Malaria Control Programme in Thailand

By Ministry of Public Health of Thailand

1. Background

In 1949 malaria was the leading cause of death with over 38,000 deaths, a rate of 201.5 per 100,000 population. The only two control measures being available were drug distribution and mosquito protection.

A WHO-UNICEF Malaria Control Demonstration Project was conducted in a northern province. During the same period the Thai Government established similar projects in other areas. The results of these projects showed that DDT residual spraying was encouraging. In 1951 the government, with US assistance developed country-wide Malaria Control Programme. By 1955 the control programme was gradually extended to cover 12 million population. Active case detection was also started in some areas.

In 1963 malaria death rate showed a reduction to 22.8/100,000 population. The first plan of operation for the Malaria Eradication Programme commenced, according to WHO policy. Following difficulties of funding and technical constraints, Malaria Control Programme was developed in 1971-1973 with more attention directed to the forested areas and was considered as a long term project in the Fifth Five-Year National Socio-economic development plan.

In 1995 following the adoption of the Global Malaria Control Strategy and the recommendations of the external and internal review panels, the malaria control policy was revised.

2. The Current Malaria Control Programme.

Objectives of Malaria Control Under the Eighth Five-Year National Health Development Plan (1997-2001)

A General Objectives

1. To reduce malaria morbidity rate and mortality rate.
2. To minimize duration of illness and reduce the risk of severity and complication
3. To enable communities having capacity for solving malaria problem on the basis of self-reliance.

B Specific Objectives

1. To reduce malaria incidence in 30 bordering provinces to 3, or less, per 1,000 population by 2001.
2. To reduce country malaria incidence to 1, or less, per 1,000 population by 2001.
3. To reduce country malaria mortality rate to 0.4, or less, per 1,000 population by 2001.
4. To reduce pre-treatment time-lag (time from onset of illness to treatment)
to 7 days or less.
5. To reduce number of severe and complicated malaria cases by 20 percent by 2001 (as compare with 1996).
6. To reduce morbidity rate of malaria repeating cases among population at high risk by 20 percent by 2001 (as compare with 1996).
7. To prevent re-establishment of transmission in non-transmission but high receptive area by reducing morbidity rate to 5, or less, per 10,000 population in such area.
8. To eliminate malaria transmission in 4 provinces such as Phayao, Udonthani, Khonkaen and Pattani; and prevent re-establishment of transmission in 14 malaria eradicated provinces.

3. Programme Priorities and strategies

Although the Eighth National Health Development Plan is focusing on human resource development, there are some major malaria problems remaining at the end of the Seventh National Health Development Plan. These are summarized as following:
1. Transmission at the borders among foreign labour force is still high.
2. Drug resistance along the Thai-Cambodian and Thai-Myanmar borders causes considerable amount of budget for treatment.
3. Even though indoor residual spraying using DDT still effective but less acceptable and less desirable due to impact on environment.
4. Health Education among population at risk to obtain less risky behavior is unsuccessful.
5. Emerging of epidemics due to migration of non-immune labour force following development projects into high receptive areas.
6. High case-fatality rate among non-immune such as tourists and migrants.

National Malaria Control Programme therefore adopts the Global Strategy for Malaria Control (WHO) and develops strategies as following:

Strategies

1. Disease Management: comprising diagnosis, treatment, referral system and case follow-up;
   1.1 To strengthen prompt treatment among risk group both residences and foreigners.
   1.2 To develop National Drug Policy aiming to provide proper and appropriate treatment for all population at risk in order to avoid encouraging drug resistance situation.
   1.3 To develop commensurate collaboration on malaria treatment between public and concerning private sectors.

2. Disease Prevention:
   2.1 To strengthen health education and public relation among all risk groups
aiming at healthy behavior and cooperation to disease control.

2.2 To promote personal protection using bed-net, impregnated net and repellent.

2.3 To operate selective vector control using bio-environmental measure and pyrethroids or other appropriate chemicals acceptable by communities.

3. To strengthen malaria control operation along bordering areas emphasizing transmission-prone areas and areas with excessive labor force of foreigners.

