

CHAPTER 1
INTRODUCTION



1.1 Background

1. Schistosomiasis in the world

Schistosomiasis is one of the most widespread human parasitic infections, and is regarded second only to malaria in terms of its public health importance among the tropical diseases in developing countries. More than 200 million people are estimated to be infected in Asia, Africa, South America, the Caribbean and the Middle East, and a further 600 million at the risk of infection throughout the world in 74 countries (WHO, 1993).

There are basically five species of schistosome. *Schistosoma haematobium* (*S. haematobium*) is endemic in 54 countries, mainly in Africa and the eastern Mediterranean; *S. mansoni* is endemic in 52 countries and territories of south Africa, the Caribbean, Africa and the eastern Mediterranean; and in 41 countries of Africa and eastern Mediterranean, both parasites are present. *S. intercalatum* has been reported from 10 countries - all, except Equatorial Guinea, with *S. mansoni* and/or *S. haematobium* as well. Either *S. japonicum* or *S. mekongi* has been reported from 7 Southeast Asian and western Pacific region countries (WHO, 1993).

Freshwater aquatic and amphibious snail intermediate hosts transmit schistosomiasis. Aquatic snails of the genus *Bulinus* transmit *S. haematobium* and of the genus *Biomphalaria* transmit *S. mansoni*; amphibious snails of the genus *Oncomelania* transmit the *S. japonicum* group and the Hydrobiid snails of the genus *Neotricula* transmit *S. mekongi* (WHO, 1993).

2. Schistosomiasis and its control in China

The finding of *S. japonicum* ova in two excavated corpses buried more than 2,000 years ago in Changsha County, Hunan Province and Jianglin County, Hubei Province suggests that schistosomiasis is not newly introduced. The first schistosomiasis japonica (*S. japonica*) case was reported by Logan, an American missionary doctor in Changde County, Hunan Province in 1905 (Zhou, Li & Yang, 1994).

Of all the schistosomes that infect man, *S. japonicum* is considered to cause the most serious disease. This may be due to the fact that *S. japonicum* female worms have a much higher egg output and the eggs are laid in large aggregates that induce intensive tissue reactions in host organs (Chen, 1989).

Before the founding of the People's Republic of China in 1949

and in the earlier phase of the national schistosomiasis control program in the 1950's, morbidity and mortality due to *Schistosoma japonicum* infection were relatively high in endemic areas. For example, in Jiashan county of Zhejiang Province, more than 17,000 fatalities related to schistosomiasis were recorded during a 10-year period (Mao, 1986). Horrifying terms were used such as "village without villagers" or "widows village" where most of the men in the villages had died because of their more frequent water contact.

After the founding of the People's Republic of China in 1949, large-scale surveys of schistosomiasis were organized, which showed that the disease was endemic in 380 counties of 12 provinces south of the Yangtze River. About 100 million people were exposed to the infection, of which 12 million were infected. About 14,000 square kilometers were infested with *Oncomelania* snails (Zhou, Li and Yang 1994).

A schistosomiasis control campaign was launched in 1956, and since then the disease has been eradicated in 4 of the twelve provinces concerned: Fujian, Guangdong, Guangxi and Shanghai. Prevalence of the disease has also been reduced in many of the other provinces; the disease has been eradicated in 158 counties and effectively controlled in 101. The number of counties in which schistosomiasis is endemic has been reduced from 380 to 129 (a 68% reduction), and the number of people infected has been reduced from 12 million to 1.6 million (an 87% reduction). The areas that serve as a habitat for infected snails have been reduced from 14,000 to 3,700 square kilometers (a 74% reduction) (Wang, 1989; Qian, 1987).

Approaches for schistosomiasis control in China are more or less like those other endemic countries and mainly consist of large-scale chemotherapy, both for infected persons and cattle, and snail control with environmental modification and mollusciciding. Health education, safe water supply and sanitation, and individual protection also have their place. Treatment for *S. japonicum* infection is free of charge and extensive use of the most effective drug - praziquantel - has expedited the control process. The great support with financial and human resources from the government and the capacity to mobilize and rely on the communities have allowed the elimination of many of the snail habitats, a task which needs a large amount of funds as well as manpower and redoubled efforts. Snail control has mainly been carried out in the course of agricultural reclaiming wetlands, levelling the lands, digging new ditches and filling up the old ones, ploughing by machines and afterwards "Pressing" (compacting) earth and mollusciciding.

