II. The Project site

The project site based in Stung Keo commune, Kampot district, and the distance from the commune to the provincial town is about 40 km. This commune is a newly developed region located in the North West of the provincial town in the mountainous forest fringe area and under the health service coverage of the health center Kampong Kreng. As the forest-dependants, the main income of villagers is generated mostly from forest products such as wood, charcoals, wild animals, bamboo etc...Since the problem of accessibility to receive the health delivery from health facility in the catchment areas and in order to institute an effective malaria control and monitoring system in that remote community, six villages were selected for the pilot study. The 6 villages are as follow Dong, Malech Kul, Anlong Mac Prang, Trapang Kok, Damrei Phong and Kampong Chen villages. The current total population in the Stung Keo commune is 6,046 persons with the land area 348.6 Km^2 (34,860 Hectares). The density of the study area is 17.34 / Km^2 with the ethnic minorities about 15%.

III. Aim of the project:

The aim of the project is to strengthen the monitoring of the existing volunteer network with the further integration of other operational and feasible interventions to reduce malaria morbidity and mortality in the newly developed area (Stung Keo Commune)
In order to prevent malaria epidemics in the region, it is vital to closely monitor malaria incidence and prevalence and investigate malaria risk factors such as migration, land transformation and residents' behavior change.
This project will meet the urgent need to investigate and control local malaria cases as well as to monitor and prevent possible malaria epidemics.

IV. Objectives of the Project:

1. To integrate and decentralize the re-impregnation activities to volunteers through ITN training with the direct monitoring from the HC, OD and PHD.
2. To oversee the malaria incidence and epidemiological trend in the villages, especially the pregnant women and children under five.
3. To monitor the volunteers' performance related to the malaria control activities based in the community.
4. To strengthen the community's knowledge and practice through the active health education through the community-based network for preventing them from malaria and making them accessible to get the prompt and correct treatment at public health service.

V. The implementing agency:

The National Center for Parasitology, Entomology and Malaria Control is the implementing agency of this project in coordination with the concerned Provincial Health Department, Operational District, Health Centre for their active participation in all the activities of this project with the help of Village Malaria Workers at the village level. All supplies and other demands needed during the project period are provided

from the budget received by the project as a grant but National Malaria Programme distributed impregnated nets to the project area.

VI. Summary of the results of the activities implemented during the project period

A) Integrated training on malaria intervention for the village malaria workers

The integrated training was organized in order to incorporate the malaria prevention intervention for an effective malaria control by increasing the insecticide treated net(ITN) coverage in the piloted villages and to strengthen the capacity of village malaria workers and the provincial supervisory team for monitoring the malaria incidence in the study villages.

The contents of the training relating mainly to net retreatment, utilization and its care taking (before and after the re-treatment), especially the record writing were also offered to the volunteers. The demonstration for the net re-impregnation was carried out inside the classroom and in the community. When the training course was finished the ITN kits were provided to the volunteers for implementing the retreatment activity in their own villages.

B) The monitoring of the malaria incidence and epidemiological trend in the study villages

In order to monitor the malaria incidence and epidemiological trend of the villages, especially, to follow up the malaria situation in the villages and provide early warning of the malaria outbreak, the malaria data was collected through the village volunteers based in the villages. The supervisory visit from the routine monitoring team from the National Malaria Center, Provincial Health Department, Operational District and Health Center also involved in those routine activity. Most of the malaria cases recorded and treated was the patients who came back from the forest where the high malaria transmission occurred in those areas. From September 2007 to February 2008, a total of 329 patients were tested by rapid diagnosis tests (Paracheck) and 217 patients were positive. Among the malaria positive cases, around 85% is the male aged between 15 to 49 years old and 15% for the age group from 15-49 female. Although the malaria increased in phase III but the positive rate was decreased about 14% i.e from 80% to 66% if compare with same period of the project implementation in phase II. The results of the malaria data collected in the study villages from Sep. 2007 to Feb. 2008 could be depicted in the following tables:

Malaria cases collected in 6 study villages from Sep.2007-Feb.2008

Month	RDT used	RDT positive	0-4 y	5-14 y	15-49y M	15-49y F	> 49 y M	> 49 y F
Sep/07	50	38	0	0	24	14	0	0
Oct/07	54	36	0	0	27	9	0	0
Nov/07	61	46	0	0	42	4	0	0
Dec/07	74	52	0	0	48	4	0	0
Jan/08	31	21	0	0	21	0	0	0
Feb/08	59	24	1	2	20	1	0	0
Total	**329**	**217**	**1**	**2**	**182**	**32**	**0**	**0**

