



CHAPTER 1

INTRODUCTION

In this chapter, the nature of the disease, malaria, and the malaria control program in China, the problem and the rationale of the research, the research questions and objectives are presented in turn.

Malaria is by far the most important tropical disease, affecting some 100 countries world-wide. It was estimated that roughly 110 million clinical cases of malaria develop annually. Some 270 million people are infected, carrying malaria parasites, although not necessarily developing symptoms (WHO, 1990).

China is one of the endemic countries of malaria. A great achievement has been made with malaria eradicated in many areas. Data collected in 1992 revealed the morbidity of malaria dropped by 98% in comparison with that in 1950s.

The cost incurred by the health provider in China in providing malaria surveillance is very considerable due to its large area and large population. In order to choose optimal actions/schemes for surveillance of the malaria situation effectively, the costs incurred by institutions as well as the change of infection rate is very necessary and important.

1.1 Nature of the Disease

Malaria is a collective name for different diseases that may result from infection by any parasites of the genus *Plasmodium*. Four species of malaria parasites naturally infect humans: *Plasmodium falciparum*, *P. vivax*, *P. malaria* and *P. ovale*. The characteristics of the disease vary with the intensity of the infection, the host's level of immunity, the adequacy of and opportunity for treatment and the parasite's susceptibility to the drugs.

Once inside a human, parasites can reproduce, destroy blood cells and cause illness and possible death. The course of malaria is characterized by rigors, fever, splenomegaly, anemia and a chronic relapse. The main symptom of malaria is fever. There are some differences between the acute attack and chronic attack.

Transmission between humans occurs through the bites of certain species of the female mosquitoes of the genus *Anopheles*. Being bitten by the female mosquitoes, an infected person can transmit parasites to the mosquitoes which will in turn transmit parasites to a healthy person by biting. Malaria transmission is focal and depends on the dynamics between humans and the vector, parasite, and environment. More important, it depends on the effectiveness of control methods, socioeconomic development and political stability.

1.2 Malaria and Malaria Control Program in China

1.2.1 Malaria in China

Malaria is one of the major parasitic diseases in China. It had a long history. According to incomplete statistics, the annual malaria cases numbered 35 million and the morbidity 6.46% in the 1940s, while the mortality rate was estimated to be about 1% before 1949 (Zhou, 1985). In the early 1950s, malaria was endemic in 1,829 counties/cities, which amounted to 70-80% of the total counties of the nation. In 1992, the malaria morbidity dropped to 0.0064%. The lethal cases due to malaria were 52 in number all over the country (Advisory Committee on Parasitic Diseases, 1993).

