



CHAPTER 4

RESULT OF COSTS AND EFFECTIVENESS MEASUREMENT

The cost-effectiveness study involves assessing the outcome (effectiveness) and resource input requirements (costs) of alternative ways of achieving a common objective. The results are usually expressed in terms of cost per unit of effectiveness for each alternative. The cost-effectiveness measures must be linked for each alternative study. The resources costed should be those that are responsive for producing the effect measured. This mean that the costs and the effectiveness were measured over approximately the same period of time.

4.1 Costs Measurement and Analysis

131 falciparum malaria inpatients were treated by antimalarial drug regimens. There were two different regimens but the same duration of treatment (five days), 66 patients were treated by Art + Dox, 65 patients were treated by Qui + Dox. Malarial inpatients in each regimen group required assessment of the costs of treatment and clinical follow up period. Baseline information of the two drug regimens are presented in Table 4.1.

Table 4.1 Comparison of Baseline Information of Two Drug Regimens

Baseline data	Art + Dox	Qui + Dox
* Number of treated patients were follow up 28 days	66	65
* Mean of age in year	37.7	37.8
* Male	34	37
* Female	32	28
** Mean of fever(C degree in day D0)	39.4	39.5
* Mean of parasite density (in day D0)	8,471.7	8,981.6

To analyze the structure of costs, we should classify the costs into two types such as costs incurred by provider (provider costs) as the value of resources used to run hospital and costs incurred by patient as the value of income loss by illness and money spent for treatment.

4.1.1 Identify, Measure the Costs Incurred by Provider (PC)

The costs incurred by provider were costs of hospital to service to patient in hospital during 28 days. To estimate the costs incurred by provider, it is necessary to classify the components. Cost elements can be broken down in several different ways.

In this study we classified costs incurred by provider by inputs. This type of cost is based on categories in which the elements have recognizable, similar characteristics; the capital costs and recurrent costs were included. The costs incurred by provider were obtained by interviewing the managers of Lamha district hospital and related persons in the district health center.

The costs were calculated : $\text{Cost/bed used/day} \times 28 \text{ days}$ (follow up period).

(1). The Capital Costs

Capital cost are defined as inputs that last for more than one year, such as building, vehicle and equipment. At Lamha district, Lamdong province, district hospital was built over 20 years ago for 100 beds. There is no vehicle and equipment is old. Therefore, the capital costs will be very small when calculating capital costs per bed per day. Because of these reasons, we looked mainly at the recurrent costs in the district hospital.

(2). The Recurrent Costs

Recurrent costs were broken down into two components, i.e. direct costs and indirect costs (medical and nonmedical costs).

a) Direct Medical Costs (DMC)

* Cost of personnel (LC)

In order to calculate cost of personnel in hospital, personnel costs were calculated by two groups. One group included doctor, nurse, nurse assistant, etc, who served directly to malarial patients in clinical room and the other were health staff who served patients in laboratory, pharmacy department, administration department and other.

- Personnel in clinical room depended on characteristic of each department. In Lamha district hospital, one doctor is responsible for 10 beds, one nurse is responsible for 5 beds, one nurse assistant is responsible for 20 beds.

Cost of personnel in clinical room (LCC) was calculated as follows.

- List the personnel: doctor, nurse, nurse assistant, etc.
- Record their salary and any allowance received by them per month.
- To determine what proportion of time used per bed per month. In this case proportion of time of personnel in clinical room was 100% of working time.
- Calculate the cost of personnel in clinical room per bed for 28 days treatment follow up:

$$LCC = \Sigma \left| \frac{MS \times 12}{NB \times 365} \right| \times 28$$

Where:

- MS = Monthly salary
- NB = Number of beds used per days.
- 12 = Number of month per year.
- 28 = Number of days follow up period
- 365 = Number of days per year.

- To calculate the costs of personnel in other departments (LCo) such as laboratory, pharmacy, administration department and managers, information were required the same to personnel in clinical room but number of beds they are responsible being depend on proportion of bed used per year (total bed in Lamha hospital = 100).

* Costs of personnel per bed used in 28 days follow up (LC) were:

$$LC = LCC + LCo$$

Costs of personnel per patient in the two regimen groups were the same because of patients in the two groups were followed up in the same period of time (28 days).