4. Prediction, Prevention and Epidemic Control:

4.1 To develop Information System, Information Technology and Epidemic Early Warning System which are sensitive to the change of factors leading to epidemic, in order to obtain precise prediction of epidemic.

4.2 To prioritize areas according to epidemic risk and prescribe line of epidemiological operation of each individual locality.

4.3 To develop Special Response Team (SRT) and Operation Plan in order to response timely when epidemic occurs or in epidemic prone situation.

5. Development of appropriate malaria control strategies to cover dynamic malaria situation:

5.1 To up-grade potential and capacity of health personnel’s at different levels, both public and community to control malaria according to local condition.

5.2 To promote collaboration of malaria control among public and community organizations in order to enhance Community Empowerment.

5.3 To conduct research on drug and measure preventing distribution of drug resistance.

5.4 To develop Disease Prevention Technology concerning pattern of mosquito-net utilization among risk group and vector control.

6. To promote collaboration among sectors, institutes and organization including government, private sectors, community organizations, international organizations and neighboring countries; and promote Thailand as Training Center for personnel development and Center for Malaria Research in South East Asia Region.

7. To promote expansion of Integration area.

4. Organization structure.

Previous organization structure of the Malaria Control Programme

The Malaria Control Programme was a Division of the Department of Communicable Disease Control (CDC) of the Ministry of Public Health (MOPH). The Director-General, CDC, was responsible for the direction and implementation of the control programme, staff, equipment, and budget. Malaria Division was responsible for malaria control policy development, planning & evaluation, budget allocation, training, monitoring and supervision. At the country level the programme comprised of five Malaria Regions, each
being directed by a Medical Officer, Regional Director, who was directly responsible to the Director-General, CDC. There were 33 Malaria Zone Offices (provincial level) and 302 Malaria Sector Offices (district level) each being responsible for the malaria control operation. The Malaria Control Programme remains organizationally vertical, although some activities such as case detection have been partially integrated into the general health service, especially in low malarious areas. Vector control activities, active and passive case finding by means of specialized malaria clinic remained under the responsibility of the Malaria Control Programme structure.

Reorganization of Malaria Control Programme Fiscal Year 1997
(Commenced October 1996)

Due to the financial constraints and the government policy on downsizing of the government institutes together with the continuous downward trend of malaria during the last decade, the Department of CDC reorganized the Malaria Control Programme structure by merging the MCP with the Filariasis and Dengue Haemorrhagic Fever Control Programmes. The new structure has been in effect since October 1996. Control of filariasis is a vertical programme, similar to the MCP whereas DHF Control is totally integrated into the general health services. The policy for the restructuring was to make best utilization of human resources, budget and equipment for control of all mosquito-borne diseases, and to minimize relatively high cost of the MCP.

At the central level there remained three technical divisions; Malaria Division, Filariasis Division and DHF Section under the General Communicable Disease Control Division. At the country level the programme comprises five regions, each directed by a Medical Officer, Director of Office of Vector-borne Disease Control (VBDO), who is directly responsible to the Director-General, Department of CDC. There are 39 Vector-borne Disease Control Centers (VBDC) and 302 Vector-borne Disease Control Units (VBDU) at provincial and district levels, respectively.

5. Malaria epidemiology.

Malaria is forest-related with the disease being prevalent along the international borders whereas in central plain areas, malaria transmission has been eliminated for more than two decades. Malaria transmission in the forested areas is intense, due to the presence of highly efficient vectors, enhanced vector longevity, and intensive population movement.

*An. dirus* and *An. minimus* are principle vectors. *An. dirus* is the most important vector within the forest setting while *An. minimus*, plays a major role due to its wide distribution in the forest-fringe areas.

The parasites commonly found are *P. falciparum* (51%) and *P. vivax* (48%). *P. malariae accounts for* less than 1%. *P. ovale* is very rare. Proportion of *P. falciparum* is observed to be very much related with
therapeutic efficacy of national treatment guidelines and some certain epidemics that affected major transmission foci

**Current malaria situation**

The epidemiological data showed a downward trend in total cases from some 200,000 cases in 1991 to some 100,000 cases in 1996. In addition to Thai cases, foreigner cases (mostly Burmese) have been on the increase, from 48,000 cases in 1991 to 66,000 cases in 1997.

