



CHAPTER 2

RESEARCH OBJECTIVES AND CONCEPTUAL FRAMEWORK

2.1 Research Questions

Chemotherapy, molluscicide and environmental change were widely used on control schistosomiasis in China. Do those approaches have different inputs and outcomes, and which is the most cost-effective approach?

2.2 Research Objectives

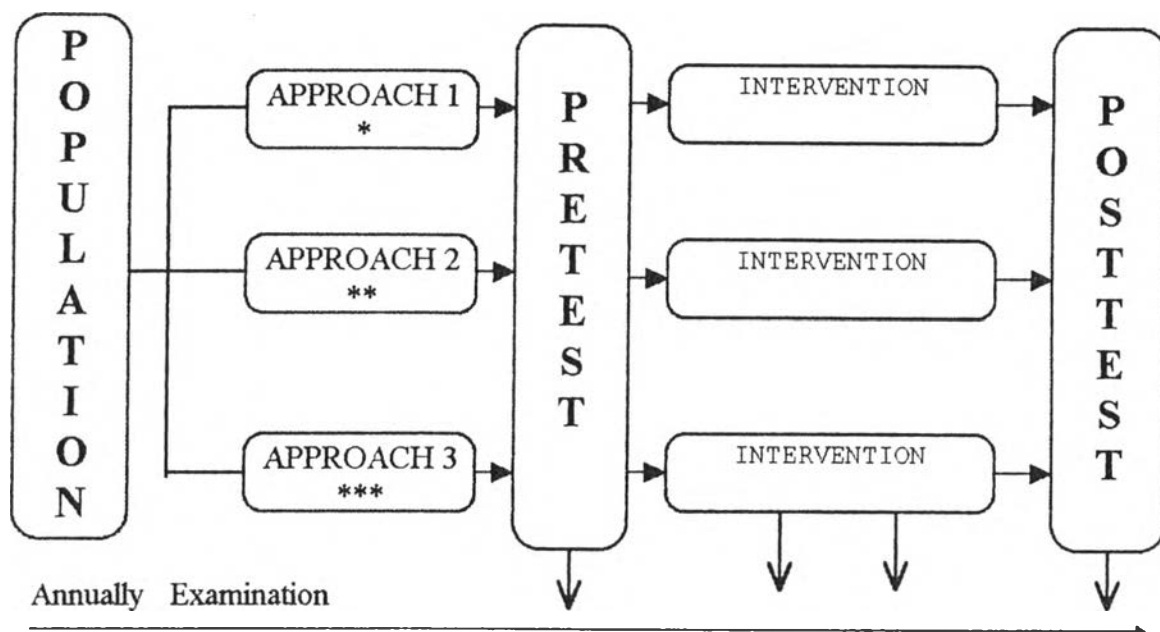
The research objectives are:

1. to measure cost, effectiveness and relationship between the cost and effectiveness of three control approaches to determine which approach is the most cost-effective; among the three approaches, namely chemotherapy, molluscicide, and modified environment in reducing prevalence of schistosomiasis in the marshland areas of south of China.
2. To use cost effectiveness analysis to help us examine alternative ways of achieving a given objective and enable us to select the method that uses available resources most effectively in schistosomiasis.

2.3 Study Framework

Three communities in Guichi County were identified. Those three communities are located within 10 km along Quipu River. The study framework is shown in Figure 2.1. Three communities were observed at the same time, by the some methods, with respect to the different control approaches. Community A received selective mass chemotherapy, Community B received molluscicide plus selective mass chemotherapy, and Community C received environmental change plus selective mass chemotherapy. Cost and effectiveness of the three approaches were measured for eight years.

Figure 2.1 The Framework of the Study



* Approach 1- Chemotherapy

** Approach 2 - Chemotherapy plus molluscicide

*** Approach 3- Chemotherapy plus environment management

2.4 Field Background and Study Sample Selection

The Research was carried out in the marshland area located Guichi County of Anhui province, south of China, (N 30.85-30.92; E 117.36-117.45) and the shore of the Quipu river whose water pours into the Yangtze River (Chang Jiang).

