerate the achievement progress of the project because the strength of the stakeholders was responsible for the decrease of malaria morbidity. The second conclusion is that the population at malaria-endemic villages had the ITNs covering more than 90% that could protect themselves from malaria. These two conclusions are the strength points of the project, and two following conclusions are the weak point. The third conclusion is that the malaria treatment within 24 hours was lower than the target that the project indicated at least 50% in 2010 and 60% in 2011. The last conclusion is that the overall API and MPR among Thais and migrants were not significantly decreased as the targeted impact of the GFATM-R7 project in first three years.

The first conclusion is that using the cooperation of community may accelerate the achievement progress of the project. We found that almost half of the local governments cooperated with the project by coping with the malaria problem in their villages; supporting the action plan and budget, procurement of chemicals for the mosquito vectors, and purchasing mosquito nets, etc. It was a great opportunity to encourage local governments to take more cooperation. Furthermore, the villagers' participation in this study participated in most activities. For examples, they had a regular meeting, talked about malaria situation analysis, monitoring and evaluation the malaria activities, and made the decision for solving the problems. Moreover, some villages had the social rules for malaria prevention and control. These are factors that can enhance the GFATM-R7 project to reduce the malaria morbidity in advance. Strengthening the stakeholders (villagers, communities, government, and non-government organizations) will increase knowledge-based decision and action that is a sustainable way to cope with malaria problems.

The second conclusion is that the population at malaria-endemic villages had the ITNs covering more than 90%. It was a successful campaign that households owned at least one ITN in three years of the intervention. Insect control is an essential part of reducing transmission. To date, two operational scale interventions, indoor residual spraying and deployment of long-lasting insecticide-treated nets (LLINs), are effective at reducing transmission. In long term, all of responsible persons (Malaria Health volunteers) need to monitor and evaluate this intervention.

The third conclusion is that the malaria treatment within 24 hours was lower than the target. This study found that the percentage of treatment was lower than the targeted indicators. By overall targeting, the percentage of results should not be less than 50% in 2010, and 60% in 2011. However, this study found the percentage of treatment was 50.1% in 2010 and 28.2% in 2011. The cause of result in 2011 was unknown. The explanation might be that the definition of records was unclear for the real practice, or patients might delay in seeking for medical treatment. The second reason seems to be more serious because the patients could possibly long transmit the parasites to others, or they could develop worse complications. Therefore, the project's monitor and evaluation need to be revised. Additionally, we considered that the Malaria Health Volunteers and Malaria Post Workers should understand and communicate this risk to all villagers. They should also enhance the IEC/BCC activities to villagers in order to be aware and come for early diagnosis and prompt treatment.

The last conclusion is that the overall of both API and MPR among Thais and migrants were not significantly decreased to meet the target of the GFATM-R7 project in three years. According to the previous mentions, there were many factors that might be affected the percentage of patients not to decrease in this project. One of the factors was the influx of both Thai and migrant patients with suspected symptoms of malaria. Before the GFATM-R7 project, they might be tested malaria parasite at other health services where were outside and far away from their villages. After the Malaria Posts were set up in their communities, the healthcare access and detection could be easily performed resulting in increasing the number of malaria records.

Although, the overall results were likely not be fully achieved some of activities of project. The researcher considered that the GFATM-R7 project was still

beneficial to the populations in remote areas including vulnerable persons who were have difficulty to access to healthcare, illegal migrants who crossed the border to seek work and healthcare, and the poor who could not pay for expensive medicines. This project provided all services free of charge to people particularly the antimalarial drugs and ITNs. These were valuable for populations in malaria-endemic areas, and the burden of malaria was likely to decline. If the Global Fund does not support the grant, the malaria burden will become problematic again. In order to be confident that the problem would not come back, the Global Fund should support continuously for several years. In the near future, when the Global Fund finishes the funding support, the local governments should intervene to run the project as one of stakeholders. In the long term, it is hoped that people might be aware and protect themselves from malaria with the correct behaviors.

Recommendations for future research

Based on the results of this study, there are several recommendations for future research. Firstly, the duration of the project's evaluation research should be longer period than this study because it might find the effects and the trend of the impact. Perhaps this study could possibly be continued to five years in order to see whether malaria control program could help to decrease malaria burden and make accelerated progress of malaria eradication program.