* Drug costs (DrC)

Costs of drugs were different between the two regimen groups. They depend on the price, dose and duration of treatment of drug. It included antimalarial drugs and other such as drugs for treatment of side effects.

Full costs of drugs were calculated by real price of drug plus 10% of real price, the cost for transport drug to hospital.

$$\text{DrC} = \Sigma \left[(\text{Pd} \times \text{Qd}) + \frac{(\text{Pd} \times \text{Qd}) \times 10}{100} \right]$$

Where:

Pd = The price of drug.

Qd = Quantities of drug used

* Costs of medical supplies (MSC)

Medical supplies are for materials used up in the course of the year and other small items purchased during the year, they could include such things as reagents, needles, lancets, slides, cotton wool, giemsa stain, oil immersion, among other things in the laboratory. The full costs of supplies were also included the real price and cost of transport (10%).

The way to identify and calculate cost of medical supply was as follows:

- List medical supplies and their quantity.
- Find out the real price of each item.
- Estimate number of tests used per year.
- To calculate the cost per test.

$$\text{MSC} = \Sigma \frac{(\text{P} \times \text{Q}) + \frac{(\text{P} \times \text{Q}) \times 10}{100}}{\text{NT}}$$

Where:

P = The real price of item.

Q = Quantity of item used for each type of test

NT = Number of tests estimated per year.

Costs of medical supplies per patient in two groups were the same, because type of test and number of diagnostic tests were the same for each malarial patient.

* Building maintenance cost (BMC)

$$\text{BMC} = \frac{\text{BMC year/SU/NB}}{365} \times 28$$

Where:

BMC year = Building maintenance cost per year.
 SU = Proportion of space used.
 NB = Number of bed used in clinical room.
 365 = Number of days per year.

* Operating costs (OC) included cost of electricity (EC), cost of telephone (TC), cost of office furniture (FC). As previously noted, the salary of guards, cleaner, etc, were counted under cost of personnel. Operating costs were calculated by dividing total operating cost of hospital by number of beds in hospital per day.

$$\text{OC} = \frac{\text{EC} + \text{FC} + \text{TC}}{\text{NB} \times 365}$$

Where:

EC = Electricity cost.
 FC = Office's furniture cost.
 NB = Number of beds used per day in hospital.
 365 = Number of days per year.

* Total costs incurred by provider (PrC)

$$\text{PC} = \text{LC} + \text{DrC} + \text{MSC} + \text{BMC} + \text{OC}$$

Results of measurement of costs incurred by provider are presented in Table 4.2. The cost of Art + Dox group in first treatment time was higher than Qui + Dox group because the price of artemisinin was higher than that of quinine. But the costs for recrudescence treatment in the Qui + Dox group was higher than the Art + Dox group due to the higher number of recrudescence cases in Qui + Dox group, therefore the total costs incurred by provider in two groups were slightly different.

Table 4.2 The Provider Costs of Two Drug Regimen Groups

Components of cost	Art + Dox regimen (VN dong) (US\$)	Qui +Dox regimen (VN dong) (US\$)
* Personnel cost	12,569,227. \$1,197.1	12,378,784. \$1,178.9
* Drug cost:Antimalarial drug (first time)	878,460. \$83.7	623,540. \$65.1
* Antimalarial drug for recrudescence treatment	39,930. \$3.8	115,555. \$11.0
* Side effects treatment	0	21,295. \$2.0
* Cost of medical supplies	244,754. \$23.3	241,046. \$22.9
* Building maintenance	1,283,827. \$122.3	1,264,376. \$120.4
* operating cost	320,957. \$30.5	316,094. \$30.1
Total provider costs	15,337,155. \$1,460.7	15,020,811. \$1,430.4
Average provider costs per patient	232,381. \$22.1	231,089. \$22.0

* US\$1 = 10,500 VN dong.

* The cost in study was calculated to unit VN dong.