Monthly malaria positive cases in the monitoring villages

Month	Sep	Oct	Nov	Dec	Jan	Feb	Total
Anglongmakprang	9	14	16	14	9	10	**72**
Kampongchen	9	6	8	7	4	3	**37**
Dong	3	6	8	11	2	2	**32**
Maleckul	7	3	9	8	2	2	**31**
Trapangkok	7	5	2	10	2	4	**30**
Dorei Phong	3	2	3	2	2	3	**15**
Total	**38**	**36**	**46**	**52**	**21**	**24**	**217**

Monthly malaria in pregnant women in the monitoring villages

Month	# pregnant women in Commune	Total RDT used	RDT positive	RDT Negative	Positive rate
Sep/07	51	14	3	11	21
Oct/07	61	12	2	10	17
Nov/07	61	3	0	3	0
Dec/07	51	0	0	0	0
Jan/08	55	6	0	6	0
Feb/08	33	30	1	29	3
Total	**312**	**65**	**6**	**59**	**9**

The blood survey was also conducted in order to evaluate the malaria prevalence comparing to the baseline survey before starting the study. 308 villagers were randomized screening during the survey. The overall slide positive rate in the study commune is only 3.6%, so it decreased if compare with baseline survey in 2005 (5.8%). The reduction also observed in Pf from 4.9% to 2.3% and little increase in Pv from 0.9%-1.3%. The findings of the findings could be summarized in the below table:

The results of the blood surevy in phase III

No	Name of Village	No of blood slides	No of slide positive	P. Vivax	P. falciparum	Mixte(Pf+Pv)
1	Malech Koul	52	3	3	0	0
2	Anlong MacPrang	50	0	0	0	0
3	Dom Rei Phong	55	7	0	7	0
4	Kampong Chen	50	1	1	0	0
5	Dong	50	0	0	0	0
6	Trapang Kok	51	0	0	0	0
Total		**308**	**11(3.6%)**	**4(1.3%)**	**7(2.3%)**	**0**

C) <u>The monitoring of the volunteers' performance related to the malaria control activities based in the community</u>

Since the education of the VMWs is limited and the training course just organized in a short period, so the technical supervisory support and other assistance are very important and extremely useful for the pilot project. For providing the malaria diagnosis and treatment's accuracy and ensuring the appropriateness of VMWs' work, particularly, for preventing the drug resistance, the supervision of the

volunteers' activities has been conducted routinely to examine their activities related to the malaria diagnosis and treatment. The supervisory team from OD/HC staff has checked the records written, RDTs and malaria drug used by volunteers for the accuracy and appropriateness of their work to ensure that they followed the national malaria guidelines and refer the severe and complicated malaria patients to the nearest public health facilities. The supervisory team also assessed the project satisfaction and volunteers' performance in order to improve the activity of the project in future. According to the result received, more than 90% of the villagers sought treatment from the VMWs as the first choice of treatment and nearly 100% of them gratify with the project activity and the performance of the VMWs in their community.

D) Strengthen and increase the community's knowledge on malaria prevention through the active health education and ITN distribution by using the community-based network

Since the health education is one of the important factors for success of any program on the lines of prevention is better than cure, the expansion and participation of the other health educator groups within the community is a very crucial issue to consider in the implementation of the project. During the project period, 75 health education sessions were provided to the study villages and 3,750 villagers participated in the events. 1807 ITNs were distributed and 823 nets were re-impregnated by village volunteers, so the ITN coverage is 100% in the study villages.

E) The monitoring of the other indicators on changes related with demographic and environmental indicators in the study villages

In order to detect and evaluate the other changes in addition to the malaria data, other data were also monitored from the study villages such as the demographic information, including number of household, total population, population increase, land transformation etc...

