CHAPTER 3

RESEARCH METHODOLOGY

3.1 Study Type and Study Population

This was a field intervention project to be described in section 3.2 below.

3.2 Schistosomiasis Survey

3.2.1 Schistosomiasis Survey in the Population

Three communities were chosen as study pilot areas. All of residents in research communities aged among 3-60 year were as the study subjects to be observed.

During the intervention period, all of the people were annually examined by the Kato-Katz method, a quantitative examination for *Schistosome japonicum* eggs. Essentially the procedure involved the use of sieves and stainless steel templates that deliver 50mg of feaces. Dissolution of particulate with a green cellophane coverslip previously soaked in 50 glycerin for 24 hours. One sample of feace were made two slides. Eggs were counted within 2 weeks after preparation of the slides.

3.2.2 Snails Survey in the Marshlands

Maps of the marshes in front of the three communities were overlaid with a 20 X 20 meters grid. Corresponding to the intersections of the grid lines, circles of one square chi (0.11 m^2) were stacked. Every year in spring these circles were used as collection points for snails. All snails within in a circle were taken to the laboratory. They were crushed and microscopically examined for the presence of cercariae.

3.2.3 Data Analysis

The prevalence of schistosomiasis in the three groups were analyzed annually. All of the people in the study areas had recorded age, sex, residence, the results of examination. The data were fed into the computer as the database file for analysis.

3.3 Cost and Effectiveness Assessment

The costs are calculated on an annual basis for the whole period. Only the cost for implementing the control program was assessed, since the aim is to determine the costs of the control programs, any cost for research components of the project will be eliminated in the cost calculation.

3.3.1 The Cost Analysis.

The cost for each control approach were calculated as follows:

1. Measure the amount of each resource that was consumed or used in each program separately.

2. Identify all resources that were involved in those control programs separately. Identify the price of each resource.

The costs were estimated on an annual basis and then the total costs of the program are determined as the sum of the costs in the whole period. It was also standard practice to separate these inputs into recurrent and capital costs. However, only the calculation of the first year costs are given in details here. The costs are divided into the recurrent cost and capital cost in here.

A. Recurrent Cost

Recurrent costs are composed of the costs of personnel, supplies, molluscicide, drug for treatment of schistosomiasis.

Personnel Cost

All full and part time personnel and all volunteers involved in the control program were included. The cost is based on the data of the Annual Report of China National Statistics Office. The cost included all administrative and operational personnel. The amount of time that each person spent on the program was calculated. This quantity can be expressed in terms of the amount of time spent or the proportional time of a person's duty on each program separately. The gross salary of each person was calculated on a weekly basis according to the China National Statistic Annual Report. The cost of part-time

personnel involved in the program was then assessed as the cost of the time spent by that person on the program.

Material and Supplies Costs

All materials used in the programme were calculated. This does not include materials required for the operating and maintenance of capital equipment, as these are normally considered under a separate heading. The materials and supplies included drugs and stationery. The amounts of all materials used were determined. it was the quantities consumed that were measured, not the amounts ordered or budgeted. These figures also included waste due to spoilage, breakage, theft and misuse.

Operating and Maintenance Costs:

All those items used in operating, maintaining and repairing any building used in the program were calculated. The costs included charges for lighting, water, heating, building insurance, materials for cleaning, painting and repairs of plumbing, roofing, heating and office furniture if present. The quantities of these materials used and the unit costs of the items were determined. The total costs of these materials were determined. The same principle applies as for determining the cost of operating and maintaining vehicles.

A comparison of different approaches (adjusted for the eight years resource outlays) was made with cost adjusted to present value (the value of the first year of study). The assumption here is that the costs all occur at the end of each year; we shall thus have:

$$R_0 = \frac{R_n}{(1+i)^n} \qquad (3.1)$$

$$R_1 = R_0$$

$$R_2 = R_0\ (1+r)^{2-1}$$

where the costs occur at the end of each year.

R_0 = money at present
R_1 = money at begin of the year 1
R_2 = money at begin of the year 2
i = interest rate.

B. Capital Cost

Each item of capital cost is divided into vehicles, equipment and building. For each capital item involved in the control program, the following information is required:

1) The type or model of the capital,
2) The number used in the program,
3) The amount of time each item was used for,
4) The cost of each item,
5) Capital depreciation.

The annual depreciation is determined by the recovery period of the asset. If the inflation rate is i per year and remains unchanged through the next years, the value of equipment at the end of nth year will be:

$$C_n = C_0 \times (1+i)^n \tag{3.2}$$

$$C_n = P_1 + P_2 + P_3 + P_4 + \ldots\ldots + P_n \tag{3.3}$$

where

C_0 = the equipment purchase cost,
C_n = the future cost of the equipment in the life of n years,
i = the inflation rate,
P_i = the every year cost of capital.

The future cost C_n is able to be distributed equally over the n years, the amount P_1 to be saved by the end of each year i will give C_n / n at the end of nth year (if it is invested in the bank at interest rate r per year). As the amount P_n saved at end of the last year will not have generated any interest, we shall have:

$$P_n = \frac{C_n}{n(1+r)^{n-1}} \tag{3.4}$$

where

C_n = the future cost of the equipment in the life of n years,
r = the interest rate of bank,

P_n = the n year cost of capital.

C. Itemized Cost Menus

The costs data were organized to construct itemized cost menus. In this way all resources are listed, and the unit price and quantities consumed of all resources are given explicitly. An itemized cost menu for mass treatment which was used as a framework in this analysis is shown in Table 3.1.