4.1.2 Identify and Measure the Costs Incurred by Patient

The costs incurred by patient were the money paid for treatment, travel to hospital, cost of food, income loss of patient and accompanying person. The costs incurred by patient can be classified as direct costs and indirect costs. costs incurred by patient were classified into direct medical costs, direct non medical costs and indirect medical costs, indirect non medical costs.

a) Direct Cost Incurred by Patient

* Direct medical costs incurred by patient (DMCp)

Direct medical costs incurred by patient were cost of drug as vitamins, drugs for improved patient's health, cost for services and cost of diagnostic tests. In this study, the direct medical costs were cover by provider to keep patient in hospital 28 days (protocol driven cost).

- Drug costs were calculated as follows:
 - List the name of patient in each regimen group.
 - Record drugs and quantity of each type of drug used by patient.
 - Record real price of drug added 10% of real price, the cost of transport.
 - Calculate drug cost using the same formula to calculate antimalarial drug.

$$DrC = \sum \left[(P_m \times Q_m) + \frac{(P_m \times Q_m) \times 10}{100} \right]$$

Where:

P_m = Price of each type of drug.

Q_m = Quantities of each type of drug used.

- Cost of service (SC) per bed per day * 28 days.
- Cost of diagnostic test (CODT) per patient.

* Sub total direct medical costs:

$$DMCp = DrC + SC + CODT$$

Where:

DrC = Drug costs.
 CS = Costs for services.
 CODT = Cost of diagnosis test.

* Direct non medical costs (DNMC)

Direct non medical costs were cost of travel, cost of food of patient.

- Travel cost of patient (TrCp) was based on ticket price if patient used public transport or money paid for private means of transport. The travel cost was included costs for coming hospital and coming back to their home.
- Cost of food (COFp) as special cost for food due to illness and in treatment period in hospital.

* Subtotal direct costs incurred by patient:

$$\begin{aligned} \text{DCp} &= \text{DMCp} + \text{DNMCp} \\ &= \text{DrC} + \text{SC} + \text{CODT} + \text{TrCp} + \text{COFp} \end{aligned}$$

b) Indirect Medical Costs Incurred by Patient (IDMCp)

Indirect medical cost incurred by patient were time cost (TCp), income loss by treatment period in hospital. Time cost of patient was calculated as follows:

- * Patients who are workers:
 - Record their salary, any allowance and other income received by them per month.
 - Estimate income loss per day by divided their income per month by 26 days, number of working days per month.
- Patients who are farmers:
 - Estimate income by money term from selling total product, that was total household's income per year.
 - Estimate farmer's income by dividing total household income by number of individual who worked to earn it.
 - Estimate number of working days per month.
 - Calculate patient's income loss per day :

$$\text{IDMCp} = \text{TCp} = \frac{\text{HI/NF}}{12} : 26$$

Where:

- TCp = time cost of patient.
- HI = total household income.
- NF = number of farmer in household.
- 12 = number of moths in a year.
- 26 = number of working days per month.

d) Indirect Non Medical Costs (IDNMCp)

Indirect non medical costs incurred by patient included travel cost, cost of food and time cost of accompanying person.

- Travel cost (TrCa) was calculated as the same way to calculate travel cost of patient.

- Time cost of accompanying person (TCa) was income loss in the days that accompanying person had come and taken care of the patient in hospital. Time cost of accompanying person was calculated as the same as time cost of patient. It depends on the number of days the accompanying person stayed in hospital.

- Cost of food of accompanying person (COFa).

* Indirect non medical costs were calculated:

$$\text{IDNMCp} = \text{TrCa} + \text{COFa} + \text{TCa}$$

* 3.1b total indirect cost incurred by patient.

$$\begin{aligned} \text{IDCP} &= \text{IDMCP} + \text{INMCP} \\ &= \text{TCp} + \text{TRCa} + \text{TCa} + \text{COFa} \end{aligned}$$

* Total costs incurred by patient (PaC):

$$\begin{aligned} \text{CIP} &= \text{DCP} + \text{IDCP} \\ &= \text{DMCp} + \text{DNMCp} + \text{IDMCp} + \text{IDNMCp} \end{aligned}$$

Results of costs incurred by patients are presented in Table 4.3. Indirect non medical costs in the Qui + Dox group were higher than Art + Dox group because some cases in the Qui + Dox group had the parasite clearance time longer. Therefore accompanying person must stay in hospital longer in comparison with accompanying person in the Art + Dox group and their income loss was higher.