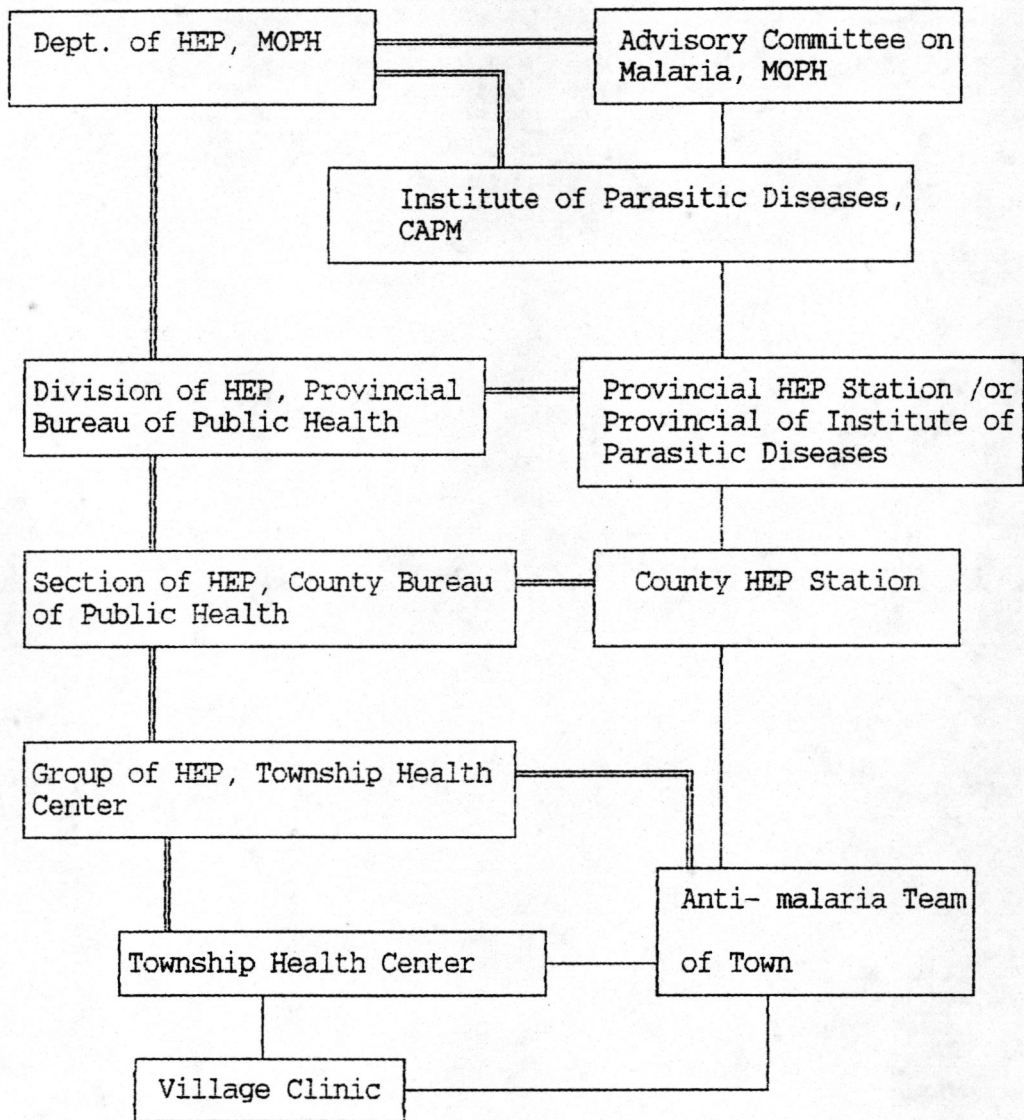
Malaria is widespread in China, and malaria cases are more abundant in the rural than in the urban areas. The prevalence gradually decreases from south to north. South of 25 North Latitude (NL) are the hyper- or mid- endemic regions, where falciparum malaria is widely present. Mid- and hypo- endemic areas are between 25 and 33 NL, where vivax malaria is the predominant species, though falciparum infections exist and focal outbreaks may occur. In the region north of 33 NL, malaria is of low endemicity, *P.vivax* being the only species; temporary epidemics are occasionally caused by imported falciparum malaria.

These variations are contributed to by the nation having a vast territory encompassing varied geographical features, economic status and living conditions, which have an impact on malaria prevalence.

1.2.2 The Organization of Malaria Control in China

After the People's Republic of China was founded, the leading groups for malaria control were set up at different levels. Research institutes and antimalarial stations were established correspondingly. The organization of malaria control and the relationship in China is shown in Figure 1-1. At the national level, the Departments of Agriculture, Water Conservancy, Communication, Commerce and Chemical Industry were incorporated in the fight against malaria.

Figure 1-1 The Organization of Malaria Control and the Relationship in China



==== Administrative relation

—— Technical relation

MOPH— Ministry of Public Health

HEP— Health and Epidemic Prevention

CAPM— Chinese Academy of Preventive Medicine

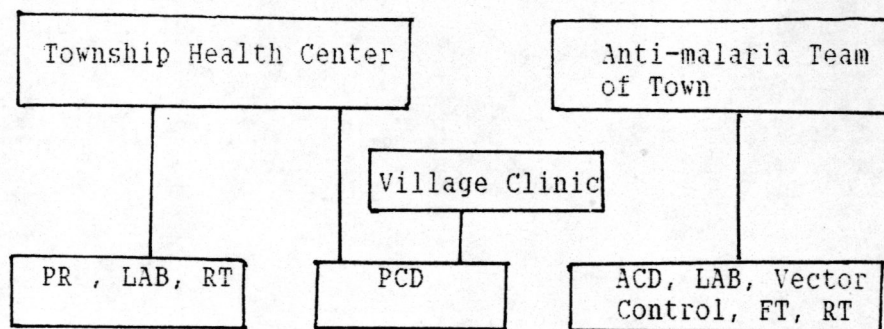
1.2.3 Features of Malaria Control in China

Features of malaria control in China are community participation and malaria intersectoral linkage. Several ten thousand administrators, health workers, and town health center doctors participate in the organization and propagation of antimalarial measures among the masses. The provincial and regional intersectoral linkage, collaboration and coordination on a large scale in the active implementation of malaria control improve and consolidate the results of malaria control in certain densely populated areas.

1.2.4 The Activities of the Lowest Organization of Malaria Control

In China, the lowest organizations of malaria control are village clinic (VC), township health center (THC) and anti-malaria team of town. The first two units usually carry out passive case detection and give presumptive treatment. The laboratories in the THC provide the microscopic examination services to the febrile outpatients, not only for THC but also for VCs. The activities of the lowest organization of malaria control is presented in Figure 1-2.

