CHAPTER 4

COSTING AND COST MODELS

Costing is defined as the process by which estimates of costs of an action are made. This may be retrospective or prospective. Costing is important at three levels of planning programs: option appraisal, budgeting and evaluation. However, the principles of costing remain the same. Though the type and accuracy of cost information depends on the purpose of costing, it is important that the costs involved are well defined and sufficiently accurate. The real costs to the society are of paramount importance to the health sector. This is applicable not only to large scale disease control programs, but also to small scale trials at community level.

Cost information is one of the basic elements of economic evaluation of a control program or strategy. While cost description is limited to the examination of only costs in the case of a single service, cost analysis involves examination of costs of the alternatives whose effectiveness is not a contentious issue. It is a process of defining and determining the nature, components and magnitude of costs incurred. This requires adequate treatment while developing a model for costing different intervention measures against parasitic diseases.

Formidable conceptual and practical problems are involved in attributing realistic costs to disease and its control. However, such data are essential if the potential control tools/strategies are to be considered for operational use, following experimental trials.

A consistent module for estimating costs is highly warranted for disease specific programs from the view point of divergent types of cost descriptions and their lacunae. It is also expected to facilitate evaluation of the extent to which variations in cost data affect the affordability of the options. The current attempt at costing is to consider the chemotherapy-based measures and snail control options. Chemotherapy is carried out in the following forms: mass chemotherapy, selected population chemotherapy, selective group chemotherapy and chemoprophylaxis. For snail control, we have focal mollusciciding, slow release-mollusciciding, environmental modification, and snail control in combination with aquatic or agriculture development. Based on the objectives of the study, cost models and itemized cost menus for calculating cost and unit cost of different options will be developed, and a simple computer program will be developed for accounting the cost of different options for control of schistosomiasis.

4.1 Internal Cost (Provider Cost)

Internal cost is the most important part of aggregate cost for the program, which refers to the total cost incurred by the program implementing institutions. This includes the costs of capital items and

recurring costs. Capital costs are considered as the costs of items that provide a service for more than one year (e.g. buildings, vehicles, equipment). This should also include nonrecurrent costs on initial training activates for the personnel involved in the program that occur only once as well as the activities related to preliminary social mobilization if carried out only once during the launching of the program. Recurring costs are the inputs that are purchased, used or replaced within a one year period and costs on performing activities. Personnel, supplies, operation and maintenance of vehicles, equipment, buildings, recurrent training for the personnel, consultancy, supervision, community mobilization activities, communication and miscellaneous items such as printing, photocopying etc, are included under recurring costs. These recurring cost components are grouped under costs directly related to the activities and indirect costs that are supplemental to control activities.

In most cases of primary health care programs like those of schistosomiasis control, provider cost assessment is essential for the health care planners and administrators in the planing and administration process. This is primarily because that primary health care is a public good and is thus provided by the government without charging the consumer directly. The costs incurred by the consumers, therefore, are not significant in most circumstances.

1. Chemotherapy

Chemotherapy for schistosomiasis is the most important strategy currently being employed in the schistosomiasis control program in China. It is generally agreed that reducing the morbidity and prevalence are the primary objectives of chemotherapy. Currently, chemotherapy campaigns are being launched in the endemic areas under the support of the World Bank Loan Program. Generally, corresponding chemotherapy options are selected in accordance with the local epidemiological situations. This is the case for technical feasibility so far. However, economic consideration of the program necessitates cost estimation during the process.

a. Identifying resources used:

The community based chemotherapy campaign is carried out by mobile medical teams , whose composition of personnel and equipment vary in line with the purpose of chemotherapy.

Personnel: A medical team usually comprises a medical officer, medical assistant, nurse and driver if available. Often, supervisors go to the field for supervision and quality control. Where diagnosis is needed, laboratory technician(s) are included in the team. The cost for personnel should include full cost of employment, which encompasses salaries, fringe benefits and per diem for field work.

Medical supplies and consumables: Praziquantel is now the sole drug used in the program for chemotherapy against S. japonicum. Other medical supplies and drugs are needed for the treatment of adverse

effects caused by praziquantel. If diagnosis is to be carried out, diagnostic materials and equipment are required, such as microscope, containers, slides, coverslips and disinfectants for stool examination; test tubes, syringes and related instruments for blood tests.

