CHAPTER 4

ANALYSIS AND EXPECTED RESULTS

4.1 Inputs of the Malaria Control Project

According to the project document, the inputs of the MCP for diagnosis and treatment will be analyzed.

Table 4.1 Inputs of the Malaria Control Project for Diagnosis and Treatment (1994)

Input	Annual Cost (kyats)	Share of Total Costs %
Capital		
Vehicles*	315	6.4
Equipment	600	12.15
Buildings-space		
Training-nonrecurrent		
Subtotal, Capital	915	18.55
Recurrent		
Personnel*	2145	43.45
Supplies* *	1699	34.41
Vehicles-maintenance		
Building-maintenance		
Other operating cost*	176	3.55
Training-recurrent	2	0.04
Subtotal, Recurrent	4022	81.45
Total	4937	100

Source: VBDC, DOH, Myanmar(1994)
Note: * = 20 % of total expenditure is used for diagnosis and treatment.
** = 50% Of total expenditure is used for diagnosis and treatment(project estimation)
personnel costs = 43.45 % of total costs
Proposed Reduction of personnel costs = 10%
Thus 10% reduction of Personnel costs would reduce total costs by 10% of 43.45% =4.35%

4.2 Estimation of Future Cost

To estimate the future cost by the ingredients approach, annualized cost of each item is calculated.

(i) Calculation of annual economic cost of a microscope
Current value:kyats 18,000
Useful life:10 years
Discount rate:10%
Annualization factor(from a standard table):6.145
Calculation of annual economic cost: 18,000/6.145
= kyats 2929.2

(ii) Calculation of annual financial cost of a microscope current value:kyats 18,000
Useful life:10 years
Calculation of annual financial cost:18000/10
= kyats 1800

Future cost estimation is crucially important for the MCP to keep its track to be achieved the set objectives and targets. The blue print of the project proposal should be covered both its proposed activities and respective financial requirements. Not only large items of capital cost but also recurrent cost is likely to be paid attention to estimating future cost.

4.3 Cost-effectiveness Analysis

We will introduce RDT in the same area with current microscopy for diagnosis and treatment of malaria. Summary data are as shown in Tables 4.2 and 4.3.

Table 4.2 Basic Assumptions for Analysis of Hypothetical Data Set

Particular	Value
Population	4,500,000
Prevalence of malaria	50%
Disease status	
Malaria	2,250,000
Non-malaria	2,250,000

Continued Table 4.2

Total costs of diagnosis and treatment (**scenario-1)**	
RDT	890,000*
Microscopy	750,000**
Total costs of diagnosis and treatment (**scenario-2)**	
RDT	1,090,450*
Microscopy	790,690**
Total costs of diagnosis and treatment(**scenario-3)**	
RDT	1,023,500*
Microscopy	675,926**

Note: * Model output by using input estimated data
** Model output by using input real data

Step by step calculation of cost-effectiveness is as shown in below.

(1) Scenario-1 (The Best Case)

Assumptions

1. There are no false positives and false negatives.
2. There is no known parasite resistance to antimalarials.

		Malaria	Non-malaria
RDT	Positive	TP 2,250,000	FP
	Negative	FN	TN 2,250,000

2,250,000 2,250,000 = 4500000

	Positive	TP 2,250,000 a	FP b
Microscopy			
	Negative	FN c	TN d 2,250,000

2,250,000 2,250,000=4500000

With RDT

Cost: kyats 890,000
Effectiveness:2,250,000
Cost-effectiveness Ratio % = 890,000/2,250,000
= kyats 39/correctly detected and treated case

With Microscopy

Cost: kyats 750,000
Effectiveness:2,250,000
Cost-effectiveness Ratio % = 750,000/2,250,000
=kyats 33.3/correctly detected and treated case

(2) Scenario-2

Assumptions

1. There are false positives and false negatives.
2. There is no known parasite resistance to antimalarials.

		Malaria	Non-malaria
	Positive	TP 2,025,000 a	FP b
RDT			
	Negative	FN 225,000 c	TN d

2,250,000 2,250,000 =4500000

	Malaria	Non-malaria
Microscopy: Positive	TP 1,350,000 a	FP b
Microscopy: Negative	FN 900,000 c	TN d
	2,250,000	2,250,000= 4500000