Figure 1-2 The Activities of The Lowest Organization of Malaria Control



ACD-- Active Case Detection
 PCD-- Passive Case Detection
 PR--Presumptive Treatment
 LAB-- Laboratory Activity
 RT-- Radical Treatment
 FT-- Focus Treatment

1.2.5 The Role of the Village Clinics and Township Health Centers for Passive Case Detection

Passive case detection (PCD) by village clinic (VC) : All village clinics in the endemic areas of malaria were encouraged to diagnose the fever patients clinically and took slides which were taken by the village doctors and then collected at a station of malaria microscopical detection (MMD) by the assistants in the township anti-malaria teams.

Passive case detection by township health centers (THC): All township health centers in the malaria endemic areas were asked to diagnose the fever outpatients clinically and took slides according to the diagnoses. If the THC had stations for MMD, the staff in the stations would take the slides and examine them. If not, the staff in the general laboratories would take the slides and the slides would be collected by the assistants in the township anti-malaria teams, then examinations would be carried out in the Stations for MMD.

1.2.6 The Station for the Malaria Microscopical Detection

In the rural areas of China, the routine services for malaria microscopical detection usually are provided at the laboratories of the THC if there are THC. However, during the periods of some investigations and researches for implementing the two Schemes, some additional temporary stations for MMD would be set up. The staff in the stations may be the laboratory personnel and the anti-malaria personnel in the anti-malaria team. Before these people work as the microscopists to do MMD, they were trained through short-term courses held by the county health and epidemic prevention stations. Usually, the training courses are given one time every year.

1.2.7 Presumptive Treatment and Radical Treatment

Presumptive treatment: This is given to all fever outpatients from whom blood slides are taken immediately when they have got the clinical diagnoses as typical malaria, suspected malaria and FUO (in Scheme B, only including the first two clinical diagnoses). Chloroquine 600mg and primaquine 22.5mg per adult and appropriate dosages of the two drugs for younger age groups are given for presumptive treatment.

Radical treatment: This is given to confirmed malaria cases detected by microscopy. Usually, the drugs are sent to the malaria cases by the assistants in the township anti-malaria teams in the areas where the malaria cases become less, such as the counties which carried out the two schemes. P.vivax cases receive chloroquine 1500mg and primaquine 90mg per adult for radical treatment. For the younger groups, the dosage of the drugs for radical treatment are adjusted by the ages.

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1.2.8 The Activities of Assistants in Anti-malaria Group

The assistants in anti-malaria groups were collecting blood slides from village clinics, then sending them to the Stations of Malaria Microscopical Detection, sending drugs for radical treatment to malaria positive cases detected by microscopists; following up the positive cases and focus elimination; doing vector surveillance;

1.2.9 The Target and Strategies of Antimalarial Activities in China

The target and strategies of antimalarial activities in China are " to persist in long-term struggle and repeated combat, so as to actively control prevalence, further lessen malaria hazard, and to attain finally the goal of eradication" (Ministry of Public Health, 1983).

The objectives of the National Program of Malaria Control (1992-1995) are to consolidate acquired achievements; to further decrease incidence; to prevent focal outbreaks; to diminish the epidemic extent of falciparum malaria; to broaden the area of basic elimination.

The target of the National Program in the whole nation envisaged in the period of the 8th 5-year plan is a decrease of 30% in case number as compared with that in the period of the 7th 5-year plan, that is, the number of malaria cases will be less than 100,000 by 1995 (Advisory Committee on Malaria, 1992).

In practice, in implementation of the strategies, integrated antimalarial measures were adopted. Different antimalarial measures are required for different endemic areas. The generally accepted concepts lead to the adoption of integrated antimalarial measures concentrated on diverse points according to different vectorial ecology and endemicity. In areas where the incidence has decreased to below 0.01 %, malaria surveillance is justified as the predominant practice, which includes case detection, focus intervention, management of migrant populations as well as prompt incidence surveillance and vector monitoring (Department of Control Endemic Diseases, 1988). Microscopic examination of febrile patients was carried out widely in the endemic areas.

1.2.10 The Two Schemes for Malaria Case Detection in China

Usually, in order to closely monitor the malaria situation in the endemic areas, blood slide parasitological examination has been practically used in the active case detection and passive case detection. The target people who get the examination include the fever

patients: typical malaria, suspected malaria, fever of unknown origin (FUO) and common cold. At the present, there are two alternative schemes for case detection of malaria surveillance in basically eliminated areas in China. In Scheme A, three kinds of fever patients (their clinical diagnoses are typical malaria, suspected malaria, FUO, respectively) who visit every level of clinics or hospitals must get blood examination. In Scheme B, two kinds of fever patients (malaria, suspected malaria is their respective clinical diagnoses) who visit the health services get blood examination.