Table 4.3 Costs Incurred by Patients in Two Drug Regimen Groups

Components of cost	Art + Dox (VN dong) (US\$)	Qui + Dox (VN dong) (US\$)
* Directs medical costs	Were covered by provider in side effects treatment	
* Direct non medical costs	6,125,000. \$583.3	6,095,180. \$580.5
* Indirect medical costs	8,108,268. \$772.2	8,044,988. \$766.2
* Indirect non medical costs	2,025,998. \$192.9	2,241,085. \$213.4

* Total costs incurred by patient	16,259,266. \$1,548.5	16,381,253. \$1,560.1
Average costs incurred per patient	246,352. \$23.4	252,019. \$24.0

4.1.3 Compare Provider Costs and Costs Incurred by Patients

Provider costs involved 66 patients in the Art + Dox regimen group and 65 patients in the Qui + Dox group. The average costs of personnel and direct non medical costs per patient were the same because the time follow up was the same. Cost of drug between two regimens was different, cost of Art + Dox (878,640 VN dong = \$83.6) was higher (683,540 VN dong = \$65.7) in the Qui + Dox group because the price of artemisinin was more expensive than quinine; the cost of doxycycline was the same in two groups. The costs of drug for side effects treatment in the Qui + Dox was 21,295 VN dong (\$1.43) and in the Art + Dox was 0.

Costs incurred by patients, direct medical cost and cost of diagnosis test were covered by provider, therefore costs incurred by patients were lower than under normal conditions.

Indirect non medical costs were different between the two groups, depending on distance of transport, time cost, cost of food of patient and accompanying person.

4.2 Effectiveness Measurement and Analysis

The study with sample size involving 131 falciparum malarial patients was distributed into two regimen groups. The 66 patients in the Art + Dox group were treated by artemisinin in combination with doxycycline. 65 patients in the Qui + Dox group were treated by quinine in combination with doxycycline. In order to analyze cost-effectiveness of regimens, we looked at the outcome of the study, that was cured patients, therefore some data of efficacy were not mentioned in this study.

4.2.1 Artemisinin and Doxycycline Combination Regimen Group

For all 66 patients (100%) the parasite clearance time was within 2 days.

The cured patients (effectiveness, E) without resistance or recrudescence within 28 days of observation period was calculated as follows:

$$E = T - R$$

$$E = 63$$

Where:

T = Total treated cases.

R = Number of resistance or recrudescence.

* The cure rate of Art + Dox (CR) was calculated:

$$\text{CR}(\%) = \frac{E}{T} * 100$$

$$\text{CR} = 95.4\%$$

Where:

E = Number of effectiveness.
T = Total treated cases.

* Number of recrudescence within 28 days observation (NOR) were:

$$R = T - E$$

$$\text{NOR} = 3$$

* The rate of recrudescence of Art + Dox drug regimen (RR) was

$$\text{RR}(\%) = \frac{R * 100}{T}$$

$$\text{RR} = 4.6\%$$

The recrudescence of falciparum parasite observed by diagnostic test and clinical symptoms. Both of three recrudescence in the Art + Dox were occurred in the third week, no resistance level R2 and R3 observed within 28 days follow up.

* No Side effect of Art + Dox regimen was observed .

The effectiveness of Art + Dox treatment regimen were presented in Table 4.4.

Table 4.4 The Effectiveness of Art + Dox Regimen Group

Regimen	Dose	T	PCT day	CP (E)	Cure rate (%)	R	R rate (%)
Artemisinin combined Doxycycline	10mg/kg/day * 5 days 2mg/kg/day * 5 day	66	2	63	95.4	3	4.6

Where:

- T = Total treated cases.
 PCT = The parasite clearance time.
 CP = Number of cured patients.
 R = Number of recrudescence.
 R rate = The recrudescence rate.

4.2.2 Quinine and Doxycycline Combination Regimen Group

a) Effectiveness of Quinine + Doxycycline regimen group: When 65 patients were followed up 28 days, the effectiveness of this regimen group is presented in Table 4.5.