During 1997-1999, due to epidemics of *P. falciparum* in some provinces in the South and *P. vivax* along the Thai-Cambodian border, total Thai cases reported increased to 128,833. The annual parasite incidence (API) was 2.27 per 1000 population in 1999. Foreigner cases continued to increase to some 79,490. Burmese accounts for 90% of foreigner cases, mostly *P. falciparum* (more than 80%).

There were several causes of epidemics, one related to the financial crisis that coincided with the occurrence of epidemics, to be discussed later in this paper. It is anticipated that malaria epidemics will continue and the Control Programme may take a few years to overcome the problem in order to bring down the country malaria incidence to an acceptable level.

However, in spite of increasing morbidity, the mortality continues to decrease greatly to a level of 1.0 death per 100,000 population in 1998, total deaths of 608.

Therapeutic efficacy study was conducted in 1997 at 6 drug resistance monitoring sites. Results showed that the current treatment regimens using either mefloquine alone or mefloquine in combination with artemisinin derivatives remained effective.

**Malaria epidemics in 1997-1999**

It is noted that there was an increasing trend of total malaria cases during fiscal year 1997-1999. Malaria epidemics were observed in various parts of the country, for instance:

Sakaew Province, along the Thai-Cambodian border, reported 613 malaria cases in 1995, some 900 in 1996 and 4800 cases in 1997. In 1998 total reported cases were 4,189 to be noted that *P. falciparum* accounted for 16% whereas it had been over 60% prior to the outbreak, *P. vivax* becoming the dominant species. Changing of parasite formula was considered probably due to the impact of artemisinin derivatives that were launched in 1995.

Chanthaburi and Trat Provinces, the long known areas for multi-drug resistant foci, malaria cases doubled in 1998 compared with 1996-1997. Increasing proportion of *P. vivax* was observed.

The southern peninsula, 8725 cases were reported in 1996 whereas 13,623 and 47,149 were reported in 1997 and 1998 respectively. Proportion of *P. falciparum* increased from 45% in 1996 to 56% during epidemics in 1998. There was re-emergence of malaria transmission in many districts where
malaria transmission had ceased. Phuket Province, where malaria transmission has been eradicated for years reported 7 confirmed indigenous cases reported in 1998. All cases contracted the infections in hilly forested areas where migrant laborers were employed. Fortunately, the transmission took place outside tourism areas.

There are multi-factorial causes for epidemics during 1997-1998; some possible causes are shown below:

- Malaria transmission has ceased for years in most of the areas, in particular the southern peninsula until the Programme withdrew vector control (mainly IRS using DDT) but area receptivity to malaria is still very high.
- Inactive surveillance due to the same reason.
- There was shifting of long-action DDT to relatively short-action synthetic pyrethroids.
- Reduced manpower and operational budget for the Malaria Control Programme (to be discussed later).
- Sharing of human resources and budget with other vector-borne disease control, e.g. DHF control which is on the increase (to be discussed later).

Fortunately, the main malaria transmission foci with multi-drug resistant *P. falciparum* along the Thai-Myanmar border remained more or less stable.


The Thai Malaria Control Programme stratifies the country into 4 categories:

1. **Control area with transmission (referred to as A)**

   This category is divided into two subcategories:
   - Perennial transmission area, where transmission is reported throughout the year or at least 6 months per year, is designated as A1.
   - Periodic transmission area, where transmission is reported 5 months or less per year, is designated as A2.

2. **Control area without transmission (referred to as B)**

   This category is divided into two subcategories, namely B1 and B2.
   - High risk area (B1), transmission was not reported within the last 3 years but primary of secondary vectors are found. Consequently, the area is potentially suitable for malaria transmission (high and moderate receptivity).
   - Low risk areas (B2), transmission was not reported within the last 3 years and both primary and secondary vectors are not found. Suspected vector, however, may be found (low and non receptivity).

3. **Pre-integration area** is district-wide area that has been categorized as low risk for at least 3 years and local health services, such as hospitals and
health centers, are able to perform case detection, treatment and case investigation.