1.2.11 Where the Two Schemes Are Implemented

At the beginning of the nationwide research which has been carried out in 24 counties of 12 provinces (two counties from each province, one carried out Scheme A, another implemented Scheme B) from 1992 to 1994. These provinces selected are located between 25 NL and 32 NL and the malaria morbidity rates were lower than 1 per 10,000 population. But later, one country withdrew from the nationwide research (hence, 23 counties have available data).

The Schemes were carried out in the counties but several counties only implemented them in the rural areas (excluding the county town) with respect to the malaria situation and flexibility to carry out. The two counties selected in Henan Province only carried out the two schemes in the rural part of the counties. In the present study here, only the data from two counties of Henan Province were used to do the micro-level study, the data from the whole 23 counties were used to estimate the direct costs for institutions at the macro-level with several assumptions.

1.3 Problem and Rationale

As a result of active implementation of malaria control measures for more than 40 years, considerable success has been achieved in China. Areas of endemicity have been diminished, malaria hazards dramatically lessened and the morbidity rate markedly decreased. But some areas such as Hainan, Yunnan, Sichuan, Anhui Provinces still have high incidence (5.8 to 11.5 per ten thousand population in 1992) (Advisory Committee on Malaria, 1993).

Case management-- prompt diagnosis and effective treatment, as recommended by a WHO Expert Committee (WHO technical report series, 1986) has long been the strategy applied in China. The malaria control intervention strategies in China consist of case detection through various mechanisms, slide examination, treatment of malaria patients, focal sites identification, and treatment of outbreaks, anti-relapse therapy, mosquito control by insecticides and malaria reporting system.

Since malaria incidence in some areas is gradually stabilizing and/or decreased to less than 1 per ten thousand population (in 1992, about 10.566 million people in 2,612 counties/ cities lived in this kind of area, including original malaria free areas as well as endemic areas now freed from the disease) (Advisory Committee on Parasitic Diseases, 1993). As schistosomiasis and other parasitic diseases relatively are serious, there is a growing pressure to cut back on funds for malaria control and to switch funds to other high incidence parasitic diseases. But which activities can and should be reduced and which stopped, given the need to reduce expenditure on malaria control?

Of the many activities in malaria control a major activity and major cost is case detection and treatment. At the present, two alternative schemes (Scheme A and Scheme B) for case detection of malaria surveillance are carried out in areas where malaria is basically eliminated in China.

According to a pilot survey, the number of patients who suffered from the fever of unknown origin (FUO) of Scheme A who get blood examination is about 30% of all the fever cases examined, but their positive parasite rate is very low, only about 0.05% (Collaborating Group for Research on Malaria Surveillance, 1992). A reduction in monitoring may be economically sound in terms of expenditure on case detection but there may be potential cost in treating new cases and new foci, if these missing cases act as the malaria infection sources and induce new cases and new foci or may be there will be a significant increase in incidence.

The existing monitoring system in China can provide information on performance, such as slide positive rate, annual parasite incidence per hundred thousand population, the numbers of malaria cases detected, treated and cured. However, the areas concerning efficiency of malaria control and/or surveillance haven't been dealt with.

In particular, the cost of case detection is not known. In order to provide a scientific basis for making decisions in selecting an optimal scheme for malaria case detection with respect to direct operating costs alone, information on magnitude and components of direct cost; unit cost in terms of cost per slide examined and cost per positive case detected; relevant additional costs needed for additional cases detected, the changes of the unit costs under different conditions, are very essential. Only then suitable responses can be made to allocate the budget and better utilize the limited resource and to choose the scheme for malaria case detection on economic basis.

1.4 The Research Questions and Objectives

1.4.1 The research objectives

- (1) To investigate the direct operating costs to be measured by institutions and outcomes of Scheme A and Scheme B for malaria case detection
- (2) To estimate the additional direct operating costs needed for additional cases detected when Scheme A is implemented for malaria case detection, in comparison with Scheme B
- (3) To examine the implications of the unit costs in terms of cost per blood slide and cost per positive case detected of the two Schemes for malaria case detection under changing conditions

1.4.2 The Research Questions

- (1) What are the magnitude and components of direct operating cost incurred by institutions for implementing the two Schemes for malaria case detection?
- (2) What are the outcomes of the two Schemes in terms of number of blood slides and number of positive cases detected?
- (3) What is the additional direct operating cost needed for additional cases detected when Scheme A is performed ?
- (4) What are the unit costs of the two Schemes for malaria case detection under conditions of different slide positive rates and number of slides examined for fever of unknown origin?