* The parasite clearance time of 3 days after first dose was 65 patients.

* Number of cured patients within 28 day follow up (effectiveness, E) was:

$$E = T - R$$

$$E = 54$$

* The cure rate of Qui + Dox regimen group was:

$$CR(\%) = \frac{E}{T} * 100$$

$$CR = 83.1\%$$

* Number of recrudescence cases (R) within 28 days follow up was high: All 11 recrudescence cases were occurred in the third week. Patients with recrudescence were treated once again by the same antimalarial drug used. No resistance level R2, R3 was observed in this regimen group.

$$R = T - E$$

$$R = 11$$

The rate of recrudescence of Qui + Dox (RR) was:

$$RR(\%) = \frac{R * 100}{T}$$

$$RR = 16.9\%$$

* The side effects of Qui + Dox group were also high; they included restriction of visual field (dazzle), noise in the ears, nausea and diarrhoea. Total patients with side effects were 41 (63.08%). Some patients with slight noise in the ear or restriction of the visual field slightly were not treated side effect by drug. Among 41 patients with side effects, 25 patients were treated by drugs because side effects in these were more severe such as diarrhoea or patients suffered from two side effects. Patients with side effects such as restriction of vision, noise in ears and nausea were treated by seduxen. Patients with side effects such as diarrhoea were treated by sulfaguanidine. Almost side effects occurred in the second or the third day in treatment duration and disappeared after 4 days when Quinine was stopped.

* Number of patients with side effects (SE) were:

$$SE = T - NOS$$

$$SE = 41$$

Where:

NOS = number of no side effects.

* The rate of side effects in Qui + Dox was:

$$\text{RSE(\%)} = \frac{\text{SE}}{\text{T}} * 100$$

$$\text{RSE} = 63.08\%$$

Table 4.5 The Effectiveness of Qui + Dox Regimen Group.

	Dose	T	PCT day	E	Cure rate (%)	R	R rate (%)	SE	Rate of SE (%)	ST	RSET (%)
Qui + Dox	30mg/kg/d * 5 days 2mg/kg/d * 5 days	65	2	54	83.1	11	16.9	41	63.1	25	60.0

Where:

- T = Total treated cases.
- E = Number of effectiveness.
- PCT = Parasite clearance time.
- R = Number of recrudescence.
- SE = Number of side effects.
- SET = Number of side effect treated.
- RSET = The rate of side effects treated.

4.3 Comparison The Effectiveness of Two Regimen Groups

The Art + Dox regimen group was much more effectiveness than the Qui + Dox regimen group. The chi square test was used to test the statistical significance of effectiveness of two regimen groups. It showed the effectiveness (63/66) of Art + Dox regimen was significantly higher than that (54/65) of Qui + Dox with $p < 0.05$.

The Table 4.6 shows that the cure rate of Art + Dox group was 95.4%, significantly higher than the cure rate (83.1%) of Qui + Dox group with $p < 0.05$.

The side effects in Qui + Dox (41/65 = 63%) were much more higher than Art + Dox (0/66).

Table 4.6 Compare The Effectiveness of Two Drug Regimens Group

Drug regimen	T	E	Cure rate (%)	R		Side effect		Side effect rate (%)
				R	R rate (%)	SE	SET	
Art 10mg/kg/d * 5 days Dox 2mg/kg/d * 5 days	66	63	95.4	3	4.6	0	0	0
Qui 30mg/kg/d * 5 days Dox 2mg/kg/d * 5 days	65	54	83.1	11	16.9	41	25	63.1

Where :

- T = Total treated cases.
 E = Total cured patients.
 R = Recrudescence.
 SE = Total side effects
 SET = Number of side effects treated.

4.4 The Cost-Effectiveness Ratio of Two Regimen Groups

4.4.1 The Cost-Effectiveness Ratio

The results were expressed in terms of cost per percent effectiveness. The cost-effectiveness ratio (C/E Ratio) of each regimen group was calculated by costs of each regimen divided by its effectiveness (%).

$$C/E \text{ ratio} = \frac{C}{E(\%)}$$

Where:

- COR = Cost of treatment regimen.
 E(%) = Effectiveness of treatment regimen.