The additional indicator monitored in the Stung Keo commune

Month	Total HH	Total pop.	HH increase	Pop increase	Land transformation (in Hectare)	Fever patients	RDT positive	Refer to HCs
Sep/07	976	5395	0	0	194	50	38	0
Oct/07	976	5395	0	0	112	54	36	0
Nov/07	1069	5695	12	49	72	61	46	0
Dec/07	1069	5695	0	0	2	74	52	0
Jan/08	1092	6046	16	46	9	31	21	1
Feb/08	1092	6046	0	0	0	59	24	0
Total	**1092**	**6046**	**28**	**95**	**389**	**329**	**217**	**1**

VII. Discussions and conclusions

- From the onset of the project so far, 204 households (888 HHs-1092HHs) have been increased in the Stung Keo (23%) and the population also augmented from 4498 to 6046 people (43.41% increase).i.e the population at risk enlarges study areas.
- From year 1 to year 3 of the study period, 893 hectares of land was transformed for farming, especial raised up in the last year of the project (389 hectares). Therefore, it leads to the increase in the number of people that expose to malaria transmission in the study commune.
- The malaria cases monitored in the study project have gone up from year to year of the study project (from 101 cases to 217 cases during the similar period of monitoring the last 2 years. So it reflects the strong association with the trend of land transformation in this commune.
- The positive rate was dropped from 80% to 66% (14%) when compared to the same duration of year 2 and year 3 of the project though the malaria cases in the study period have been lifted up.
- The malaria patients for RDT positive in the age group 5-14 was decreased from 20% in phase II to only 1% in phase III. However the increasing rate was obviously observed in age group 15-49 year male and female from 67% to 84% and 7% to 15% respectively. So there is the shift of risk age group exposed to malaria transmission since 99% of the malaria cases in year 3 contributed from the age group 15-49.
- The referral cases were reduced from phase I to phase III of the monitoring because of the active health education conducted, the ITN distribution and net re-impregnation in the project site, especially the early diagnosis and prompt treatment provided by the village volunteer network in the study areas.
- Since the trends of migration and population movement increase from year to year to the newly developed areas where the malaria transmission is very high and the study period is short, it is important to continue to conduct further studies to get more information on the mobile population for assessing the epidemiological, epidemiological including the drug resistance, the Pv trend, demographical, geographical indicators and other factors. This could help to identify the effective malaria intervention measures in those affected areas and follow up the tendency of the changes in the study areas.

VIII. Acknowledgements

We would like to express our profound sincere thanks and gratitude to the Ministry of Health, Welfare and Labor, Japan, for generous support to the national malaria control in Cambodia , especially the heartfelt thanks to the General National Institute of Infectious Disease, Japan for their kind assistance in coordinating and make the project operate successfully. A special thanks also to the study project staff at national and provincial levels VMWs for their hard work to contribute to the project.

Annual Report for April 2007-February 2008

Project title: Training for Validation of Loop-mediated isothermal amplification (LAMP) assay for malaria diagnosis

Principal Investigator:
Jeeraphat Sirichaisinthop, M.D.
Director, Vector Borne Disease Training Center
Phrabuddhabat, Saraburi 18120, Thailand

Research activities:

Rapidity and precision of malaria detection in human blood samples is important for prompt treatment which is important for reduction of the diseases severity and transmission in the endemic area. Precise diagnostic tools are considered helping saving lives in locations like Thailand where MDR, Multi-Drugs Resistance, is of great concern. Conventional PCR is complicated to use at malaria clinics or replace microscopic examination in a remote malaria endemic area. Loop-mediated isothermal amplification (LAMP) is found to be highly specific, very sensitive and very rapid comparing to regular PCR method and does not require sophisticate equipments. LAMP which is specific for all 4 human malaria species has been developed under collaboration with Dr. Takafumi Tsuboi, Ehime University, Japan and Dr. Jetsumon (Sattabongkot) Prachumsri, AFRIMS, Thailand and we propose to validate LAMP assay for feasibility to use as rapid diagnosis of malaria at malaria clinics. As our Vector Borne Disease Training Center has accessed to malaria patients and population in malaria endemic areas in Thailand so blood samples that has been used for evaluation of this method were collected from patients and asymptomatic population in malaria endemic areas in Thailand.

The Specific Aims:

1. To collaborate with field staff at malaria clinics in order to identify risk and malarious areas for sample collection.

2. To facilitate on site training on LAMP assay. If the LAMP assay proved to be relatively simple to be performed by staff at Maesod clinics, then expansion of training for clinics in other malaria endemic areas will be planned.