The collected data of this study such as cooperation of community were probably inadequate to describe the impact of the community-based malaria control program. Next research should add more samples, and should include in-depth interview in order to generalize the effect of program confidently.

Finally, this study only measured the API and MPR of GFATM-R7 project. Actually, there were many outcomes that were not measured in this study such as drug resistance, effectiveness of the RDT, effectiveness of the IEC/BCC, etc. Future studies should include all of these factors to assess the whole program.

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APPENDICES

APPENDIX A

Questionnaire

Part 1 Characteristic of village:

1.1 Type of the international borders that the provincial area is adjacent to
□ 1. Thai-Myanmar border □ 2. Thai-Cambodia border
□ 3. Thai-Malaysia border □ 4. Thai-Laos border
□ 5. Non-border

1.2 Village areas □ 1. Adjacent to border
□ 2. Not adjacent to border

1.3 Number of households..... (census in 2011)

1.4 Number of Thai residents..... (census in 2011)
Number of M1 migrants.....(census in 2011)
Number of M2 migrants.....(approximately on going in-out village per day)

1.5 The distance from village to the nearest hospital.....kilometres, and spending time for .....hours..... minutes (especially in rainy season)

1.6 The majority of ethnic people in village are;
□ 1. Thai □ 2. Thai-Myanmar
□ 3. Thai- Karen □ 4. Thai-Laos
□ 5. Thai-Cambodia □ 6. Thai-Muslim
□ 7. Others (Hmong, Moo Ser, Lee Saw, E Kho, Islander, etc.).....

1.7 The majority of the villagers' occupation
□ 1. Rice-farming □ 2. Crop-farming
□ 3. Searching for food in jungle □ 4. Fishermen
□ 5. Rubber or fruit plantation □ 6. Logger or forestry plantation
□ 7. Laborer (specify).....
□ 8. Others (specify).....

1.8 Where is the health service that most villagers usually go to when they got malaria?
□ 1. Malaria Post ; MP(under GFATM-R7) □ 2. Malaria Clinic
□ 3. Health center □ 4. All levels of Hospitals
□ 5. Private clinic □ 6. Others (specify) …….....

Part 2 Community's cooperation

2.1 Management of malaria prevention in village (find out from village's records or else)

2.1.1 The village has plans about the malaria prevention and control that are assigned in operational plan of the local government from 2009 to 2011

□ 1. Yes □ 2. No (proceed to 2.1.4)

2.1.2 According to 2.1.1, the operational plans had already considered by the village's committee comprising of;

1) Village's authority □ 1. Yes □ 2. No
2) Member of local government □ 1. Yes □ 2. No
3) Health officer □ 1. Yes □ 2. No
4) Village health volunteer / MPW □ 1. Yes □ 2. No
5) Other members □ 1. Yes □ 2. No

2.1.3 For operational plans in 2.1.1, the village has the responsible persons who have role and responsibility for malaria preventing and controlling plans.

□ 1. Yes □ 2. No

2.1.4 There is the malaria preventing and controlling committee in village that comprise of;

1) Village's authority □ 1. Yes □ 2. No
2) Member of local government □ 1. Yes □ 2. No
3) Health officer □ 1. Yes □ 2. No
4) Village health volunteer / MPW □ 1. Yes □ 2. No
5) Other members □ 1. Yes □ 2. No

2.1.5 According to 2.1.4 the committee has the regular meeting;

□ 1. at least 3 months each.
□ 2. between 3 and 6 months each.
□ 3. between 6 and 12 months each.
□ 4. more than 1 year each.
□ 5. Never

2.1.6 According to 2.1.5 how often the meeting records were held?

□ 1. Always
□ 2. Sometimes
□ 3. Never

2.1.7 According to 2.1.5 what issues are they talking about and how often?

1) Malaria situation analysis for their village
□ 1. Always □ 2. Sometimes □ 3. Never
2) Monitoring and evaluation the malaria activities in their village
□ 1. Always □ 2. Sometimes □ 3. Never
3) Consider the alternative way to solve the problems
□ 1. Always □ 2. Sometimes □ 3. Never

2.1.8 Have the village's committee regulated for malaria prevention and control?

□ 1. Yes (remarks).....
□ 2. No (skip to 2.2.1)

2.1.9 According to 2.1.8, if the village have the regulations, the monitoring could be undertaken for real action.

□ 1. Yes (for example).....