4.4.2 Compare the Cost-Effectiveness Ratio Between Two Regimens

Cost-effectiveness ratio were compared in provider perspective and patient perspective between two groups to identify which cost-effectiveness ratio was lower and to whom, provider or patients.

The cost-effectiveness ratios of the two regimens are presented in Table 4.7. The cost-effectiveness ratio to provider in the Art + Dox group was lower than the cost-effectiveness ratio to provider in the Qui + Dox group. The cost-effectiveness ratio to patients in the Art + Dox regimen group was also lower than that in the Qui + Dox regimen group

Table 4.7 The Cost-Effectiveness Ratio of Two Regimen Groups.

Drug regimen	Provider perspective			Patients perspective		
	Costs (VN dong) (US\$)	E (%)	C/E ratio (VN dong) (US\$)	Costs (VN dong) (US\$)	E (%)	C/E ratio (VN dong) (US\$)
Art+Dox	15,337,155. \$1,460.6	95.4	160,766. \$15.3	16,259,266. \$1,548.5	95.4	170,432. \$16.2
Qui+Dox	15,020,811. \$1,430.5	83.1	180,755 \$17.2	16,381,253. \$1,560.1	83.1	197,127 \$18.7

4.5 Sensitivity Analysis

In order to analyze cost-effectiveness of two treatment regimens, falciparum malaria inpatients in this study were followed up for 28 days in hospital, therefore some costs incurred by the patient were covered by the provider such as cost of side effects treatment, cost of services, cost of diagnostic tests.

In normal treatment conditions, malarial patients are treated in hospital when they get fever and parasite test is positive. With these treatment regimens, the parasite clearance time was from 2 to 3 days and the treatment duration of both two regimens was 5 days, therefore the provider costs and the costs incurred by patient should be

changed and depend on:

Provider will cover the costs of antimalarial drugs and the costs of malaria parasite test.

Patient should have to pay for:

- The cost of non antimalarial drugs.
- The cost of side effects treatment.
- The cost of services.
- The cost of other diagnostic tests.

4.5.1 The Costs of two Drug Regimens for 5 Days Treatment Duration in Normal Treatment Practice.

The costs incurred by provider and incurred by patient are presented in Table 4.8. With the same drug regimen groups and 5 days of treatment duration in hospital, the average provider costs per patient were 52,585 VN dong (\$5.0) in the Art + Dox drug regimen and 49,791 VN dong (\$4.7) for the Qui + Dox drug regimen. Average costs incurred per patient in Art + Dox drug regimen were 76,392 VN dong (\$7.3) and 80,889 VN dong (\$7.7) for the Qui + Dox drug regimen.

4.5.2 The Costs of two Drug Regimens with 5 Day Treatment Duration Include the Cost of Recrudescent Treatment.

To estimate costs in normal treatment conditions including costs of 5 days of treatment in hospital and costs of recrudescent treatment, we assume that:

- Five days treatment in hospital is first treatment duration.
- The effectiveness of both drug regimens in normal condition are the same as follow up 28 days in hospital.
- All recrudescent patients will come back hospital for recrudescent treatment and they will be treated by the same drugs regimen as in first treatment duration.
- Patients live in the same malaria situation.

From the results of effectiveness of two drug regimens were mention above, 3 among 66 patients in the Art + Dox drug regimen group recrudesced, and 11 among 65 patients in the Qui + Dox drug regimen group recrudesced. These recrudescent patients should come back hospital for recrudescent treatment in 5 days the same with the first treatment duration, therefore the costs for recrudescent patients will be double if the costs are estimated in the time of one month. The results of costs in normal conditions are calculated and presented in Table 4.9. The average cost incurred by malarial patients in the Art + Dox drug regimen group was lower than that in the Qui + Dox drug regimen group. Average provider costs per malarial patient in the Art + Dox group were also lower than the average provider costs per malarial patient in the Qui + Dox group.