Progress for period of April 2007-February 2008

Validation of Loop-Mediated Isothermal Amplification (LAMP) for malaria diagnosis and trainings:

Developing LAMP technique has been validated at field clinics. Staff from Vector Borne Disease Training Center have help organizing and facilitated on site trainings on LAMP assay for assigned personnels from Vector Borne Disease Training Center and Maesod malaria clinics. Data and information on trainings has been collected for analysis in order to revise and expand suitable trainings for other settings of malaria clinic as well.

Future Plan:

Validation of LAMP for diagnosis of malaria at field clinics has been planned to be brought to larger scale in 2008-2009. Trainings of staff at different settings of malaria clinic will be conducted to support the validation.

Summary Report for April 2006-February 2008

Project title: Construction of net work on epidemiology and control of malaria in Asia and Pan-pacific area

Purpose: Because of the recent progress of malaria control, mortality and morbidity due to *Plasmodium* infection have dramatically decreased in Asia. This change in epidemiology has resulted in inadequacy of the indicators and systems that had been used for many years. Drug resistant malaria still poses a significant public health threat to the world. The design and incorporation of chemotherapeutic intervention may be essential for the next step of malaria control. In order to promote communication and exchange of the information of malaria, network of institutes among Asian countries and Pacific Rim should be constructed and strengthened.

Specific Aim:

1.To validate loop-mediated isothermal amplification for a rapid diagnosis of malaria parasite in human blood samples in comparison with microscopic examination as gold standard.

2. To identify risk and malarious areas for sample collection.

3. To identify any changes or trends in malaria pattern in Thailand.

4. To facilitate on site training on LAMP assay.

Summary of Research Activities:

Epidemiology of malaria in Thailand has been reviewed as critical factors affecting malaria situation in Thailand. These factors are migrant population and MDR , Multi-Drugs Resistance, malaria. Different parts of the country plays different roles on malaria seasons. While western border of Thailand is responsible for malaria in rainy season, Thai-Cambodia on the East is responsible for Winter malaria. It has been revealed that vivax malaria in this region has shown a relatively increasing trend during the last decade. Thailand also experienced the same trend througout the country except in the South of Thailand where falciparum showed a bigger proportion.

Malarious areas and some hot spots have been identified to help planning for selection of locations and time most suitable for validation of LAMP in Thailand. Field staff have been trained to use LAMP at malaria clinic level where most of cases at grass root level were detected. Data has been collected for development of LAMP and expanding of training to other malaria clinics as well.

REDUCTION OF THE FREQUENCY OF EPIDEMICS THROUGH BETTER STRATEGIES USING THE PRESENT MALARIA INFORMATION SYSTEM IN SOLOMON ISLANDS

BY

BERNARD BAKOTE'E

A joint study between the Solomon Islands Medical Research and Training Institute and the National Institute if Infectious Diseases, Tokyo.
2006-2007

REDUCTION OF THE FREQUENCY OF EPIDEMICS THROUGH BETTER STRATEGIES USING THE PRESENT MALARIA INFORMATION SYSTEM IN SOLOMON ISLANDS

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4.2.DETERMINE IF THE PRESENT PASSIVE-ACTION STRATEGY IS EFFECTIVE

4.3. ANALYZING BOTH METEOROLOGY AND MALARIA DATA TO DEVELOP A SYSTEM THAT COULD ASSIST MALARIA OFFICERS IN PREDICTING EPIDEMICS AND FORCASTING MALARIA CASES. HENCE RESPONDING IN TIME, WHILE WAITING FOR MALARIA DATA TO ARRIVE FROM THE CLINICS