Vehicles and other transportation means: If available, a vehicle is used by the mobile medical team to deliver drugs. As its costs are shared by many activities, only the local rental rate for the same type of vehicle will be used for estimation of vehicle cost for the purpose of convenience. The running cost for vehicle is calculated based on the gasoline and other materials consumed. In the case where there is no vehicles available, bicycles will be used by the staff to deliver the drugs.

b. Internal Cost Model for Chemotherapy:

$$ICC_j = (PC) + (VC) + (CoC) + (CaC) \quad (1)$$

Where:
ICC = internal cost for chemotherapy
PC = personnel cost
VC = vehicle cost
CoC = consumable cost
CaC = capital cost
j = specific chemotherapy activity

That is:

$$ICC_j = \Sigma \{(Sd*d + Pd*d) + (Vr*k + Vg*k) + (Bd*e*1.05) + (CoC*1.05) + [(Cv/Af)*Th)*Sh]\} \quad (2)$$

Where:
Sd = salary per day
Pd = per diem per day
Vr = vehicle rental
Vg = Vehicle running
k = Km
Bd = praziquantel dosage
e = unit price per praziquantel dosage
1.05 = 5% wastage
CoC = Consumable cost
Cv = current value of the capital item
Af = annualizing factor; based on the useful life years and discount rate (Creese & Parker, 1993)
Th = total utilizing hours in a year
Sh = utilizing hours for specific activity
d = days
j = specific chemotherapy activity

c. Itemized Cost Menu by Activity:

The purpose of developing an itemized cost menu is for the practical application in calculating the cost and unit cost for a specific chemotherapy activity. A simple computer program will be worked out based on the cost menu shown below so that the figures could be easily inserted; the cost and unit cost of the activity will be calculated and the cost analysis be made more simple (see Table 4.1).

Notes on calculation: Based on the principles provided by the cost models (1) and (2), calculations of the cost items in the menu are described as follows:

Personnel costs: Salary includes fixed amount plus fringe benefits provided by the institutions, which is calculated as salary per day. The daily per diem for field work will be used in the calculation.

Vehicle costs: The local rental and running rate per kilometer for the same type of vehicle will be used to calculate the cost of vehicle.

Consumable costs: They are calculated based on the real consumption of the drugs and materials in the operation.

Capital costs: Of those items which have a useful life more than one year, the costs will be calculated based on the useful life years and discount rate to get the annualizing factor which is divided by the current value (replacement costs) of the capital items. The allocation of capital costs is based on the time used for a specific activity.

Table 4.1 COST CALCULATION MENU FOR CHEMOTHERAPYY(PROVIDER)

Category/Item	Unit	Unit Pric	Total Unit	Sub Total Cost	Costs Allocated by Activity (RMBY) Superv.	Mobil.	Train.	Diagn.	Treat.
Personnel:									
Supervisor salary	Day								
Supervisor per diem	Day								
Medical officer salary	Day								
Medical officer per diem	Day								
Medical assist.salary	Day								
Medical assist.per diem	Day								
Lab technician salary	Day								
Lab technician per diem	Day								
Driver salary	Day								
Driver per diem	Day								
Sub Total									
Vehicle:									
Rental	Km								
Running	Km								
Sub Total									
Consumables:									
Praziquantel	Person								
Other drugs	Person								
Slides	Person								
Coverslides	Person								
Kato-Katz plates	Person								
IHA plates	Person								
ELISA plates	Person								
Antigen	Person								
Other consumables	Person								
Sub Total									
Capital Cost:									
Building	M2/D								
Microscope	W/D								
Weighing scale	W/D								
Bicycle	W/D								
Other equipment	W/D								
Sub Total									
Grand Total									
Total Number Chemotherapied									
Unit Cost Per Chemotherapy									

2. Snail control

a. Identifying resources used:

Personnel: For the snail control activities, the personnel involved includes expert, technical staff, technical assistants and supervisors. Like other personnel costs, the salaries, fringe benefits and per diem for field work should be included. In practice before and after focused molluscicide, a snail survey is usually carried out. In this case, the cost for snail survey should also be included in the activity.

Supplies and consumables: Molluscicides, principally niclosamide and NaPCP, are being used for killing the snails. For running the spraying machine, gasoline or diesel will be consumed. In the spraying process, protection measures should be taken to the workers as the chemicals are poisonous to human beings.