Table 4.8 The Costs of 5 Days in Normal Treatment Conditions

Components of cost	Art + Dox (VN dong) (US\$)	Qui + Dox (VN dong) (US\$)
1) Provider cost		
Personnel cost	2,244,505. \$213.7	2,210,497. \$210.5
Antimalarial drug	878,460. \$83.6	683,540. \$65.7
Cost of medical supply	61,116. \$5.8	60,190. \$5.7
Building maintenance	229,255. \$21.8	225,781. \$21.5
Operating cost	57,314. \$5.0	49,791. \$4.7
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Total provider costs	3,470,650. \$330.5	3,236,453. \$308.2
Average cost per patient	52,585. \$5.0	49,791. \$4.7
2) Cost incurred by patients		
Direct medical costs	0	21,295. \$2.0
Diagnostic tests	66,000. \$6.3	65,000. \$6.2
Direct non medical costs	1,502,000. \$143.0	1,415,800. \$134.8
Indirect medical cost	1,447,905. \$139.9	1,436,605. \$136.8
Indirect non medical costs	2,025,997. \$192.9	2,241,085. \$213.4
-----	-----	-----
Total cost incurred by patients	5,041,902. \$480.2	5,257,785. \$500.7
Average costs incurred by per patient	76,392. \$7.3	80,889. \$7.7

Table 4.9 The Costs of 5 Days Include Cost of Recrudescence Treatment in Normal Treatment Conditions

Components of cost	Art + Dox (VN dong) (US\$)	Qui + Dox (VN dong) (US\$)
1) Provider costs		
- Personnel cost	2,346,528. \$223.5	2,584,581. \$246.1
- Drug cost	918,390. \$87.4	799,216. \$76.1
- Cost of medical supply	63,970. \$6.1	70,459. \$6.7
- Building maintenance	239,675. \$22.8	262,990. \$25.1
- Operating cost	55,255. \$5.2	58,530. \$5.5
- Total provider costs	3,623,835. \$345.1	3,776,776. \$359.7
- Average provider cost per malarial patient	54,306. \$5.2	58,102. \$5.5
2) Costs incurred by patients		
- Direct medical costs	172,500. \$16.4	190,000. \$18.1
- Diagnostic test	69,000. \$6.5	76,000. \$7.2
- Direct non medical costs	1,570,272. \$149.5	1,746,597. \$166.3
- Indirect medical costs	1,513,718. \$144.1	1,679,722. \$159.9
- Indirect non medical costs	2,118,088. \$201.7	2,620,345. \$249.5
- Total costs incurred by patients	5,443,578. \$418.4	6,312,663. \$601.2
- Average costs incurred by patient	82,487. \$7.8	97,118. \$9.2

4.5.3 The Cost-Effectiveness Ratio of Two Drug Regimens in Normal Treatment Practice.

1) Change the cost-effectiveness with costs in 5 days treatment.

The results of costs and effectiveness of two drug regimens were calculated under controlled condition of 28 days in hospital. In normal treatment practice, patients stay 5 days in hospital and costs incurred by provider and patients are presented in Table 4.9. In this condition, the recrudescence of parasites are out of control because the patients live in hyperendemic and holoendemic areas, therefore the recrudescence malaria and reinfected malaria can not be distinguished and they are considered like new malaria patients requiring treatment. The Table 4.11 presents the cost-effectiveness ratio of two drug regimens in 5 days in normal treatment condition and including 5 days recrudescence treatment.

Table 4.10 The Cost-Effectiveness Ratio in 5 Days and 5 Days Including Recrudescence Treatment in Normal Treatment Practice.

COND	PERS	Art + Dox			Qui + Dox		
		Cost (C)	E (%)	C/E (%)	Cost (C)	E (%)	C/E (%)
5 days	Provider	3,470,650. \$330.5	95.4	36,380. \$3.4	3,236,453. \$308.2	83.1	38,946. \$3.7
	Patients	5,041,902. \$480.2	95.4	52,850. \$5.0	5,257,785. \$500.7	83.1	63,270. \$6.0
5 days and R.T	Provider	5,747,161. \$547.3	95.4	60,242. \$5.7	6,117,125. \$582.6	83.1	73,611. \$7.0
	Patients	5,443,578. \$518.4	95.4	57,060. \$5.4	6,312,663. \$601.2	83.1	75,964. \$7.2

Where:

COND = Condition.