With RDT

Sensitivity =90%

90% = a/2,250,000

$a = \frac{90 \times 2,250,000}{100} = 2,025,000$

Cost: kyats 1,090,450

Effectiveness:2,025,000

Cost-effectiveness Ratio % = 1,090,450/2,025,000

=kyats 53.8/correctly detected and treated case

With Microscopy

Sensitivity =60%

60% = a/2,250,000

$a = \frac{60 \times 2,250,000}{100} = 1,350,025,000$

Cost: kyats 790,690

Effectiveness:1,350,000

Cost-effectiveness Ratio % = 790,690/1,350,000

=kyats 58.6/correctly detected and treated case

(3) Scenario-3 (the worst case)

Assumptions

1. There are false positives and false negatives.
2. There is known parasite resistance to antimalarials.

		Malaria	Non-malaria
RDT	Positive	TP 2,025,000 a	FP b
	Negative	FN 225,000 c	TN d

2,250,0000 2,250,000= 4500000

Only 70% are correctly(completely) treated.(VBDC, DOH, Myanmar, 1993a)
Therefore, 2025000 X 0.7=1,417,000 correctly detected and treated cases

		Malaria	Non-malaria
Microscopy	Positive	TP 1,350,000a	FP b
	Negative	FN 900,000 c	TN d

2,250,000 2,250,000= 4500000

Only 70% are correctly(completely) treated(VBDC,DOH, Myanmar ,1993a).
Therefore, 1,350,000 X 0.7 =945,000 correctly detected and treated cases

With RDT
Cost: kyats 1,023,500
Effectiveness:1,417,000
Cost-effectiveness Ratio % = 1,023,500/1,417,000
= kyats 72/correctly detected and treated case

With Microscopy
Cost: kyats 675,926
Effectiveness:945,000
Cost-effectiveness Ratio % = 675,926/945,000
=kyats 71.5/correctly detected and treated case

The summary results of all scenarios are as shown in Table 4.3.

Table 4. 3 Cost-effectiveness Ratio of Two Diagnostic Technologies

Technology	cost	Effectiveness	Cost-effectiveness ratio %
scenario-1			
RDT	890,000	2250000	kyats 39
Microscopy	750,000	2250000	33.3
scenario-2			
RDT	1,000,150	2,025,000	kyats 49.3
Microscopy	790,690	1,350,000	58.6
scenario-3			
RDT	1,023,500	1,417,000	kyats 72
Microscopy	975,926	945,000	71.5

Note: Scenario-1 = There are no false positives and false negatives.

Scenario-2 = There are false positives and false negatives. Sensitivity level is assumed as 90% for RDT and 60% for microscopy.

All true positives are completely treated. (no treatment failure)

Scenario-3 = There are false positives and false negatives.

70% of true positives are completely treated.

Based upon our hypothetical data, diagnosis and treatment of malaria with microscopy has better cost effectiveness outcome than that of RDT in the scenario-1 and 3. But this is not true in the case of scenario-2 where there are problems of false positives and false negatives but no treatment failure due to drug resistance. This can be explained, that if there is no problem of drug resistance RDT will be more cost effective than microscopy. This points out that RDT may

incur less costs for false positives and false negatives by comparison with microscopy,i.e. RDT has better diagnostic accuracy than that of microscopy. In scenario-3, RDT is less cost-effective than the current diagnostic technology, microscopy. This can be explained that there may be more costs for using potent antimalarials which are more expensive than that of the first line drug. If our finding in the real situation shows that RDT has less cost-effective than the current technology, microscopy we have to think about the high unit cost of RDT at this time. Without any consideration of its advantages such as reduced waiting time, the high unit cost of RDT comparative to that of microscopy may be a potential constraint to introduce it in the MCP. For a wide application of RDT, ways and means for reduction of unit cost is a necessary and essential point to consider. Because of reduced waiting time with RDT we may reduce presumptive drug wastage(the first line drug) and are able to use appropriate second and third line drugs so to reduce morbidity and mortality effectively.