Vehicles and other equipment: A vehicle is necessary for carrying the spraying machine and molluscicides to the field. A spraying machine is the essential tool for molluscicide. As for the environmental modification, the community bears much of the costs by contributing considerable amounts of labor as well as materials.

b. Internal cost model for snail control:

$$ICS_j = (PC) + (VC) + (CoC) + (CaC) \quad (3)$$

Where:
ICS = internal cost for snail control
PC = personnel cost
VC = vehicle cost
CoC = consumable cost
CaC = capital cost
j = specific snail control activity

That is:

$$ICS_j = \Sigma\ [(Sd.d + Pd.d) + (Vr.k + Vg.k) + (Mw.e.1.05) + (CoC*1.05) + [(Cv/Af)*Th)*Sh]] \quad (4)$$

Where:
Sd = salary per day
Pd = per diem per day
Vr = vehicle rental
Vg = Vehicle running
k = Km
Mw = molluscicides in kg
e = unit price per kg of molluscicides

1.05 = 5% wastage
CoC = consumable cost
Cv = current value of the capital item
Af = annulizing factor; based on the useful life years and discount rate (Creese & Parker, 1993)
Th = total utilizing hours in a year
Sh = utilizing hours for specific activity
j = specific activity of snail control
d= day

c. Itemized cost menu for snail control:

The purpose of developing this itemized cost menu for snail control is the same as that for chemotherapy. By using this menu, the cost and unit cost can be quickly calculated and cost component analysis can easily be carried out. Also, a simple computer program will be developed for practical application (see Table 4.2).

Notes on calculation: Based on the principles provided by the cost models (3) and (4), the calculation of the cost items in the menu are described as follows:

Personnel costs: The salary includes the fixed pay and fringe benefits, such as accommodation and other subsidies provided by the institutions, which is calculated as salary per day. The daily per diem for field work will be used, which includes subsidy for working with poisonous substances.

Vehicle costs: The local rental and running rate per kilometer for the same type of vehicle will be used to calculate the costs of vehicle.

Consumable costs: This is calculated based on the real consumption of the molluscicides and materials in the operation.

Capital costs: Of those items which have a useful life more than one year, the costs will be calculated based on the useful life years and discount rate to get the annualizing factor and then divided by the current value (replacement costs) of the item. The allocation of capital costs is based on the time used for a specific activity.

Table 4.2 Cost Calculation Menu for Snail Control Options (Provider)

Category/Item	Unit	Unit Price	Total Unit	Sub Total	Costs Allocated by Activity(RMBY)				
					Superv.	Train.	Snail sur.	Mollusc.	Engene.
Personnel:									
Supervisor salary	Day								
Supervisor per diem	Day								
Technician salary	Day								
Technician per diem	Day								
Technician assist.salary	Day								
Technician assist.per diem	Day								
Lab technician salary	Day								
Lab technician per diem	Day								
Sub Total									
Vehicle:									
Rental	Km								
Running	Km								
Sub Total									
Consumables:									
Molluscides(spraying)	M2								
Molluscides (Immersion)	M2								
Fuel for spraying machine	Work hour								
Material for maintaining mach	Work hour								
Material for personnel protec	Work hour								
Other consumables	Work hour								
Sub Total									
Capital Cost:									
Building (store house)	M2/day								
Spraying machine	Work day								
Microscope	Work day								
Bicycle	Work day								
Other equipment	Work day								
Sub Total									
Grand Total									
Total Square Metre Treated									
Unit Cost Per Square Metre									

4.2 External costs

External costs are defined as the hidden costs imposed on the patients, the patients' family and relatives, the local community and on other agencies. Even if the costs towards any of these events are small and are unlikely to make any difference, it is worthwhile identifying such cost categories in any event although the estimation of them might not be pursued any great detail.

In this specific case, external costs are the costs incurred outside the schistosomiasis control program, i.e., those incurred by the community collectively or by the consumer individually. As indicated in the previous chapter, external costs are also important components of the aggregate cost, especially in the snail control activities. In this case, community contributions such as labor and materials constitute a significant part of the total resource used.

Consumer costs:

The costs borne by the target society in receiving the services offered under a given control program is a part of the social costs. It is basically the economic cost as the time/opportunity costs is the major component. Incorporation of external costs is an extension of the actual resources spent for a given program. From the economist's view point, costs from the demand side of a health service is as pertinent as the supply side. The costs of obtaining services are just as pertinent as the costs of producing services. The two principal elements in receiving the services by the consumers are the time cost and travel cost. It is also necessary to add the treatment cost if charged and/or costs for drugs if prescribed. Indirect costs are also attached to this as the patients receiving the services need to be accompanied by another member from the family or society. They also have to incur travelling cost in addition to foregoing opportunity costs. Examination of household costs of this type is also useful to understand consumer behavior in utilizing the services offered for a particular health problem.