□ 2. No

2.2 The operation of malarial surveillance, prevention, and control

2.2.1 There are the malarial information at Malaria Post;

1) Number of patients for monthly report and cumulative

□ 1. Yes □ 2. No

2) Graphs or charts show trend of malaria situation

□ 1. Yes □ 2. No

3) Map illustrates malaria cases or areas which contained malaria cases

□ 1. Yes □ 2. No

2.2.2 Between 2009 – 2011, village has done the malaria campaigns such as; health education, environmental setting for malaria prevention, etc.

1) Year 2009 □ 1. Yes □ 2. No

2) Year 2010 □ 1. Yes □ 2. No

3) Year 2011 □ 1. Yes □ 2. No

2.2.3 According to 2.2.2, how often did the community join with some activities of malaria campaigns in their village?

□ 1. All of the activities

□ 2. Some of activities

□ 3. Never

2.2.4 According to 2.2.3, the community had evaluated the malaria prevention and control.

□ 1. Yes

□ 2. No

2.2.5 How often have village done for Indoor Residual spraying between 2009 and 2011?

□ 1. at least 6 months for each spraying

□ 2. Between 6 and 12 months for each spraying

□ 3. More than one year for each spraying

□ 4. No spraying throughout three years

Part 3 The Performance Framework reports of the GFATM-R7 Year 1-3

Number of outcomes	Year		
	2009(Jul08-Jun09)	2010(Jul09-Jun10)	2011(Jul10-Jun11)
3.1 Number of Thai people and M1 migrants in Village			
3.2 Number of malaria cases (Thai and M1 migrants) from malaria health services			
- Malaria Post ; MP			

Number of outcomes	Year		
	2009(Jul08-Jun09)	2010(Jul09-Jun10)	2011(Jul10-Jun11)
- Malaria Clinic ; MC			
- Health center			
- District or Community Hospital			
- General/Tertiary Hospital			
- Others			
Total reported cases			
3.3 Annual Parasite Incidence, malaria cases per 1,000 population			
3.4 Number of M2 migrants who were tested for malaria infection			
3.5 Number of M2 migrants who were found malaria			
3.6 Percentage of M2 migrants who were found malaria			
3.7 Number of households of village			
3.8 Number of households owning at least one ITN			
3.9 Percentage of Thai and M1 migrants who have good Knowledge			
3.10 Percentage of Thai and M1 migrants who have good attitude			
3.11 Percentage of Thai and M1 migrants who have good practice			
3.12 Number of Thai and M1 migrants with fever who were tested for malaria			
3.13 Number of Thai and M1 migrants who had malaria, and they were cured by antimalarial treatment within 24 hours			
3.14 Number of LLINs distributed to Thai and M1 migrants			
3.15 Number of LLINs distributed to M2 migrants			
3.16 Number of existing ITNs reimpregnated			
3.17 Number of targeted population reached by IEC/BCC activities			
3.18 Number of people reached through home visit by health volunteers			

APPENDIX B

The GFATM Round 7 (The PR-DDC, Thailand, 2008)(4)

1. Project description

Although, overall burden of malaria in Thailand has fallen dramatically in the last 10 years, the serious challenges are contributing factors include migrants from Myanmar in the West and serious civil conflict in the South. Nationwide, there are an estimated 2.5 million migrants half of whom are illegal. They were living in malaria-endemic area, registered migrants do not benefit fully from official health services due to discrimination. Illegal migrants are particularly vulnerable as they are not entitled to any public-sector services. This project namely "Partnership towards malaria reduction in migrant and conflict-affected population in Thailand" supported by The Global Fund Round 7 can solve these challenging problem.

In 2004-2008, a GFATM-R2 project targeting 300 villages had partially addressed the situation by setting-up additional malaria posts at village level, improving ITN coverage and surveillance system. Nevertheless, the GFATM-R2 project does not specifically target migrants and did not plan for impregnated bed nets and drugs for the most vulnerable migrant population. This GFATM-R7 project will ensure maximum coverage of population at risk by 2013 to reduce transmission area and numbers of malaria-endemic villages; besides, to increase unregistered migrants to access malaria services.