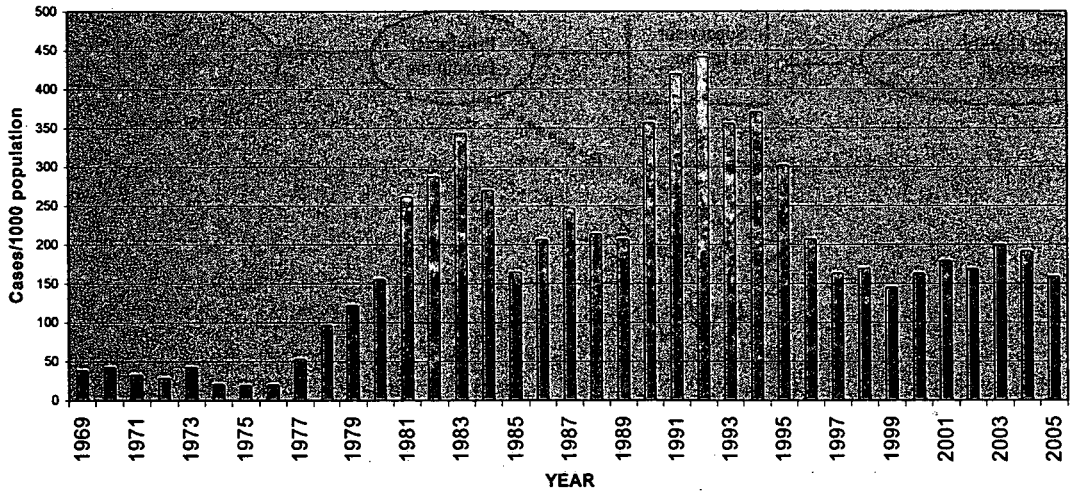
REDUCTION OF THE FREQUENCY OF EPIDEMICS THROUGH BETTER STRATEGIES USING THE PRESENT MALARIA INFORMATION SYSTEM IN SOLOMON ISLANDS

1. INTRODUCTION.

The Solomon Islands through the Vector Borne Disease Control Programme (VBDCP) has been waging a war against malaria since 1969. Malaria has been the main health problem in this island nation then and is still the main health problem. In 1992 malaria incidence in the Solomon Islands increased to 440 cases/1000 population(fig.1). The highest malarious country in the Western Pacific Region. The country with its natural beauty tried to attract tourism to improve its economy like the other Pacific Countries but could not, because of malaria. Malaria has also affected the performance of school children in education and the production of agriculture.

A lot of achievements had been made since 1992. Malaria has been reduced from 440 cases/1000 population in 1992 to 191cases/1000 population in 2004. In 2005 it was reduced to 158.2 cases/1000 population (fig.1).

Fig. 1: MALARIA TREND FOR SOLOMON ISLANDS



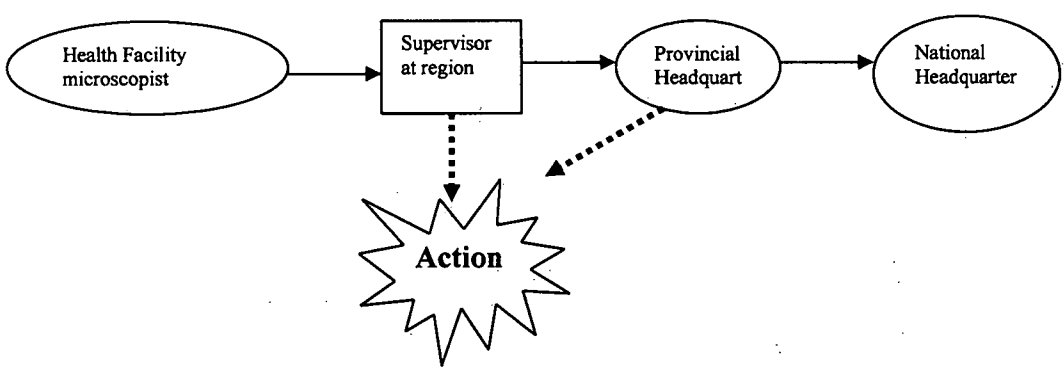
One of the main factors that contributed to the reduction of malaria was the improvement of the malaria information system and strategies used. The VBDCP believes that an effective and efficient monitoring information system supported with effective strategies could contribute greatly to the control of malaria in the Solomon Islands.

A monitoring Unit was established to develop a malaria information system (MIS). This unit integrates management of data on malaria disease with data on intervention measures.

All malaria data collected are from microscopists based at the health centers. Malaria suspected cases presented at the clinics that have microscopists are microscopically diagnosed for malaria. The microscopists would compile their monthly reports and send to their supervisor at the region. The regional supervisor would compile all data collected from the clinics and analyze data. After analyzing, the data is then passed on to the provincial manager at the provincial headquarter. The provincial manager would then compile all data collected from the regions and analyze them. The compiled data is then sent to the National headquarter (see flow diagram, fig 2).

At the regional level where the data is analysed relevant action is done. The most problem villages are identified and attended. The activities done to reduce malaria in these priority villages are : bednet distribution/retreatment, residual spraying, Mass Blood Surveys (MBS) and awareness. The provincial office would monitor the regional situations and assist with advice and supplies (see fig 2).

