

## Chapter 1

### Introduction and objectives

#### 1.1 Background and rationale

Malaria is an infectious disease, caused by protozoan parasites of the genus *Plasmodium*. Four species of *Plasmodium* can produce the disease in its various forms: *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium ovale* and *Plasmodium malariae*. *P. falciparum* is the most widespread and dangerous of the four: can lead to fatal cerebral malaria.

The parasites are transmitted from one person to another by the female anopheline mosquito. The parasites develop in the gut of the mosquito and are passed on in the saliva of an infective mosquito each time it takes a new blood meal. The parasites are then carried by the blood in the victim's liver where they invade the cells and multiply. After 9-16 days they return to the blood and penetrate the red cells, where they multiply again, progressively breaking down the red cells. This induces bouts of fever and anaemia in the infected individual. In cerebral malaria, the infected red cells obstruct the blood vessels in the brain. Other vital organs can also be damaged often leading to the death of the patient. A danger to life in the acute stage, the chronic form of falciparum malaria lowers the physical well-being and working capacity of its victims.

Malaria can normally be cured by antimalarial drugs. The symptoms, fever, shivering, pain in the joints and headache, quickly disappear once the parasite is killed.

In endemic regions, where transmission is high, people are continuously infected so that they gradually develop immunity to the disease. Until they have acquired such immunity, children remain highly vulnerable. Pregnant women are also highly susceptible since the natural defence mechanisms are reduced during pregnancy.

Malaria is one of the most serious and complex health problems facing humanity in the 20th century. The spread of the disease is linked with activities like road building, mining, logging and new agricultural and irrigation projects. Elsewhere, disintegration of health services, armed conflicts and mass movements of refugees worsen the malaria situation. Of all the parasitic diseases, malaria is not only the greatest killer, but also one of the most widespread. It occurs or has occurred in all continents, in territories extending roughly from 60°N to 40°S. The distribution of the plasmodium species is not uniform, climate, vector mosquito density, intensity of man/vector control, efficiency of the vector species, and the size of the parasite reservoir, all influence the degree of malaria endemicity. Malaria is endemic in 91 countries with small pockets of transmission occurring in a further eight countries. There are 365 million people living in areas where malaria is still highly endemic. Approximately 300 million of the world's people are infected by the disease and between 1 and 1.5 million people die from it and more than 120 million clinical cases occur in the world each year. Malaria accounts for 10% to 30% of all hospital admissions and is responsible for 15% to 25% of all deaths of children under the age of five. Around 800,000 children under the age of five die from malaria every year. It is thus one of the major causes of infant and juvenile mortality. Pregnant women are also at risk since the disease is responsible for a substantial number of miscarriages and babies born underweight.

Malaria thus has disastrous social consequences and is a heavy burden on economic development. It is estimated that a single bout of malaria costs a sum equivalent to over 10 working days in Africa. The cost of treatment is between \$ US 0.08 and \$ US 5.3 according to the type of drugs prescribed as determined by local drug resistance. In 1987, the total "cost" of malaria - health care, treatment, lost production, etc. was estimated to be \$ US 800 million for tropical Africa and this figure is expected to be more than \$ US 1,800 million by 1995 (WHO, 1997).

Previously extremely widespread, the disease is now mainly confined to the poorer tropical areas of Africa, Asia and Latin America. The problems of controlling malaria in these countries are aggravated by inadequate health structures and poor socioeconomic conditions. The most endemic areas are tropical Africa and Asia. Over 80 percent of world's reported cases came from these two areas(Fernando, 1983).

China is among these endemic countries, malaria is also one of the major parasitic diseases in China. Since 1950 antimalarial campaigns have been launched in endemic areas, the policy makers gave priority to control of the disease in the context of public health and a nationwide control program was started in 1955. 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). After more than 40 years, the malaria control program has attained great achievement, but malaria is still endemic in China. Some areas such as Hainan, Yunnan, Sichuan, Anhui Provinces have high incidence ( 5.8 to 11.5 per ten thousands population in 1992) (Advisory Committee on Malaria, 1993). The National Program of Malaria Control (1992-1995) aims: 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.