Community costs:

In the control of vector-borne diseases like schistosomiasis, it is necessary to consider community activities towards the control of snails. This, along with prevention measures, has to be considered under community related external costs. When the collective force is utilized through community participation in the snail control program, the time cost, travelling costs and the cost for coping with their routine activity, if any, have to be considered.

Costs imposed on other agencies:

When the programs are aimed at intersectoral collaboration or co-ordination by involving other agencies such as other governmental departments, non-governmental agencies, etc, which are outside the health services, it is necessary to consider these resources while

costing. They are may be in the form of personnel or equipment or vehicles, diverted for collaborative activities in delivering the health services. Inclusion of this cost however depends on the relative magnitude. If the cost towards this is small, it can be omitted. But some justification should be given for the elimination of such costs perhaps based on previous empirical work.

1. External costs for chemotherapy

a. Identifying resources used:

Consumer: During the chemotherapy campaign, the mobile medical team go to the endemic villages and residential quarters to deliver praziquantel. Thus, the transportation and time costs incurred by the individual residents are not significant and thus not going to be estimated.

Community: When the mobile medical teams go to the field and deliver the chemotherapy drug praziquantel, carry out stool examination or collect blood samples, it is usual that the villages provide necessary labor to help the operations and the village leaders are responsible for organizing and mobilizing the villagers to coordinate the activities. This is the time and material costs incurred by the community.

b. External cost model for chemotherapy:

$$EC_j = \Sigma\ [(Ls.d)+(Vs.d)] \qquad (5)$$

Where:
EC = external cost
Ls = daily salary for labor assistant (paid by villages)
Vs = daily salary for village leader
d = day
j = specific chemotherapy activity

2. External cost for snail control

a. Identifying resources used:

Consumer: As snail control is preventive work, the residents usually do not take up the responsibility individually. Therefore, there is no need to estimate the consumer cost.

Community: For the snail control activities, the communities take up most of the responsibilities. Villages should provide labor to carry out molluscicidiing in the responsible areas under the technical guidance of the professionals from the anti-schistosomiasis organizations. The earth work of the environmental modification and agriculture or aquaculture integrated snail control projects are the responsibilities of the local communities through investment and labor

contributions. Some projects, such as the aquaculture integrated snail control projects, will have economic returns, for example, from fish harvesting. It will be enjoyed by the project investors of the community. Therefore, the net cost for the community should be the cost minus the economic return.

b. External cost model for snail control:

$$EC_j = \Sigma \quad [(Ls.d)+(Vs.d)+(MC_j)] \qquad (6)$$

Where:
Ls = daily labor salary
Vs = daily salary for village leader
MC = cost of material contribution
d = day
j = specific snail control activity

And:
$NEC_j = EC_j - ER_j$ (7)

Where:
NEC = net external cost
EC = external cost
ER = economic return from the project
j = specific snail control activity

4.3 Time factor for cost calculation

1. Present value

To calculate the present value for the future costs, it is always necessary to take inflation into account. The following formula can be used for calculation assuming the costs occur at the end of the year.

$$P = \sum_{n=1}^{n} F_n(1+r)^{-n}$$

$$= \frac{F_1}{(1+r)} + \frac{F_2}{(1+r)^2} + \frac{F_3}{(1+r)^3}$$

Where:
P = Present value
r = interest rate
n = cost at year n
F = future costs

2. Future costs

It is natural that people would rather have money at hand now rather than in the future. So, any of the costs/benefits occurred in the future should be discounted using the discount rate of 5%. Future costs should include the total investment cost (capital cost) and recurrent cost for a given year.

$$F(n) = \sum_{t=1}^{n} \frac{C_t}{(1+i)^t} + K_0$$

Where:

K_0 = capital costs
C_t = recurring costs of the year 't'
i = discount rate
n = costs at year n
F = future costs

The factor $(1+r)^{-t}$ is the discount factor and can be obtained from a given 'n' and 'r' from the annualization table (Creese & Parker, 1994).

4.4 Aggregate cost

Aggregate cost for a specific activity is the sum of the internal and external costs.

Aggregate costs = Internal costs + external costs