However, there are still 3600 sq. km. snail infested land in China, spreading over 121 counties in eight provinces, mainly in the lake areas (95.5%); the rest are in the mountains (4%) and land areas linked by water ways (0.5%). An estimate 1,560,000 people are infected with schistosomiasis, 80% of whom come from the lake areas, the rest from the mountains (Yuan, 1992). In the lake areas, schistosomes are found in snails along the Yangtze River and the lake shores that are linked to it. The water level is high in the summer and goes down in the winter, leaving a deep deposit of silt and sand from the river, in

which grass springs up, providing an environment in which the vector breeds rapidly. As a result, the snail infested area is actually increasing. Snails carrying the parasite travel into the farming areas through the irrigation channels. Migrants and their cattle who visit these areas also get infected, and carry the parasite further afield. In mountain areas with a mild climate and abundant rainfall, snails breed in the streams, valley pastures, terraced fields and irrigation canals. The complex canal systems, steep mountains and widely scattered population in these areas make control difficult, especially as cattle and wild animals are the main reservoir of infection.

The main features of schistosomiasis endemic areas in China are shown in figure 1.1.

3. Schistosomiasis control organization

The schistosomiasis control organization rests on three somewhat independent "legs" - the political, administrative and technical structure (Fig. 1.2). These three parallel but mutually supportive lines of authority and responsibility extend from the national to the township levels; and each serves a distinct but complementary function. The intersectoral leading groups report to the political chain of command and provide policy direction; the health bureau staff report to the Ministry of Public Health (MOPH) and oversee implementation; and the research institutes, anti-schistosomiasis stations and anti-epidemic stations at various levels provide scientific leadership, undertake much of the schistosomiasis control activities, and provide technical support services required for disease surveillance, prevention and control.