The budget for the GFATM-R7 project is supported by the Global Fund, US$ 24,689,670 over 5 years (2009-2013). The overall goal is to make accelerated progress towards achieving the national welfare goals in Thailand by further reducing the population at risk of malaria by at least 50% and morbidity/mortality rate by at least 50% in 2013. Impacts by 2013 will include: (i) the population at risk in endemic areas will decline from 2,276,974 in 2008 to 1,372,317 in 2013, (ii) the API including

migrant population will decline from 1.34 to 1.00, (iii) More unregistered migrants will access basic malaria healthcare.

The overall goal of the proposal is to reduce the malaria burden among the resident population and migrants in endemic areas, mainly situated in provinces bordering Cambodia, Lao PDR, Malaysia and Myanmar. Main objectives will be to ensure the whole population at risk are able to access malaria services when and where needed, backed up by necessary measures to increase the knowledge of populations at risk and by increasing capacity of provincial and NGO staff to manage and monitor interventions. By the end of 2013 or at the end of the project period, a 50% reduction in the national Annual Parasite Incidence (API) and 50% reduction in the number of people living in malaria endemic areas are expected to be achieved through 4 major objectives and 9 Service Delivery Areas (SDAs) as follows:

Major Objectives

Objective 1: To improve access to early diagnosis and treatment of malaria among vulnerable populations.

Objective 2: To improve access to effective malaria prevention measures among vulnerable populations

Objective 3: To increase effective utilization of impregnated bed nets by the population at risk and encouraging patients with fever to access early diagnosis and prompt treatment.

Objective 4: To improve the overall functionality of malaria control among vulnerable populations

Service Delivery Area (SDA)

Programmatic activities conducted 3,345 endemic villages in zones A1(460 villages) and A2(2,285 villages) and target also migrants. The SDA are to enhance achievement of objective 1-4 and to facilitate and improve implementation of the corresponding 9 SDAs, as follows:

SDA 1 Case management: Increasing access to early diagnosis and prompt effective antimalarial treatment. Basic health services for malaria diagnosis and treatment will become more accessible to the target population through

the establishment of village-level Malaria Posts (MP) and existing Malaria Clinics (MC). The MPs will be managed by Malaria Post Worker (MPW), supplied with Rapid Diagnostic Tests (RDT) that can detect *P. falciparum* and *P.vivax* infections as well as with ACTs supported by updated guidelines and supervised by district staff or liaison officers in villages where the proportion of migrants is very high (>50% of the total population). Key measurement indicators include the proportion of targeted villages where provision of early diagnosis and treatment is set up , an increasing proportion of M1-migrants (through village surveys) and number of M2-migrants (MP records) accessing healthcare services.

SDA 2: Prevention: Long-lasting nets (LLINs). The provision of LLINs to Thai and M1-migrants in A1 and A2 malaria-endemic areas who have not mosquito nets or are not covered by Indoor Insecticide Residual spraying operations. M2-migrants (who are highly mobile and more difficult to trace) who have contact with MP staff and who are confirmed to be malaria infected shall be provided with one LLIN. The indicator is the proportion of villages with at least one LLIN per two people.

SDA 3: Behavioural Change Communication (BCC) -community outreach. This SDA will promote and enhance the performance of activities described in objectives 1 and 2. Activities include the development and reproduction of culturally-appropriate IEC materials in local languages for migrants and southern residents to be used during health worker's home visits, mass communication campaigns, and education sessions and as part of school training package.

SDA 4: Supportive environment: Coordination and partnership development. Under this SDA, provincial health management committees will be set up and monthly meetings will be conducted to review progress made against essential planning activities. Appropriate measures on program related issues will be taken and arising concerns will be expressed and addressed. Effort will be made to involve in such meetings many interested stakeholders, particularly community members and plantation owners (who's labor force is exposed to increased risk of malaria infection through work) in order to increase both political and private interest to address migrant health concerns.