(4) Integration area is province-wide area that has been pre-integration area for at least 3 years and Provincial Health Office is capable of managing all activities concerning malaria. Population covered under different stratified areas are shown as below

<table>
<thead>
<tr>
<th>Area stratification</th>
<th>Population covered</th>
<th>% covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Control area</td>
<td>3,396,000</td>
<td>6.00</td>
</tr>
<tr>
<td>1.1 Control area with transmission</td>
<td>729,719</td>
<td>1.29</td>
</tr>
<tr>
<td>1.1.1 perennial transmission</td>
<td>2,666,000</td>
<td>4.71</td>
</tr>
<tr>
<td>(A1 area)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1.2 periodic transmission</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(A2 area)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2 Control area without transmission</td>
<td>38,013,000</td>
<td>67.18</td>
</tr>
<tr>
<td>1.2.1 high risk area in presence of primary and/or secondary vectors (B1 area)</td>
<td>9,761,000</td>
<td>17.25</td>
</tr>
<tr>
<td>1.2.2 low risk area, no known vectors, suspected vectors may be found (B2 area)</td>
<td>28,252,000</td>
<td>49.93</td>
</tr>
<tr>
<td>2 Pre-integration area (PA)</td>
<td>2,936,000</td>
<td>5.19</td>
</tr>
<tr>
<td>3 Integration area (IA)</td>
<td>12,237,000</td>
<td>21.63</td>
</tr>
<tr>
<td>Total population</td>
<td>56,582,000</td>
<td>100</td>
</tr>
</tbody>
</table>

7. Malaria situation in border areas

7.1 Malaria cases in border area (FY 1996-1998)

<table>
<thead>
<tr>
<th>Year</th>
<th>1996</th>
<th>1997</th>
<th>1998</th>
</tr>
</thead>
<tbody>
<tr>
<td>Border area</td>
<td>Thai</td>
<td>Foreign National</td>
<td>Thai</td>
</tr>
<tr>
<td>Thai-Myanmar</td>
<td>60,365</td>
<td>58,841</td>
<td>58,439</td>
</tr>
</tbody>
</table>
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- Inactive surveillance due to the same reason.
- There was shifting of long-action synthetic pyrethroids.
• Reduced manpower and operational budget for the Malaria Control Programme.
• Sharing of human resources and budget with other vector-borne disease control, e.g. DHF control which is on the increase.

Fortunately, the main malaria transmission foci with multi-drug resistant \textit{P. falciparum} along the Thai-Myanmar border remained more or less stable.

8. Vector Control

\textbf{Background}

Insecticide residual spraying (IRS) using DDT was introduced into the Malaria Control Programme (MCP) in 1949. Its impact on mosquito vectors and malaria was obvious. This measure was gradually expanded to cover all malaria transmission areas. During 1970s-1980s IRS remained single main vector control measure for the MCP. Its dosage was 2 gm/sq. m and it was applied 2 cycles per year in mountainous and high malarious areas, 1 cycle in the late attack phase.

In 1975 following increase of malaria in various areas, including resurgence of malaria in eradication areas, regular focal spray was introduced to cope with epidemics. In 1976 DDT emulsion was introduced in order to improve community compliance. Other alternative methods were tested or introduced into the MCP. Abate 50% EC, biological control using larvivorous fishes, mosquito repellents were also introduced.

In 1979 during massive malaria outbreaks along the Thai-Cambodian border space spraying (fogging) using Malathion was introduced to control explosive epidemics in refugee camps.

Various kinds of indigenous larvivorous fishes were tested; panchax, guppy and gambusia against different anopheles larvae. Various insecticides were tested against DDT; Bendiocarb (0.4 gm/sq.m 2 cycles/yr.) in 1980. DDT emulsion against DDT wetable powder, etc.

It was reported that \textit{Anopheles minimus} developed a shift in its behavior from being highly endophilic to exophilic.

During 1982-1987 Fenitrothion was donated by the Government of Japan (JICA) and used in the Thai-Cambodian areas.