Figure 1.1 The Schistosomiasis Endemic Areas and Their Features in China

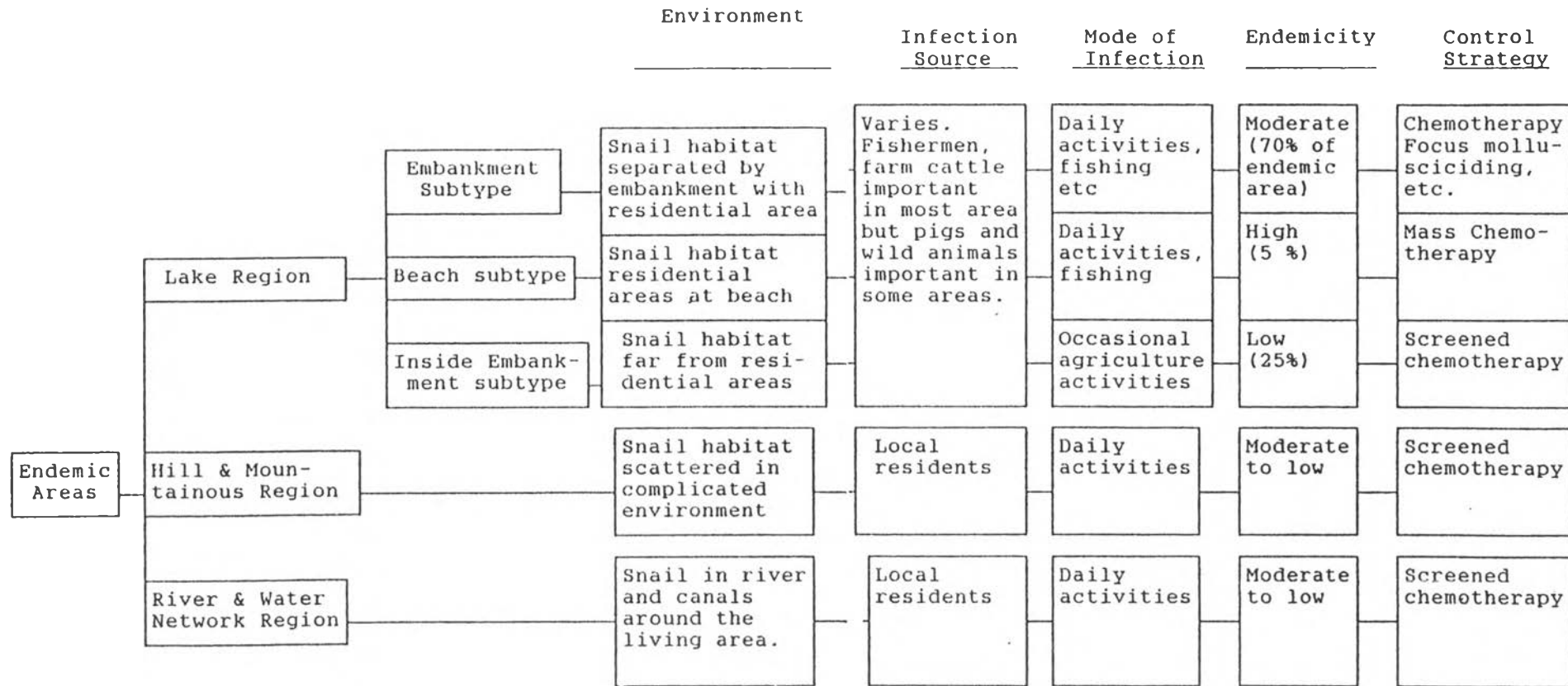
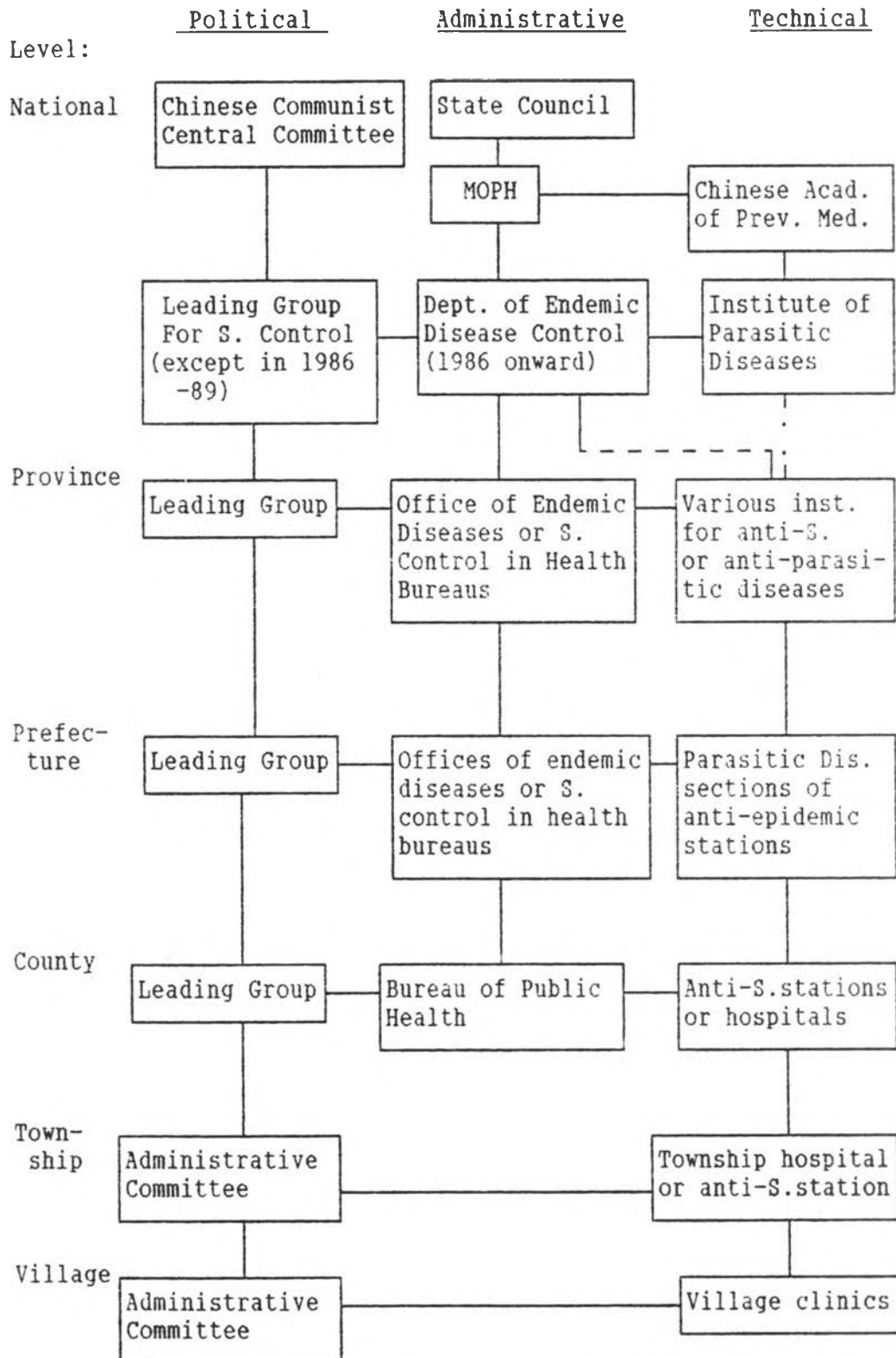