SDA 5: Health Systems Strengthening: Community systems strengthening. In high endemic A1 areas, a network of Migrant Health Volunteers (MHV) in migrant communities, and Community Health Workers (CHW) in the southern provinces, shall be formed, tasked to perform a wide range of health services from patient screening clinical diagnosis, referral to MP, treatment follow-up through home visits and health education sessions / campaigns. In A1 endemic areas, where concentrations of migrants are very high, MHVs will be supervised by Migrant Liaison Officer (MLO); on the basis of one MLO per 10 villages, who is based in the Health Center and who will serve as a link to addressing barriers between MHVs and Governmental healthcare facilities. Each MLO as part of its supervisory and monitoring function will conduct monthly meetings with the MHV. Both the MHV and MLO will be trained using a developed training curriculum. MHVs, CHWs and MPWs will also be supervised by district staff under the PHO.

SDA 6: Supportive environment: Monitoring drug resistance: Multidrug-resistant *falciparum* malaria is a major problem in Thailand and decisions on anti malarial drug policy change is based on results generated by in vivo therapeutic efficacy studies regularly conducted in representative sentinel sites. Major activities related to drug resistance monitoring are as follows: 1) in vivo therapeutic efficacy studies in patients, 2) in vitro sensitivity of the parasite to the drugs, 3) molecular studies to exclude resistant parasites from re-infection as well as exploration of drug resistant molecular markers 4) pharmacokinetics of the drug in patients to address issues linked to absorption, distribution, metabolism and excretion of the drugs and 5) drug quality including the identification of fake drugs. Networking is also encouraged among partners interested in monitoring drug resistance such as universities and NGOs which will the same protocols and will exchange relevant data.

SDA 7: Supportive environment: Technical monitoring and quality assurance. A routine system to monitor quality of RDT both from manufacturers and from the field shall be put in place using WHO guidelines. Teams to test RDTs coming from the field will be trained. Indicator used will measure the proportion of purchased RDTs which have been quality tested. The indicator will measure the proportion of tests checked against those received.

SDA 8: Information system and M&E. A "Knowledge, Attitudes and Practices" (KAP) survey will be conducted to gather baseline information on target population and areas that serve as basis for designing activity strategies and implementation. An important activity will focus on strengthening capacity of provincial staff in database management and reporting. Regular supervisory monitoring and evaluation visits by all levels are conducted using program developed reporting forms. Reports will reflect program indicators on an annual and semi-annual basis. The midterm and final evaluation with external experts involvement will be conducted after 18 months project inception and during the last year of the project. Indictors will focus on measuring the number of provincial staff trained in database management on the basis of 3 staff per province (A1 and A2) and on the measurement of the proportion of bi-monthly supervision visits made against planning in A1 areas.

SDA 9: Service delivery. Strengthen the administrative, technical and functional capacity of the PR and SRs in the form of capacity building, staffing, material support for administration, monitoring and evaluation, infrastructure rental and transportation. The main indicator proposed will measure the number of A1 provinces which have a dedicated and performing program assistant managing the Global Fund Round 7-supported program.

2. Project implementation

The project has been managed by the Principal Recipient Administrative Office of Department of Disease Control (PR-DDC). PR-DDC has used its existing structure, to provide the strategic coordination, administrative support, and project monitoring and evaluation to the sub-recipients (SRs). The SRs; BVBD, ARC and MORU-SMRU submitted their annual work plan and budget to the PR for approval. They have also submitted quarterly progress reports as well as financial reports to the PR. PR should disburse the requested budget according to the performance of each SR. The PR will be submitting their progress reports along with requesting disbursement to the Global Fund semi annually.

The Department of Disease Control (DDC), as the Principal Recipient, has developed its procurement and supply management system of health products and

medicines based on the government policy and regulation set up by the Ministry of Public Health and the Ministry of Finance including the National Malaria Drug Policy Committee.