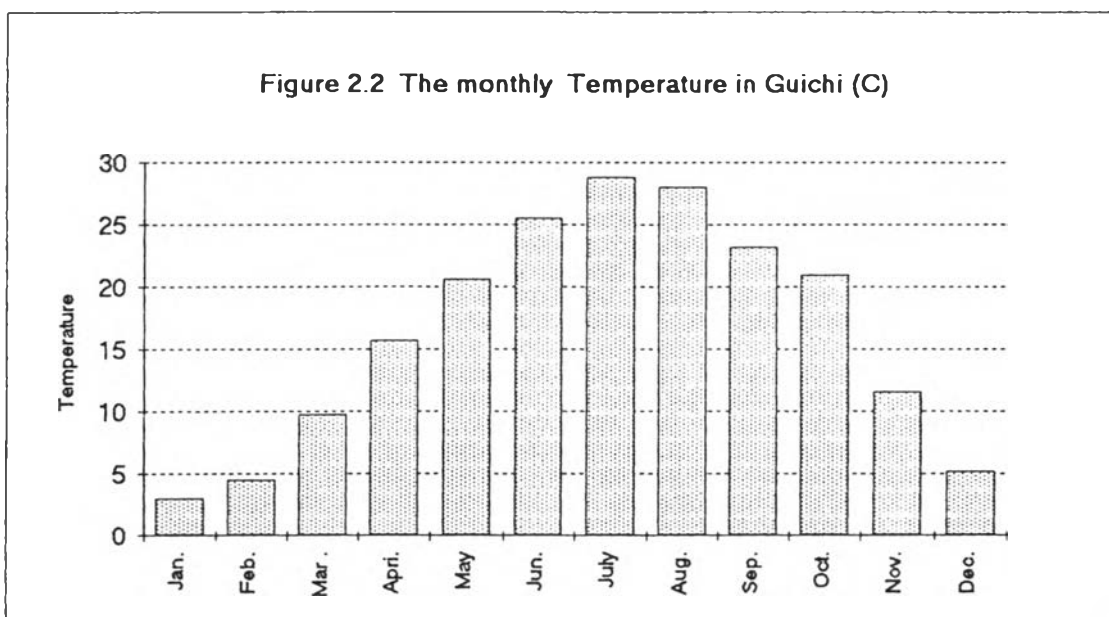
There are four seasons and abundant sources of light, heat and water. The first frost is at the middle of November and the last frost is at the middle of March, and no-frost time is about 230 days of a year. The mean of yearly temperature is 16 °C, the coldest days are in January. The mean monthly temperature change is 3.2 °C. The hottest days are in July and the mean monthly temperature is 28.7 °C.

The rainfall is about 1200 to 2000 mm and there are about 150 rainy days every year. The distribution of rain is not the same in the four seasons. Spring has more rain days, Summer has more heavy rains, Autumn has rarely rains and Winter is the dry season. The rainfall distribution in the four seasons is shown in Figure 2.3.

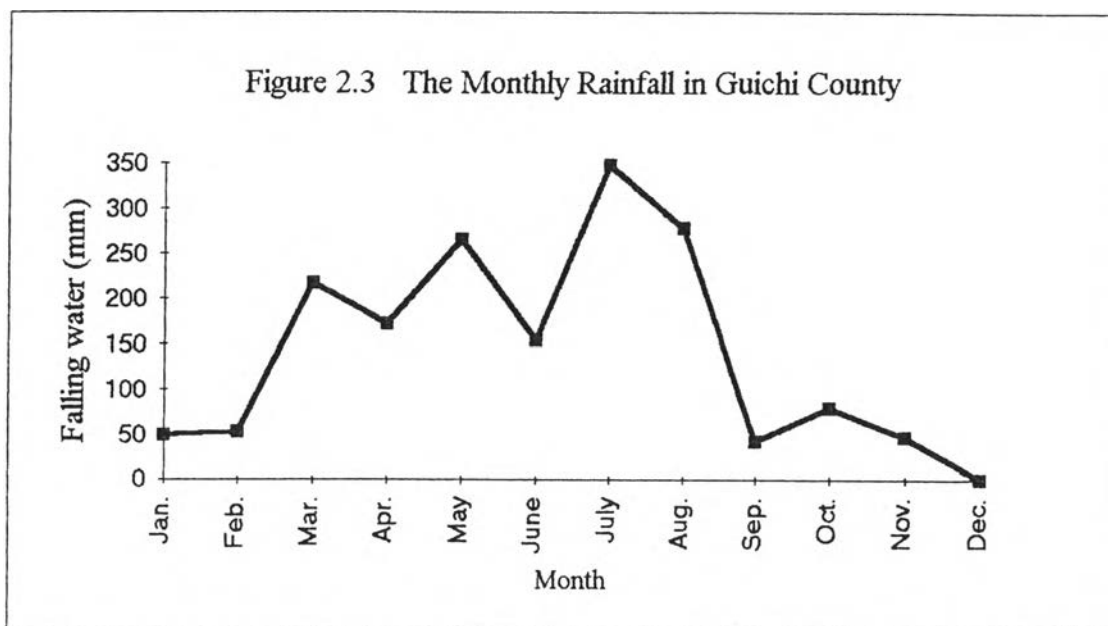
Water level in pilot areas is affected by the level of the Yangtze river. The flood season usually runs from May or July to October or December. In the flood season, the marshlands are covered by water and it looks like a lake. This area is called the Summer lake area.

There are large marshlands located on both banks along the Quipu River. The height of the marshlands is about 7-10 meters (Wusong high level: China criterion high level). The underground water can be found only under soil about 0.4 meter. The PH of soil is between 6.5-7.5. The organic layer soil is about 1.3-3.8% in the surface of soil. The grass in the marshes is abundant.

The snails are comfortable in the wet seasons and temperature above 13 °C. From Figures 2.2 and 2.3, we can see the snail activity seasons are from March to November.