Fig.2: The flow of information and where action is done



1.1. Selecting priority problem villages by passive action

In each month no activity is done until priority problem villages are selected – passive action. The definition of passive action in this case is to "*wait for data to arrive, analyse it and base on the analyses action is done*". The priority problem villages are those villages with the highest malaria cases that when their total malaria case are summed would give 50% of all cases in that month.

1.2. Problems of the malaria information system (MIS)

The main problem of this system is delayed reporting. Reports from the health facilities would take two weeks before reaching the regions. From the regions to the provincial headquarters it would take a month. The areas of concern of this MIS are:

1) Timely action is not possible if data is to arrive to the regional supervisor two weeks delayed and by the time action is done in the problem villages the problem has either gone worse or the epidemic has passed unattended. If the epidemic has passed unattended the control operation that was implemented later becomes a waste of time and money. A wasteful operation in regards to money and time, a poor country could not afford to repeat.
2) If timely action could not be improved could we change the strategy of being passive-active to pro-active.
3) Also if timely reporting could not be improved could an alternate system be developed to predict an epidemic and forecast malaria cases thus attending predicted problem villages in time. The delayed reports could be used to validate accuracy of the prediction and for record purposes.

This study is to develop a strategy of how to avoid having epidemics even if the delay in reporting could not be improved. If such an alternative could be found it will help the control of malaria in the Solomon Islands to be more cost-effective and efficient.

1.3. MAIN OBJECTIVES OF THE STUDY:

1) The strategy used, which is to select the problem villages, as they appear monthly, has not actually been proven if it's the best strategy. This study is to determine if being pro-active in determining problem villages and attending them based on historical data before another epidemic occurs is an effective strategy in reducing the frequency of epidemics and malaria as a whole.
2) Does the period that the reports arrive from the health facilities for analyses verses the time of attending the problem villages justifies the use of this present passive –action strategy?
3) To determine if the use of climate data could be used as an alternative system to predict epidemics and forecast malaria cases. Hence, timely implementation of appropriate malaria control activities.

1.4. Specific objectives

1) Find the frequency of occurrence of problem villages based on past records and monitor them for one year.
2) Determine if pro-action on problem villages is a better strategy than the present passive –action method in regards to cost of control operation, time of implementation of operation and reduction of malaria.

3) Improve the quality of malaria diagnoses of microscopists in regions of study.
4) Determine the relationship between MBS and incidence in a problem village and if that relationship could be used to predict or confirm an epidemic.
5) Develop a malaria warning system for a region and for their problem communities.
6) Analyzing both meteorology and malaria data to develop a system that could assist malaria officers in predicting epidemics and forecasting malaria cases. Hence responding in time, while waiting for malaria data to arrive from the clinics.

2. METHODOLOGY

2.1. STUDY AREA

All provinces in the country are divided into regions. The number of regions in a province varies. Bigger provinces may have more than the smaller ones. The regions are further sub-divided into zones. The number of zones for each region varies also.

Each region has its own malaria team, managed by a regional superviser. Some regions may have a monitoring unit officer assisting the regional supervisor.

The study will be done in the Central region of Malaita province and Tetere region (Zone 4) of Guadalcanal province. Both have the highest populations and highest malaria in their respective provinces. Environmentaly they are different. Central region is a wet area with rainfall throughout the year. Tetere region is in a savannah area and has a distinct dry season in the middle of the year.

Central region of Malaita province

Malaita province is divided into six regions. Central region is the highest malaria endemic region in Malaita province. The region is sub-divided into three zones (Zone 64,65 and 85)。 Central region has an estimated population of 14,000 people. The number of villages studied is 113 villages.

Tetere region of Guadalcanal province

Tetere region of Guadalcanal is the highest malaria endemic region of Guadalcanal. Its population is estimated at 18,176. The region is divided into four zones (Zone 2, 3, 4 and 5) The study is done only in zone 4. A total of 357 villages in zone 4 was studied.

2.2. DETERMINING THE COST-EFFECTIVE STRATEGY , PRO-ACTION or PASSIVE ACTION

2.2.1. Collection of malaria case details

When village people are sick they go to their nearest health clinic (facility) for service. Patients that are sick with fever are diagnosed for malaria. Diagnoses are done microscopically by a microscopist. Those that are found positive with malaria are treated. All malaria case records are kept by microscopists and nurses at the clinic. These case detail records contains the following: date, name of patient, age, sex and result of microscope diagnoses.