Sensitivity Analysis

It is necessary to measure the cost-effectiveness ratio using varying level of sensitivity: Sensitivity analysis(Table 4.4).

Table 4.4 Sensitivity Analysis

Sensitivity level	Cost	Effectiveness	Cost-effectiveness ratio %
1. 90%			
RDT	1,023,500	2025000	kyats 50.5
Microscopy	675,926	2025000	33.3
2. 80%			
RDT	1,023,500	1800000	kyats 56.0
Microscopy	675,926	1800000	37.0
3. 70%			
RDT	1,023,500	1417500	kyats 72
Microscopy	675,926	1417500	47.7
4. 60%			
RDT	1,023,500	1350000	kyats 75.8
Microscopy	675,926	13500001	50.0

Note: Based upon scenario-3

4.4 Expected Patient Costs for Diagnosis and Treatment

Patient interview with structured questionnaire will be conducted in the near future for collection of real data for seeking diagnosis and treatment in the malaria clinic of the malaria control project, Myanmar. For analysis in this study, hypothetical data will be applied as shown in Table 4.5.

Table 4.5 Patient Costs for Diagnosis and Treatment

Cost Items	Amount (kyats)*			
	mean	median	mode	1SD
Direct cost				
Traveling cost	5	7	6	1.2
Food cost	15	10	9	1.5
Indirect cost				
Time cost	25	15	20	2.5

Note: *Hypothetical data
Sample size is assumed as 100

The mean value of direct cost is 59% of total costs for a patient while the indirect cost is 41%. Based upon hypothetical data time cost is the highest among all the costs. It is also true for accompanying persons. This is partially due to the time cost of waiting for the services. Loss of income may be obvious for those suffering of malaria. It will, needless to say, affect the overall welfare of family, community, and even the nation as a whole in an endemic country. To reduce the waiting time, rapid on-site diagnostic technology may be one of the possible solutions. The median value is also crucially important to determine the amount of willingness to pay by half of the participants(Table 4.6).

4.5 Willingness to Pay

Patients' WTP is important because their responses to prices will influence service utilization and pattern. Here, how much patients are willing to pay for a service with RDT may be assessed by asking them directly(Table 4.6).

Table 4.6 Willingness to Pay When RDT Diagnosis is to be Introduced

Particulars	Number	percentage
Willing to pay	50	50
Not willing to pay	40	40
Don't know/No answer	10	10
Total	100	100

When the interview section is focused on introduction of RDT, it is hypothesized that 50 % of participants have willingness to pay for it. But the important point here is that there is not too much difference % of patients having no willingness to pay for it. This means they may not have enough knowledge of RDT and/or the services rendered for RDT may not be satisfactory to them. They may find at difficult to believe in this innovative test comparative to microscopy (Indaratna and Kidson, 1995a). The social marketing approach including what product will be introduced at what price and accessible at which place, promoted by appropriate means of communication, would be needed to call the community's attention to this new technology.

Table 4.7 Willingness to Pay When Waiting Time Reduced to 15 Minutes

Rate of charge	% willing to pay	% Not willing to pay	% Don't know/No answer
For diagnosis	70	25	5
For treatment	90	5	5

Note: Hypothetical data

Here(Table4.8), we suppose 70% of patients are willing to pay for diagnosis and 90% are for treatment. It means they prefer to pay for the treatment than the diagnosis. This phenomenon shows that patient's attitude toward the treatment is more positive than to the diagnosis. One of the possible reasons may be perceived outcome of treatment such as provision of drugs and the expected immediate responses. The other possible reason may be their understanding of the diagnosis as an ever-together part of the treatment. Perhaps, they might have no idea of considering diagnosis as a separate service of the treatment. There may be their misunderstanding of

this question. This possible reason is also raised by Donaldson and others in their study at Aberdeen Maternity Hospital of WTP in which they point out the need to make clear to respondents understanding of the set questions.

Table 4.8 Expected Amount of Willingness to Pay If RDT is to be used

Amount To Pay (kyats)	Frequency*
5-10	*25*
11-15	*15*
16-20	*10*
21+	*0*

Note: * Hypothetical data

The amount to pay is different among the 50 patients who are willing to pay for RDT service(Table 4.9). 50 % of them are willing to pay between 5 and 10 kyats. There is no one willing to pay more than 21 kyats for it. The factors accounting for variation in amount may be their belief and trust in this new technology as Ryan(1995) has mentioned in his study.