Source: Guichi County Weather Forecast Station Annual Report



Source: Guichi County Weather Forecast Station Annual Report

The products of agriculture in this areas are rice, oil crops and vegetables. The hygiene of villages and residence environments are poor.

Guichi is a typical rural area. The marshes of the study communities, that is the part of banks of Quipu River, are used for the grazing of cattle, water buffalo and pigs. The grass is harvested as winter fodder. The population consists of farmers, some of whom are part-time fishermen in the flood season. The closer farmers live to the shore, the higher is the probability of water contact. The residents go the marshlands for mowing grass, fishing, herd cattle, washing and swimming(Chen, 1990).

The flooding season starts in May and lasts through October or later. During this season, the marshlands are gradually flooded. The land starts to reemerge in September. Pig in marshland belongs to the inhabitants of villages near the marshes.

Three communities in Guichi county, Anhui Province were identified. Each study community was asked to have 5 natural villages (about 600 persons) as survey samples. The three communities are located within 10 km within 500 meters of marshes. Community A received chemotherapy, Community B received molluscicide and annual chemotherapy, and Community C received

environmental management, annual chemotherapy and molluscicide.

2.5 Fields Research Stages

The time of study was divided into two stages. The first four years was the implementation period (stage one). In this stage the community A received the approach of chemotherapy, the community B received the approach of molluscicide plus selective mass chemotherapy, the community C received the approach of environmental change plus selective mass chemotherapy. The other control will be described latter.

After stopping the intervention, we continued to observe for the another four years, called the maintenance period (stage two), to observe the long-run effects of three approaches. In the maintenance stage, the experimental approaches were stopped, other approaches were given by local anti-schistosomiasis stations according to local anti-schistosomiasis programmes. Annually data of prevalence of schistosomiasis and control approaches were collected for eight years. Those data are used to calculate the results of cost and effective of each alternative. In this period, the surveys for the population and snail were engaged by the research team. The persons with schistosomiasis when they asked to be treated were treated by local health workers and the other anti-schistosomiasis approaches were given by local anti-schistosomiasis stations.

In the whole study period, the population were examined in the spring. The other anti-schistosomiasis approaches were given after the population examination.

2.6 Sample Size

Assumptions of the study communities were set: For each approach, before intervention the prevalence of schistosomiasis is 15% (P_1), after intervention the prevalence will decrease to 8% (P_0). The sample size is:

$$n / \text{Group} = \frac{(Z_{1-\alpha/2} \times \sqrt{2PQ} + Z_{1-\beta/2} \times \sqrt{P_1Q_1 + P_0Q_0})^2}{(P_1 - P_0)^2} \quad (2.1)$$

- α = Type I error,
 the probability of rejecting a true null
 hypothesis, here α was set at level of 0.05.
 β = Type II error,
 the probability of accepting a false null
 hypothesis, here β was set at level of 0.1.
 P_1 = Prevalence of schistosomiasis before the
 intervention
 P_0 = Prevalence of schistosomiasis after the
 intervention
 $Q_0 = 1 - P_0$;
 $Q_1 = 1 - P_1$

where:

$$\begin{aligned}
 P_0 &= 0.15, \\
 P_1 &= 0.08 \\
 P &= (0.15+0.08) / 2 \\
 &= 0.115 \\
 Z_{1-\alpha/2} &= 1.96 \\
 Z_{1-\beta/2} &= 1.282
 \end{aligned}$$

$$\begin{aligned}
 n / \text{Group} &= \frac{(1.96 \times \sqrt{2 \times 0.115 \times 0.885} + 1.282 \times \sqrt{0.15 \times 0.85 + 0.08 \times 0.92})^2}{(0.15 - 0.08)^2} \\
 &= 434
 \end{aligned}$$

The population for each community was asked to be more than 450.

2.7 Technical Definitions

Capital depreciation or capital recovery is the reduction in value of assets covered by the corporation.

Depreciable life is the life of assets with depreciation.

Depreciation rate is the fraction of the basic initial cost removed through depreciation from the corporate books each year.

Prevalence of infection is the proportion of the population with schistosomiasis, i.e. the population of individuals with schistosoma eggs in the stool.

Intensity of infection is estimated according to the number of eggs per gram of faeces. The data is presented according to egg-count classes.

2.8 Operational Definitions

Selective mass chemotherapy is a treatment of infected persons identified by diagnostic survey of population.

Area-wide mollusciciding is a method for the control of transmission of schistosomiasis. The molluscicides were sprayed on whole marshes and pools where snails breed. In this study, the molluscicide sodium pentachlorophenate was used for destruction of snail host.

Focal mollusciciding is a way of chemically spraying the marshes where near the villages and snails breed. The areas of spraying the molluscicide is less than area-wide mollusciciding. In this study the molluscicide of sodium pentachlorophenate was used.

Environmental Change (environmental management) is a method to modify the marshes and swamps where snails breed.