The case detail records from the clinics are sent to the regional office of the Vector Borne Disease Conrtrol Programme (VBDCP) each month. Malaria past records of the study areas are collected from the regional office (either from the regional supervisors or the monitoring officers).

From the data collected the following were calculated:

- Infant malaria - malaria cases from children less than one year
- Infant rate – infant malaria cases/total infants diagnosed.
- Slide Positivity Rate (SPR) – total cases/number of blood slides diagnosed
- Total malaria cases/village/month
- Monthly malaria incidence – total cases/population
- Priority villages – highest malarias villages that together contributes about 50% of all malaria cases for that month
- Number of Priority villages/month
- Top priority villages – these are priority villages that appeared several times more common than the others, in a year

2.2.2. Finding the frequency of occurrence of problem villages based on past records and monitor them for one year

Villages were monitored each month for the period of study. This is to find out if it is the same villages that re-occur as problem priority villages and what months do they appear as problem priority villages. Such findings could help us understand if the passive-action strategy used is effective in suppressing problem villages from re-occurring as problem villages.

Selection of priority problem villages was based on total malaria cases and the steps used are as follows:

i) all villages that appeared in the case detail record, during the month of interest were enlisted in an excel spreadsheet.

ii) The first column of the spread sheet was the list of all the villages on the month data was first collected. The columns thereafter are for months that data was collected until 2007.
iii) In situations where new villages appear in the latter months the villages were added onto the column for villages.
iv) For each month the problem priority villages were marked.
v) The priority villages are those highest malarious villages that contributed around 50% of all cases.
vi) Each month each villages' total cases are recorded on the spreadsheet.
vii) From the data collected in 2005-2007 the following were extracted:

- Number of priority villages per month,
- Total cases of priority villages and
- The months each priority village occurs.

2.2.3. Increasing the chances of predicting a village that would become a priority village

Top priority villages -
Priority villages are those that appeared as a priority village at least once or more. The more frequent a problem village appearing as a problem village the more obvious it is ranked as a problem village. Top priority villages are those that appeared more frequently than others in a year. The more frequent it appears the higher the possibility of predicting it to be a problem village in the coming year.

Therefore to increase our chances of predicting epidemic villages we select top priority villages. Selection of top priority villages is done only after monitoring problem villages for one year, as follows:

a) all villages that appeared in the case detail record, during the months of study were enlisted in an excel spreadsheet.
b) The first column of the spread sheet was the list of all the villages on the month data was first collected. The columns thereafter are for months that data was collected until 2007.
c) In the case where new villages appear in the latter months the villages were added onto the column for villages.
d) For each month the problem priority villages were marked.
e) The priority villages are those highest malarious villages that contributed around 50% of all cases.
d) Throughout the year the problem villages that appeared several times in the following categories are recorded:

- more than 4 times
- more than 5 times
- more than 6 times

e) Check the following year for each category, how many of these top priority villages appeared again.

2.2.4. Determine if present passive –action strategy is effective

i) all priority problem villages that appeared in the case detail record, during the period of study were enlisted in an excel spreadsheet.

ii) The first column of the spread sheet was the list of all priority problem villages. The columns thereafter are for months of the period of study.

iii) The months in which each priority village occurred as a priority village was marked.

iv) A certain malaria control activity implemented in a particular priority village was also indicated on the month it was done.

v) The following indicators were recorded:

- The time gap the priority village remained a non priority village after malaria control activities was recorded.
- The proportion of these priority villages that reappeared again as problem priority villages within one year.

2.2.5. Determine if pro-action strategy is a better strategy than that of passive action.

i) In the first six months of a year, the top priority villages were selected. Top priority villages selected within a six months period are those villages that appeared as problem villages more than three times.

ii) In the top priority villages a Mass Blood Survey was done. Blood slides were taken from as many villagers as possible. The blood slides were stained with giemsa and checked for malaria parasites at SIMTRI.

iii) Those that were found positive with malaria were treated the next day

iv) Also bednets were distributed to villagers that need them.

v) Each month for six months the top priority villages were monitored. Total case records of each village was obtained from the cased detail records collected from the clinics that these villages attended.

2.2.6. Determine the relationship between MBS and incidence in a problem village and if that relationship could be used to predict or confirm an epidemic.

1) Villages that were once priority problem villages were selected.