Fig. 1.2 Organization of Schistosomiasis Control in China



1.2 Rationale

Without doubt, the control of schistosomiasis in China has been quite successful in the areas of achieving reduction of endemic areas and protection of people's health. As early as 1955, a national program for schistosomiasis control took shape when the Central Communist Party drafted the National Agricultural Development Program. Schistosomiasis control was considered a priority in one of the articles of the program because of the detrimental effect on the rural population and agriculture development. From then on, the political priority and attention paid by different levels of government enabled the disease control activities to enjoy a considerable amount of resources, both from the government input and the local involvement. However, along with the changes of the scenarios of endemicity and the national economic reform, the control program encountered different problems, some of which need application of economic principles and theories to solve.

1. The economic concern of the program

In principle, the limited economic resources available for health in developing countries necessitate the involvement of cost analysis in the planning of any control interventions. However, as China had for many years been practicing a central planning system before the market economic reform was introduced, schistosomiasis control program was by no means an exception under which more attention was paid to the outcome of the program, i.e., the number of patients cured and the snail habitat areas decreased etc., while much less care was going to the input as well as the efficiency of the control activities. This is a situation which has not changed significantly and a great deal of work need to be done in this regard. Furthermore, along with the economic reform process, the health care planners and managers are feeling more and more strongly the limited health care resources which can be allocated for control activities, which could be judged from the stable or slightly increased nominal input but actually decreased input for the schistosomiasis control activities from the central government in those years (MOPH, 1991). It is quite predictable that the financial input from the central government will become less and less compared with the health needs due to the decentralization reform. It is therefore imperative to further explore the nature of the cost components and means of choosing the most cost effective way in the control program which will be affordable under the changing economic context.

2. The concerns for financing after the completion of the World Bank Program

Since 1992, a World Bank Loan Program for schistosomiasis control in China has been implemented in the endemic provinces for a period of five years. The injection of the loan is of great help to the current control program which encountered substantial financial constraints and the endemic situation was deteriorating in some areas. As a result, during the loan program period, the Chinese

schistosomiasis control is now enjoying a degree of financial input which it has never had before. However, it is expected that there will be a radical reduction in the financial input for the program when the loan project finishes. This problem is critical because now we have an amount of resources sufficient to carry out the control activities. However, the future financial situation for schistosomiasis is expected to be worse than ever if a stable and reliable financing mechanism could not be secured. There are several arguments to support this point of view. Firstly, the provincial governments will be responsible for the repayment of the loan when it is due. Secondly, the local governments in the future will need to take up more financial responsibilities for the local affairs. This is considered as a double burden, which, if not carefully studied and planned, could deteriorate the financing of the program and thus deter progress in the control of the disease.

Furthermore, the implementation of the World Bank Loan Program has changed the schistosomiasis control strategies and policies to some extent. Some of the changes deserve careful study about the impacts on future financing. For example, the control strategies have been changed from emphasizing integrated measures, including treatment of infected human beings and animals, snail control by mollusciciding and environmental modification etc., to depending heavily on chemotherapy throughout the endemic areas. The chemotherapeutic drug, praziquantel, is now being provided by a South Korean company who won the international bid, while the production lines in the domestic factories which used to produce the drug now are closed. The molluscicides now being used also changed from NaPCP which is cheaper but harmful to the environment, to niclosamide which is more expensive but friendly to the environment.

In general, financial problems are imminent for the schistosomiasis control program in China, hence the need for economic approaches to help resolve them.

1.3. Research questions

1. How will the resource requirement be estimated?
2. In terms of resource requirement and resource availability, what will be the "resource gaps" by implementing different control approaches?
3. How to make up the expected "resource gap" and how to sustain the program under different scenarios?

1.4 Objectives

1. To develop a model for calculation of cost and unit cost for different schistosomiasis control approaches in China.
2. To simulate the "resource gaps" between resource requirement and resource availability.

3. To derive policy implications for sustaining and financing schistosomiasis control under different scenarios.