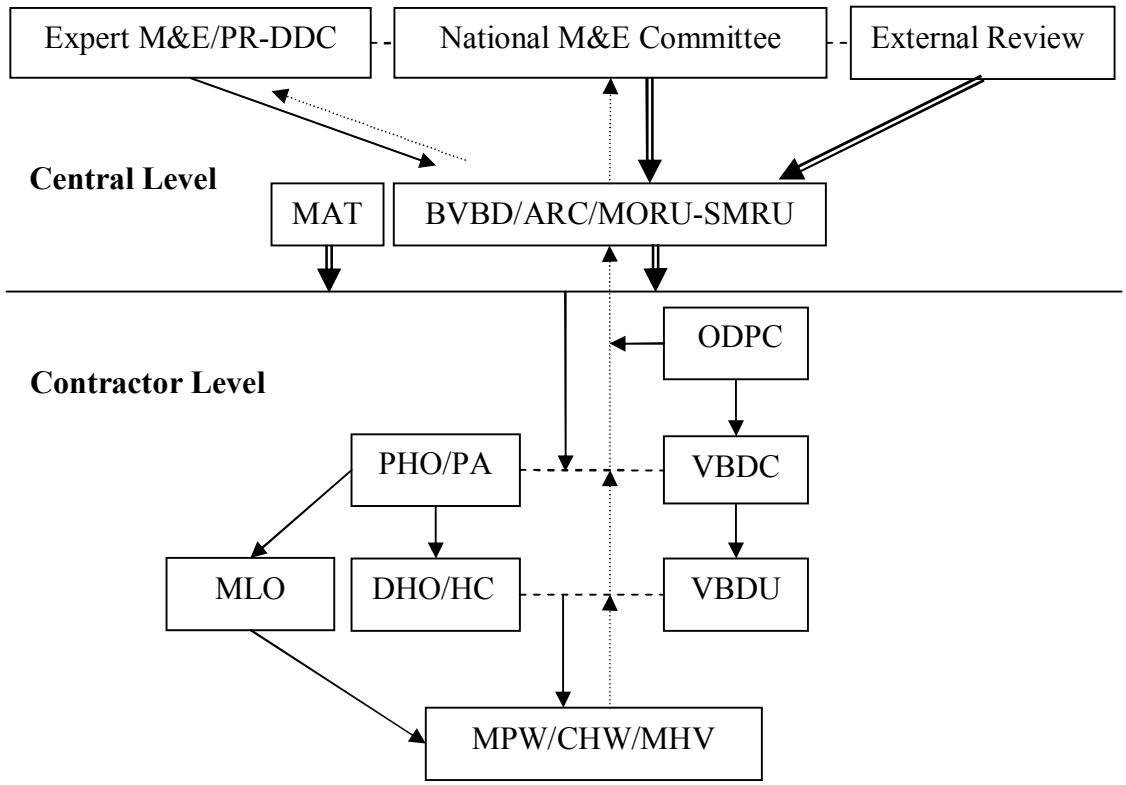
The Bureau of Vector Borne Diseases of the DDC, as the National Malaria Control Program Manager, will be responsible for procurement and supply plan development and management based on the need of the contractors (mostly are provincial health offices). DDC will be distributed malaria drugs, ITNs and RDTs and the budget to all SSRs.

3. Project Monitoring and Evaluation

Monitoring and evaluation plan and system has been established at both the central level and contractor level to regularly monitor and evaluate. The BVBD, the sub-recipient of the project, will report the progress of the project up to the national system. In addition, monitoring and supervision will be also conducted to provide technical guidance and help solve the management obstacles of the project. Meetings to share information and monitor the progress report among all partners will be quarterly conducted.

The proposed malaria control program will be implemented by multi-partners of the BVBD as the National Malaria Control Program Manager; Mahidol-Oxford Tropical Medicine Research Unit's Shoklo Malaria Research Unit (MORU-SMRU); American Refugee Committee (ARC) and also Malaria Association of Thailand. Therefore, harmonization and standardization of data collation, reporting system including monitoring and evaluation system of all partners at all levels will be carried out and should be integrated into the national monitoring and evaluation plan and system. However, to ensure the effectiveness of these activities and to build the capacity of project health personnel on M&E, technical expert of international standard on monitoring and evaluation system is also needed. The procedures of Monitoring & Evaluation and Data management of GFATM-R7, as follows:

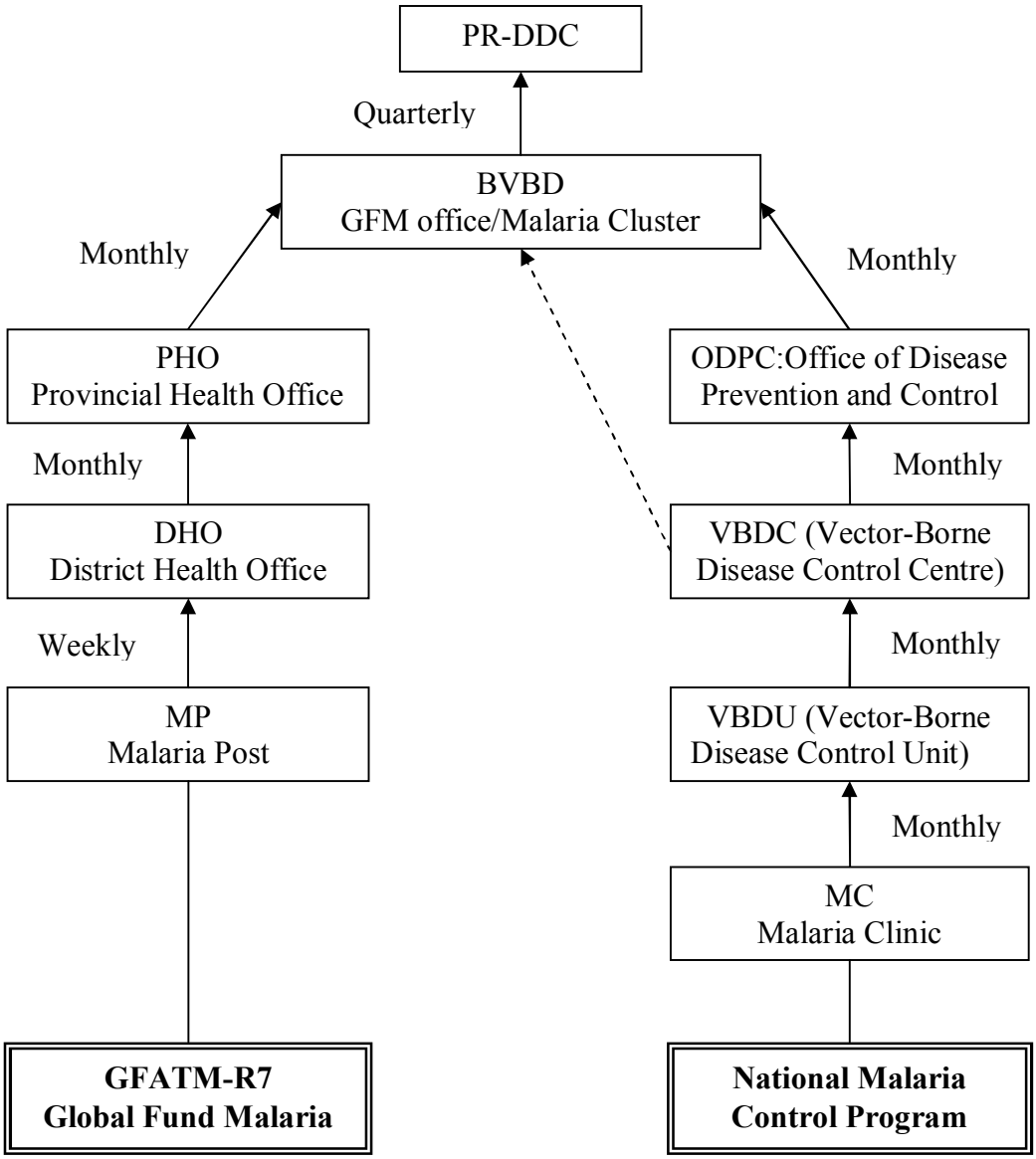
Monitoring and Evaluation of GFATM-R7 project



Abbreviations in the bracket are the responsible organizations. BVBD (Bureau of Vector Borne Disease), Mahidol-Oxford Tropical Medicine Research Unit's Shoklo Malaria Research Unit (MORU-SMRU), American Refugee Committee International (ARC), MAT (Malaria Association of Thailand), ODPC (Office of Disease Prevention and Control), VBDC (Vector Borne Disease Control Center), VBDU (Vector Borne Disease Control Unit), PHO(Provincial Health Office), DHO (District Health Office), HC (Health Center), CPW (Community Post Worker), MPW (Malaria Post Worker), MLO (Migrant Liaison Officer, MHV (Malaria Health Volunteer), CHW (Community Health Worker)

..... → data flow
——→ monitoring line
═══→ evaluation line
--------- correlation line

Data management Procedures of GFATM-R7 project



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PUBLICATION / PRESENTATION	…… ……..…….. ……..……..……..... ……..