Table 3.1 The Calculation Menus of Items Cost

Category	Units	Unit Price	Quantity	Subtotal Cost
Current Cost				
1. drug (praziquanent)				
2. molluscicide (sodium pentachlorophenate)				
3. personnel				
4. materials				
5. supplies				
6. operating and maintenance				
Capital Cost				
1. vehicles				
2. equipment				
3. building				
Total cost				

3.3.2 Effectiveness Analysis of Each Approach

From each community, all of the population were examined pre-intervention and post-intervention parasitogically by the Kato-Kaze technique and the intensity of infection in each individual was recorded. This data were used to determine the reduction in the prevalence and intensity of infection. Density of snails in marshlands was measured. Several measures of outcome were determined. These are as follows:

1) The reduction in the prevalence of infection
2) The reduction in the intensity of infection
3) The change in the density of snail
4) The change in the density of infected snail.

The effectiveness of each control was determined as the difference in the prevalence of infection between pre-control and post-control. This is expressed as the absolute difference in these values that would be analyzed as in Table 3.2.

Table 3.2 The Effective Measurement of Three Approaches of Control Schistosomiasis

Year	Effectiveness	for three approaches	
Pre-control indicator (B)	B_1	B_2	B_3
Post-control indicators (A)	A_1	A_2	A_3
Effectiveness (E) * $(B_i - A_i)$	E_1	E_2	E_3

B = The number of cases with schistosomiasis pre-control
A = The number of the case with schistosomiasis post-control
E = The number of the case with schistosomiasis decrease by the control approach
E_1 = Chemotherapy
E_2 = Molluscicide and chemotherapy
E_3 = Environmental change, molluscicide and chemotherapy

3.3.3 Cost-Effectiveness Analysis Procedures

The cost-effectiveness can be presented as in Table 3.3. Cost-effectiveness ratios (CER) of three approaches were calculated. the lowest cost-effectiveness ratio of three approaches belongs to the most cost effective approach.

Table 3.3 The Cost Effectiveness Ratio Measurement

Cost-effectiveness for three approach	Total		
cost	C_1	C_2	C_3
Effective	E_1	E_2	E_3
Cost-effectiveness ratio**	C_1/E_1	C_2/E_2	C_3/E_3

* the case of schistosomiasis reduction
** the cost per case reduction for each approach

3.4 Regression Analysis

The costs of different approaches would have different outputs. If there were no approach in those areas, the prevalence of schistosomiasis would be consistent. The prevalence of schistosomiasis would be decreased and the cases of schistosomiasis would be reduced by each approach. Comparing with pre-approaches, we can get the reduction of the case number of schistosomiasis. If we take the number of yearly accumulative cases decrease as an independent variable and take the yearly accumulated cost of each approach as the dependent variable, a regression model can be developed. From the model, the regression coefficient (b_i) of each approach indicates the cost of each approach, which is the cost for one case decrease. The smallest coefficient (b_i) will belong the most cost-effective approach. The process of regression calculation process showed in Table 3.4.

Table 3.4 The Relations Between the Case of Schistosomiasis Decreasing and the Cost of Each Approach

Year	ACD	CHE	MOL	ENV
1	ACD_{11}	CHE_1	0	0
2	ACD_{12}	CHE_2	0	0
...	ACD_{1n}	CHE_n	0	0
1	ACD_{21}	0	MOL_1	0
2	ACD_{22}	0	MOl_2	0
...	ACD_{2n}	0	MOL_3	0
1	ACD_{31}	0	0	ENV_1
2	ACD_{32}	0	0	ENV_2
...	ACD_{3n}	0	0	ENV_3

Regression of Three Approach

$$ACD = b_0 + b_1 CHE + b_2 MOL + b_2 ENV$$

where
ACD = the number of accumulative case decrease
CHE = cost of chemotherapy;
MOL = cost of molluscicide and chemotherapy;
ENV = cost of environmental change, molluscicide and chemotherapy.

3.5 The Factors of Individual Getting Infection

A logit probability model was developed to determine the probability of an individual getting infection. The probability of individuals infected with schistosomiasis was decided by some factors, such as the approach of control in the community level that can decrease chance of individual getting infection, the level of intermediate host-snail in each marshland of community and personality characteristics like sex, age. The logit probability model was developed here to express the factors that can affect the people's chance of getting infection. In the model the dependent variable is defined as a dummy variable.

$$P(D|x_1, x_2, x_3 \ldots) = \frac{1}{1+e^{-(a+\sum b_i x_i)}} \qquad (3.5)$$

where:

D = the person with schistosomiasis

x_i = the explanation variables which can be described as fellow

MOLL = 0 without molluscicide,
1 with molluscicide;
ENVM = 0 without environmental change,
1 with environmental change;
SEX = 0 if the person is female,
1 if the person is male;
Age3 = 1 0-9 year age group,
0 other age group;
Age10 = 1 10-19 year age group,
0 other age group;
Age20 = 1 20-39 year age group,
= 0 other age group;
DS = the density of the snail in the community marshes;
IDS = the density of infected snail in the community marshes.

If all of AGE3 AGE10 AGE20 were 0, that mean the person age was above 40 year age group.

Every person in the study was given the chemotherapy. The variable of chemotherapy was a common variable, so that the variable of chemotherapy approach was not listed as the independent variable in regression analyzed.