PERS = Perspective.

In fact, some patients stay only 3 days in hospital (when they suffer from fever and positive parasite test). With these patients, the dose of antimalarial drug should be lower compared with other patients, who get enough dose of drugs. Looareesuwan (1993) used oral artesunate with total dose of 300 mg/3 days plus doxycycline 200 mg/day for 7 days to give a cure rate of 81%. In the Qui + Dox drug regimen, if patients

use drugs 3 days, the cure rate will be very low (The standard dose of Quinine is 1.2 to 1.5 gm/day for 7 to 10 days). Both of these drug regimens in 3 days will give very low effectiveness and they are out of the guideline on selection and use of artemisinin as recommended by WHO, (1993).

2) Change recrudescence of malaria.

In hypoendemic malaria and holoendemic malaria areas, the main vectors are available with a high density, the recrudescence and reinfection can not be identified in normal conditions. People living in these epidemiological areas are very easy infected malaria. To evaluate the cost-effectiveness in changing recrudescence we assume that:

- Patients live in the same malaria situation.
- The percentage of recrudescence (or reinfection) is 10%-15% higher than follow up in hospital. That means the cure rate of the Art + Dox drug regimen will be 85.4% - 80.4% and the cure rate of Qui + Dox drug regimen will be 73.1% - 68.1%.

In this condition, the costs incurred by provider and costs incurred by patients in 5 days treatment are not changed and lead the cost-effectiveness ratio change. These changes are presented in Table 4.12.

Table 4.11 The Cost-Effectiveness with Different Percentage of Recrudescence

Cond.	Pers.	Art + Dox			Qui + Dox		
		Cost(C)	E(%)	C/E(%)	Cosst(C)	E(%)	C/E(%)
R increase 10%	Provider	3,470,650. \$330.5	85.4	40,640. \$3.8	3,236,453. \$308.2	73.1	44,274. \$4.2
	Patients	5,041,902 \$480.2	85.4	59,038 \$5.6	5,257,785 \$500.7	73.1	71,926 \$6.8
R increase 15%	Provider	3,470,650. \$330.5	80.4	43,167. \$4.1	3,236,453. \$308.2	68.1	47,525. \$4.5
	Patients	5,041,902 \$480.2	80.4	62,710 \$5.9	5,257,785 \$500.7	68.1	77,207 \$7.3

Where:

Cond = Condition
Pers = Perspective

3) Change percentage of the side effects.

If in normal treatment practice, all of the patients with side effects require treatment of side effects or drugs used for side effects treatment may be higher than in the study (because patients with severe or more than one side effect in study were treated as mentioned in Table 4.8 to avoid the impact of side effect treatment on the effectiveness of antimalarial drug in study). This case is only for the Qui + Dox drug regimen. When side effects increase, the effectiveness of drug may be decrease because abdominal pain, diarrhoea will reduce absorbability of antimalarial drugs into blood and level of antimalarial drugs in these patients will be lower than that in other patients without side effects. Furthermore in normal treatment conditions, some patients are afraid severe side effects and so do not take a high enough dose per day. These reasons will reduce the effectiveness of antimalarial drugs. If the percentage of side effects increase, the provider costs are not changed but the costs incurred by patients will be changed because patients have to pay for side effect treatment.

Assume that effectiveness of Qui + Dox will be reduced 10% in comparison with follow up 28 days in hospital. Table 4.13 present the cost-effectiveness of Qui + Dox in condition where all side effects will be treated when the cure rate of Qui + Dox is 83.1% (in study) and effectiveness will be reduced 10% (cure rate is 73.1%).

Table 4.12 The Cost-Effectiveness of Qui + Dox with Different Percentage of Side Effects.

Side effects	Perspective	Qui + Dox		
		Cost(C)	E(%)	C/E(%)
All side effects treated with cure rate 83.1%	Provider	3,236,453. \$308.2	83.1	38,946. \$3.7
	Patients	5,292,708. \$504.1	83.1	63,690. \$6.1
All side effects treated with cure rate 73.1%	Provider	3,236,453. \$308.2	73.1	44,274. \$4.2
	Patients	5,292,708. \$504.1	73.1	72,403. \$6.9