Determination of the relationship between the dependent variable(WTP) and that of independent variables are to be explored in accordance with the multiple regression analysis. The regression analysis is to be performed by putting many independent varibles that are seemed to influence patients' WTP for seeking diagnosis and treatment(Table 4.9). The regression analysis is computed with the following assumptions:

1. The independent variables are nonrandom variables.
2. For the each value of independent variable, there is the value for the dependent variable.

Table 4.9 Independent Variables for Willingness to Pay

Independent variables	Willing to pay	Not willing to pay
1. sex Male Female		

Continued Table 4.9

2. Marital Status Single Married Widow		
3. Education (year of schooling) <4 years 5-10 years >10 years		
4.Household income <3600 kyats 3601-50000 50001-10000 + 10001		
5. Occupation private public dependent others		
6.perceived severity Mild Moderate Severe		
7.quality of service poor fair good		
8.Travel time <1/2 hour ½- 3 hours > 3 hours		

In this study, the relationship between dependent variable, willingness to pay (WTP), and independent variables is to be determined.

Willingness to Pay (WTP) = f(I,SI,QC,Tr,Oc,Sex,Edu)

$$Y=\beta_0+\beta_1 I+\beta_2 SI+ \beta_3 QC + \beta_4 Tr + \beta_5 Oc + \beta_6 Sex + \beta_7 Edu$$

I = Income of household per annum;
SI = Perceived severity of the illness;
QC = Perceived quality of malaria clinic;
Tr = Traveling time to arrive the clinic;
Oc = Patient's occupation;

Sex = Sex different of patients;
Edu = Education level of patient.

Among many independent varibles, some are to be removed if it is statistically not significant by looking at the p value according to t statistics. The expected regression results are to be summarised as shown in Table 4.10.

Table 4.10 Regression Results

Independent varibles	coefficient	value	s t a n d a r d error	t-statistic

Dependent varible = WTP for diagnosis and treatment
Number of variables.....(including the constant)
R^2 =..... Adjusted R^2 =.....

The amount of the change between the dependent variable (WTP) and the said independent variables is determined by the estimated regression coefficient. As expected, the quality of care, severity of illness, income of household per annum, occupation of the patient and educational level coefficient are positives. This can be interpreted to mean that some unit increase (improvement) of quality of care will lead to a unit increase in patient's WTP for the service rendered to them. This finding strongly supports the need to improve the quality of malaria clinics if there is a plan to introduce user-charges.

We may assumed that there will be positive relationship between WTP and severity of illness. In that case, we can explain that the more they suffer, the more they want to pay for the required services. This may be true because the patient wants to recover his/her health

quickly so that to become productive person in the labor force which in turn restore his/her earning capacity.

If the household income per annum is positively related to WTP for service it can be explained that they want to pay more when their income is increased. This may be true if they valued their health. If the relationship is negative , it indicates that they want to pay less when they have more income. This can be explained that they want to spend their money for their basis needs such as food, shelter and clothes. They only expect free-of-charge service for their illness.

If there is negative relationship between traveling time and WTP, it indicates that the longer the traveling time, the lesser they want to pay for the service required. Here, the point to ponder is whether the service points are to be established nearer to the users. The other independent variables are also to interpret according to their regression results.

There may be assumed as positive relationship between quality of service and severity of illness. If so, it means the more severe the illness they suffered, the better quality of service they preferred. Thus, in an endemic area it is necessary to establish quality-assured malaria clinics. Rapid diagnosis and prompt treatment as well as correct treatment is of crucial importance to assess the quality of the service. For this issue, RDT (ParasightF test) should be appropriate to consider for rapid confirmation of clinical diagnosis. National drug policy for malaria, treatment protocol, adequate supply and logistic control of antimalarials, skilled medical personnel and continuous monitoring of parasite resistance to antimalarials are important parts of the correct case management. Soe-Aung, Soe-Win and others (1994) stress this factor in their study conducted in Mudon township, one of the high malaria risk areas in Myanmar.