In 1988 the MCP gradually changed its philosophy from mainly relying on IRS (using mainly DDT) and adopted other vector control measures; i.e. integrated vector control. Personal protection using plain mosquito nets and mosquito repellents were recommended for use by the general population. The MCP initiated the so-called “Malaria Self Reliance Village” project in high malarious areas. Seed money for village fund were kindly sponsored by WHO. The objectives were to increase mosquito net coverage and its utilization. One of the Malaria Regional Offices trained hill tribe housewives to produce home-made net to expand net coverage.
A pilot study on IRS using synthetic pyrethroids (Deltamethrin and Lambdacyhalothrin) was conducted in 1995.

In 1995 the MCP decided to change the insecticide policy. DDT has been banned by the government since 1995 due to some political reasons. The last purchase was made in 1995. However there is still considerable amount of DDT leftover and is still being utilized in remote mountainous areas. Deltamethrin and lambdacyhalothrin were only two alternative pyrethroids available at the time and were comparatively tested against DDT in a large scale field trial. The results were reviewed and discussed by a group of experts. Following assessment in entomological, epidemiological, social and cost-effectiveness analysis the group recommended DDT be replaced by Deltamethrin. Since DDT has longer effect and currently being applied once a years whereas Deltamethrin has to be applied twice a year. The operational cost for IRS doubles that of DDT. The cost of Deltamethrin alone is 2 times higher than that of DDT.

**Current Vector Control**

At present the vector control does not rely mainly on IRS as in the old days. Alternative vector control such as fogging, impregnated mosquito net, mosquito repellent and bio-environmental control are supplementary measures to IRS. In addition other compounds are being tested and compared with Deltamethrin.

In principle vector control is being carried out in all active transmission areas (i.e. A1 A2 areas in Table 1). It is also applied in B1 areas where resurgence of malaria has been confirmed and in some circumstances such as massive movement of refugees or non-immune labours.

The criteria for application of each vector control activity are as follows:

**Indoor residual spraying (IRS)**

Deltamethrin 5% WP is operationally employed by the MCP. The dosage is 20 mg./sq. m. IRS is conducted twice a year in perennial transmission area (A1 areas) and once a year in periodic transmission area (A2 area) covering the transmission season.

DDT 75% wdp. is employed only in remote and difficult areas at the dosage of 2 gm./sq.m once a year. Its use has been phased out since 1996. It is expected that the MCP will use up the leftover stockpile by 1999.

Other chemicals such as Etofenprox, Alphacypermethrin, Bifenthrin, etc. are being tested.

**Impregnated mosquito nets (IMN)**

This activity has been introduced recently to supplement IRS. In areas where public acceptance to IRS is low and net coverage is higher than 60-70% IMN will replace IRS. The MCP staff treat villagers owned nets. In
high malaria transmission areas free of charge nets offered by the MCP are distributed to the poor who can not afford to purchase nets.

Nets are treated by dipping with Permethrin 0.3 gm./sq.m, twice a year. Other chemicals are now being tested and compared with Permethrin, e.g. Alphacypermethrin, Deltamethrin (SC)

**Thermal fogging**

Thermal fogging has a relatively limited role. It is applied during malaria outbreaks and or in uncontrolled transmission areas. In principle it is applied once a week for 4 consecutive weeks. Chemicals used were Malathion in the old days and Deltacide (Espioallethrin + Deltamethrin + Piperonyl Butaoxide) at present.

**Chemical larviciding**

Abate was used to control malaria vectors in urban areas but now it is abandoned.

**Bio-environmental control**

Environmental control was introduced for years through the primary heath care approach without satisfactory success. At present biological control using larvivorous fishes is now being encouraged by the MCP. At any MCP field office larvivorous fishes (mostly guppy) are distributed to villagers. Malaria volunteers also involve in rearing larvivorous fishes in artificial and natural breeding places. Fishes are now being promoted for DHF control. Other biological control, such as bacteria was tested in field circumstances but never reach operational stage.