Yunnan province, one of serious endemic areas, is located in the south-western part of China. There were 128 endemic counties/district ; after implementation of malaria control activities for many years, malaria has been eradicated in 18 counties up to 1995. Yunnan province neighbors Laos, Vietnam and Myanmar, with a total about 4067 km border, and the malaria spread can occur from one country to another. Malaria is transmitted during the whole year, but the high endemic months are from May to November. The incidence rate of malaria is 3.974 per ten thousand population in Yunnan province in 1995, at the second rank, and 30% of malaria cases are from Yunnan province at first rank in China; Malaria accounts for 20.98% of total cases of communicable diseases in

the province, malaria outbreaks occur in 11 administrative villages (Zhu et al, 1995), while the incidence rate is reducing gradually, stabilizing and/or decreasing to less than 1 per ten thousand population in most other provinces.

Malaria has been recognized as a major hindrance to economic progress in the province. Apart from the morbidity and mortality directly attributable to malaria, especially falciparum malaria, the disease is important mainly because of the chronic impediment to the health of rural populations, to increased deaths from other causes and to impairment of physical and mental activity. This vast load of sickness frequently overwhelms the local people. In some areas, there is a vicious circle of disease and stagnation of economic development: "people are sick because they are poor, they become poorer because they are sick, and sicker because they are poorer".

The local government has spent a lot of money on building up a malaria control network, providing materials and personnel for malaria control activities and leading to great achievement. However today malaria is becoming an even greater health problem than before in the province. Since 1978, when economic system reform occurred in China, the cooperative medical system disintegrated in many rural areas, because of the collectives' disintegration; morbidity of some parasitic diseases including malaria increased promptly. Health financing has varied greatly, especially in the preventive health care sector and the malaria endemic situation has changed also in this period. The fiscal system reform also caused the health budget to change from central government to the government. Decision making changed to county level. Resources available to the malaria control program are scarce in relation to needs and aspirations for the province. Preventive medical institutes should be supported by government wholly, but in some areas, anti-epidemic stations can only get half of their expenditure from government due to poor economic status, so they have to get money from their services to enable balance of finance. People should pay for malaria treatment and part of services fee for prevention, such as spraying insecticides and delivering preventive

medicine if they can afford. At the same time, the disease spreading conditions worsen in boundary areas. Mobile populations crossing boundary lines increase the risk obviously. These domestic people are often non-immune or low-immune in status and at high risk of malaria. Foreign malaria carriers move to different areas to leave malaria more difficult to control. Unfortunately, these population movements and the intensive urbanization are not always accompanied by adequate development of sanitation and health care. Malaria spread in the border areas become a leading problem in Yunnan province; malaria incidence was variable in Yunnan province and increased in some counties (Zhu et al, 1994).

Government paid more attention to disease control previously, much research about disease control strategies have been done, but rare concerned how to evaluate if health expenditures on malaria control activities were efficient and equitable. It becomes a very important issue to best use scarce resources.

Health financial resources should be allocated efficiently and equitably. Allocative efficiency is an optimal status at which the pattern of consumption of goods or services in a society can not be rearranged to make any individual better off without making anyone worse off. According to economic theory, in a perfect market the efficiency of resources allocation can automatically achieve, but the market of the health industry is not perfect one, because of the existence of market failure. Malaria is complex but it is a curable and preventable disease. Lives can be saved if the disease is detected early and adequately treated. It is known what action is necessary to prevent the disease and to avoid or contain epidemics and other critical situations. The technology to prevent, monitor, diagnose and treat malaria exists. It needs to be adapted to local conditions and to be applied through local and national malaria control program. In health industry provider side is more important than consumer side, government can play a very important role by adjusting the amount of supply, giving subsidies to malaria control activities, regulating the market

and reallocating the financial resources to minimize the cost of malaria control activities, close to optimal status.

There is a malaria case report system existing in China: utilizing it to analyze allocative efficiency and equity of malaria control activities and feed back to decision makers is useful for best use of scarce health resources.

## 1.2 Research question

Was the allocation of health expenditure of the malaria control program in Yunnan province of China in relation to different activities in the past efficient?

Were health expenditures equitable in different regions?

## 1.3 Objectives

### 1.3.1 General objectives

To analyze allocative efficiency in different malaria control activities in Yunnan province of China.

To analyze allocative equity of health expenditure of malaria control program in different regions of Yunnan province in China.

### 1.3.2 Specific objectives

To build an empirical model, and calculate the marginal effect of different malaria control activities.

To analyze allocative efficiency and equity applying the marginal effect.