**Vector Control Activities**

Vector control activities during 1994-1998 are shown in Table 2

**Table 2** Vector Control for Malaria in Thailand, 1994-1998

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Indoor Residual Spraying (IRS)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Pop. protected under planned spray operation (000)</td>
<td>2,046</td>
<td>1,440</td>
<td>1,316</td>
<td>1,038.905</td>
<td>930.531</td>
</tr>
<tr>
<td>2 Pop. protected under emergency (due to epidemics)</td>
<td>0.004</td>
<td>0.005</td>
<td>0.005</td>
<td>5.136</td>
<td>58.577</td>
</tr>
</tbody>
</table>
### 9. Surveillance & case detection method

**Passive case detection (PCD)** is proved to be more cost-effective than active case detection. Malaria clinic system has been one of the most cost-effective case detection method for malaria control. Its impact on reduction of mortality due to malaria is obvious. House to house visiting has been withdrawn and replaced by the so called **“Special Case Detection” (SCD)** which is active case finding carried out during peak transmission or epidemics to supplement inaccessible PCD.

Mobile malaria clinic is another activity similar to SCD but with microscopic facilities. It is more costly than traditional PCD. **Periodic mobile clinic or Fixed schedule mobile clinic** (on a fixed weekly schedule) was observed to have low institutional costs per smear, but relatively high cost per positive case. For patients, Periodic mobile clinic had low community costs (those paid by patients and their families).

In some circumstances, a combination of central, peripheral malaria clinics and periodic clinics was proved to be cost-effective, maximize access to malaria treatment (thus prevent malaria deaths) and minimize the community costs. *(Ettling et al, 1991)*

### 10. Identification of risk factors for malaria and area stratification

High Annual Blood Examination Rate (ABER) is no longer indicating high coverage of surveillance. Low slide positivity rates (SPR) does not always reflect low malaria situation. In another word it may indicate the un-targeted surveillance. If malaria risk is accurately identified by age, sex, occupation and spatial data, blood examination can be more directed towards target groups and more cost-effective. This stratification also requires regular assessment of local malaria epidemiology which is dynamic.

### 11. Method of blood examination

At present there are non-microscopic examination based on Antigen-capture assay (dipstick technology) recently developed and made available for commercial use. Therefore, in circumstances where malaria

<table>
<thead>
<tr>
<th>Method</th>
<th>Population protected (000)</th>
<th>(000)</th>
<th>(000)</th>
<th>(000)</th>
<th>(000)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spray operation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Biological control</strong></td>
<td></td>
<td>2.271</td>
<td>6.269</td>
<td>2.337</td>
<td>3.010</td>
</tr>
<tr>
<td><strong>Source reduction</strong></td>
<td></td>
<td>0.052</td>
<td>0.054</td>
<td>0.03</td>
<td>0.051</td>
</tr>
<tr>
<td><strong>Personal protection</strong></td>
<td></td>
<td>0.524</td>
<td>0.84</td>
<td>1.153</td>
<td>1.378</td>
</tr>
</tbody>
</table>
diagnosis and treatment is integrated into the general health services to minimize institutional cost for malaria control, or when skilled microscopists are scarce, the use of dipstick technology is potential as it is more cost-effective than the microscope-based system.

A preliminary study conducted in Thailand indicated that Institutional cost of dipstick was 60 Baht per one positive compared with 250 Baht for microscopic examination. Community cost was not fully calculated in the study but it is assumed that cost incurred by patients in the dipstick group is much less than those in the microscopic group because time spending at the clinics is much shorter. (Plasai, 1996, unpublished data)

The dipstick has not been introduced extensively in the Control Programme since its unit cost remains high and the Programme offers free service.

12. Case treatment

1 Treatment of uncomplicated *P. falciparum* cases

All microscopically confirmed *P. falciparum* cases are treated according to level of mefloquine resistance of areas. The Malaria Control Programme stratifies the total areas of the country based upon drug sensitivity monitoring data, i.e. *in-vivo* tests of mefloquine 750 mg. standard treatment and follow-up for 28 days.

<table>
<thead>
<tr>
<th>Cure rates (%)</th>
<th>Level of mefloquine resistance</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>70+</td>
<td>non or low</td>
<td>the rest of the areas, plain areas and central parts</td>
</tr>
<tr>
<td>50-70 (+RIII cases)</td>
<td>moderate</td>
<td>Sakaew Province, at the Thai-Cambodian border</td>
</tr>
<tr>
<td>less than 50% (+ many R III cases)</td>
<td>high</td>
<td>Tak Province, at the Thai-Myanmar border</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trat and Chanthaburi Provinces, at the Thai-Cambodian border</td>
</tr>
</tbody>
</table>

**Non or low mefloquine resistant areas:**

First line drug Mefloquine 750 mg. and primaquine 30 mg. single dose

Second line drug Quinine + tetracycline for 7 days or quinine alone for 7 days and primaquine 30 mg. on the last day.
Third line drug     Artesunate or artemether 700 mg. in divided dose over 5 days
                and primaquine 30 mg. on the last day.

**Moderate mefloquine resistant areas:**

First line drug    Mefloquine 750 mg. followed by artesunate or artemether at 6-hour interval 300 mg. on Day 1
                Artesunate or artemether 300 mg. and primaquine 30 mg. on Day 2

Second line drug   same as non-low mefloquine resistant

Third line drug    same as non-low mefloquine resistant

**High mefloquine resistant areas:**

First line drug    Mefloquine 750 mg. start followed by artesunate or artemether 300 mg. on Day 1
                Mefloquine 500 mg. at 6 hour interval
                Day 2 artesunate or artemether 300 mg. and primaquine 30 mg.

Second line drug   same as non-low mefloquine resistant

Third line drug    same as non-low mefloquine resistant

2 Treatment of *P. vivax* and *P. ovale* cases
Chloroquine 1500 mg. base over 3 days
Primaquine 15 mg. daily for 14 days

3 Treatment of *P. malariae* cases
    Same as *P. vivax* but no primaquine

4 Mixed infections, if with *P. falciparum* malaria, treat as *P. falciparum* malaria

**Presumptive treatment**

As mentioned earlier that presumptive treatment using sulfadoxine/pyrimethamine (1000/50 mg.) together with 30 mg. primaquine, is given to symptomatic cases with suspected history to suppress symptoms and interrupt transmission. Presumptive treatment is given by health centers and malaria
volunteers. Realizing that presumptive treatment is underdose treatment and may
induce drug resistance, the Control Programme decided to phase out presumptive
treatment by the end of 2001. Early diagnosis and prompt radical treatment
according to parasite species is promoted to replace presumptive treatment.

Chemoprophylaxis
Chemoprophylaxis is not recommended for general population. Personal protection using mosquito repellents and impregnated bed nets is strongly
recommended. In case that chemoprophylaxis is unavoidable, daily
doxycycline(100 mg.) for no longer than 3-4 weeks is recommended for all instances.
Standby drug for special groups such as military staff, laborers crossing
border, etc., is to be considered by the Malaria Regional Directors. Drug of choice is
artemisinin derivatives 700 mg. over 5 days for adults and children over 4 years old.
Younger children and pregnant women are prescribed with quinine for 7 days.

13. National Anti-malarial Drug policy
Drug policy can be developed to minimize cost as follows:
Presumptive treatment using sulfadoxine/pyrimethamine is now abandoned
in order to minimize its impact on drug resistance as well as reduce cost incurred by
the Control Programme.
Regular monitoring of drug resistance enable the Control Programme to
change treatment guideline whenever essential. At present, although in-vitro
microtest plates are purchased from abroad at high cost and cost for conducting
therapeutic efficacy study is high, the Control Programme decided to carry on this
activities. Cost incurred to the Control Programme and community when drug
resistance emerges is much higher than the cost of the monitoring system.
Improved management of drug stockpile is required to ensure quality
assurance of drugs, ensure continuous supply and avoid waste (expired drugs). Efficient management of stocks should be applied for all supplies for the Control
Programme.

14. Health education and community empowerment for malaria control
The country has been investing enormously both financial and human
resources on health education schemes, production of health education and the so
called “malaria self-reliance villages”. Following the reorganization, the health
education materials were produced in package for all mosquito-borne diseases to
minimize cost.
Active community participation for malaria control and prevention can
be strengthened by modern techniques, such as participatory rural appraisal (PRA)
but the capital investment for this is high and need long term capability strengthening
of field staff.

15. Research and training
During the financial crisis, budget of conducting operational research
and staff capability strengthening were the first budget lines to be reduced. We anticipated that no impact would be observed if this is transient. However, prioritization is helpful to allocate budget to the essential research topics and training courses. External funding should be also explored.

Source: http://eng.moph.go.th/ 05/05/2003