

CHAPTER 5

RESULTS

5.1 Costs of Personnel

Table 5-1 shows the total direct costs of personnel including physicians, pharmacists in THCs, microscopists in the stations for the malaria microscopical detection, assistants in anti-malaria teams in County A and County B. Because of the differences in the number of personnel in the two counties, the total direct costs of personnel were different.

Table 5-1 Total Direct Costs of Personnel in County A and B

Personnel	Salary per month per capita	Number of personnel		Total Salary all the year around (X 100) (Yuan)	
		County A	County B	County A	County B
Physician	300	47	56	1692	2016
Pharmacist	250	30	43	900	1290
Microscopist	250	10	13	300	390
Assistant	250	16	21	480	630
Village doctor	300	45	54	1620	1944

County A = Xinyie County

County B = Kaifeng County

The total annual direct costs of personnel spent on malaria case detection and treatment in County A and County B are presented in Table 5-2. Because the number of THCs and VCs, the number of personnel, the number of fever outpatient visits were different in the two counties, then different apportioned factors was used to allocate the costs of personnel, so the total direct costs of personnel spent on malaria case detection and treatment in the two counties differed.

Table 5-2 Total Annual Direct Costs of Personnel Spent on Malaria Case Detection and Treatment in County A and County B

Personnel	Total Salary per Year (X 100 Yuan)		Apportioned Factor	Total Annual Costs of Personnel on Malaria (x 100 Yuan)	
	** C.A	C.B		C.A	C.B
Physicians	1692	2016	N_f/N_i	2910.24	29.03
Pharmacists	900	1290	N_f/N_o	685.80	8.25
Microscopists	300	390	$N_{p.s}/N_{t.s}^*$	30000	1674.01
Assistants	480	630	Time	9600	12600
Village doctors	1620	1944	N_{vf}/N_{vc}	916.92	30.71

** C.A = County A C.B = County B

* only for County B

The apportioned factors are listed in Chapter 4.

5.2 Costs of Materials

Costs of materials (glass slide, stains, needle, cotton, alcohol) were based on the report of the Collaborating Group for Malaria Surveillance (1993). The material cost per slide examined was 0.50 Yuan. The aggregated costs of materials were got by multiplying the material cost per slide by the total number of slides examined.

For County A, the costs of materials = 0.50 Yuan / Slide * 5597 slides = 2798.50 Yuan

For County B, the costs of materials = 0.50 Yuan / Slide * 111 slides = 55.50 Yuan

5.3 Cost of Presumptive Drugs

This was based on the purchasing prices of the drugs and weighted by the dosage per adult (Collaborating Group, 1993).

The cost of presumptive drugs per person was 2.00 Yuan. The aggregated costs of presumptive drugs were got by multiplying the presumptive drug costs per fever patient by the total number of fever patients provided.

For County A, the costs of presumptive drugs = 2.00 Yuan / patient * 5597 patients = 11,194.00 Yuan

For County B, the costs of presumptive drugs = 2.00 Yuan / patient * 111 patients = 222.00 Yuan

5.4 Costs of Radical Drugs

This was based on the purchasing prices of the drugs and weighted by the dosage per adult.

The cost of radical drugs per person was 6.00 Yuan. The aggregated costs of radical drugs were obtained by multiplying the radical drugs cost per positive malaria case by the total number of positive malaria cases.

For County A, the costs of radical drugs = 6.00 Yuan / malaria case * 10 malaria cases = 60.00 Yuan

For County B, the costs of radical drugs = 6.00 Yuan / malaria case * 49 malaria cases = 294.00 Yuan

5.5 The Total Direct Costs of the Resources Used for Malaria Case Detection and Treatment in the Two Counties

The annual direct cost profiles for malaria case detection and treatment in two counties are shown in Table 5-3.

The costs of personnel contributed 75.84% in County A, 96.17% in County B of the total direct costs in the two counties, respectively. They were the main components contributed to the total direct costs. Because other cost categories except personnel contributed more to the total direct operating costs in County A than that in County B, so they had different percentage. Due to the larger number of slides examined in County A, it had a larger costs of material compared with County B. The same reason could explain the difference in the costs of drug for presumptive treatment in the two counties.

Comparing the costs of drugs for presumptive treatment and the costs of drugs for radical treatment, it was found that in County A, the former was 185 times of the latter. The reason was that a large number of fever patients (5597 persons) received presumptive treatment and less positive cases were detected (10 positive cases). In County B, because of the cost of drugs for radical treatment per capita being 3 times of that for presumptive treatment per capita, even though the number of two kinds of fever patients (111) was 2.26 times of that of positive cases (49), there was no great difference between the two kinds of costs. The costs of material in County B were the lower, as were the costs of the drugs for radical treatment in the County A.

Table 5-3 Annual Direct Operating Cost Profiles for Malaria Case Detection and Treatment in Two Counties

Cost Category	Cost Profile - Yuan (% of Total Cost)	
	County A (Scheme A)	County B (Scheme B)
Personnel	44112.76 (75.84)	14342.00 (96.17)
Material	2798.50 (4.81)	55.50 (0.37)
Drug for Presumptive Treatment	11194.00 (19.25)	222.00 (1.49)
Drug for Radical Treatment	60 (0.10)	294 (1.97)
Total	58165.46(100%)	14913.50(100%)

The annual direct cost items for different types of diagnoses of fever outpatients in County A are presented in Table 5-4. It shows that in County A, when Scheme A was carried out, FVO groups consumed the largest amount of resources in terms of personnel, material, drugs for presumptive treatment.

Table 5-4 Annual Direct Operating Cost Items for Different Types of Diagnoses for Fever Outpatients in County A

Cost Items Type of diagnosis	Personnel (Yuan)	Material (Yuan)	Drugs (Yuan)		Total (Yuan)
			P*	R*	
Typical malaria	55.17	3.50	14	42	114.67
Suspected malaria	236.45	15	60	18	329.45
FUO	43821.14	2780	11120		57721.14
Total (Yuan)	44112.76	2798.5	11194	60	58165.26

P* - Presumptive treatment

R* - Radical treatment

5.6 Cost Saving Due to Scheme B Implemented in County A

Assumptions:

- * the number of fever outpatients of typical malaria and suspected malaria and the personnel were constant.
- * the total number of outpatient visits and total number of internal-medicine outpatient visits didn't change.

If Scheme B was carried out in County A, the annual direct operating costs for malaria and suspected malaria diagnosed in County A would be 9981.79 Yuan (Table 5-5).

Table 5-5 Annual Direct Cost Items for Different Types of Diagnoses for Fever Outpatients in County A under Scheme B

Cost Items Type of diagnosis	Personnel	Material	Drugs		Total (Yuan)
			P*	R*	
Typical malaria	1859.60	3.50	14	42	1919.10
Suspected malaria	7969.69	15	60	18	8062.69
Total	9829.29	18.50	74	60	9981.79

P* = Drugs for presumptive treatment

R* = Drugs for radical treatment

Comparing Table 5-5 with Table 5-3, it can be found that the cost profile of Scheme B in County A (Table 5-5) was similar to the result of Scheme B in County B (Table 5-3): the costs of personnel were the majority; the costs of the material were the least. However, because the two counties had different health service points, health personnel, disease load, it is not possible to assess the cost saving due to implementing Scheme B rather than Scheme A in two counties. There was only one way to achieve the objective, that is carrying out the comparison in the same county.

Figure 5-1 Cost Profiles for Two Schemes in County A

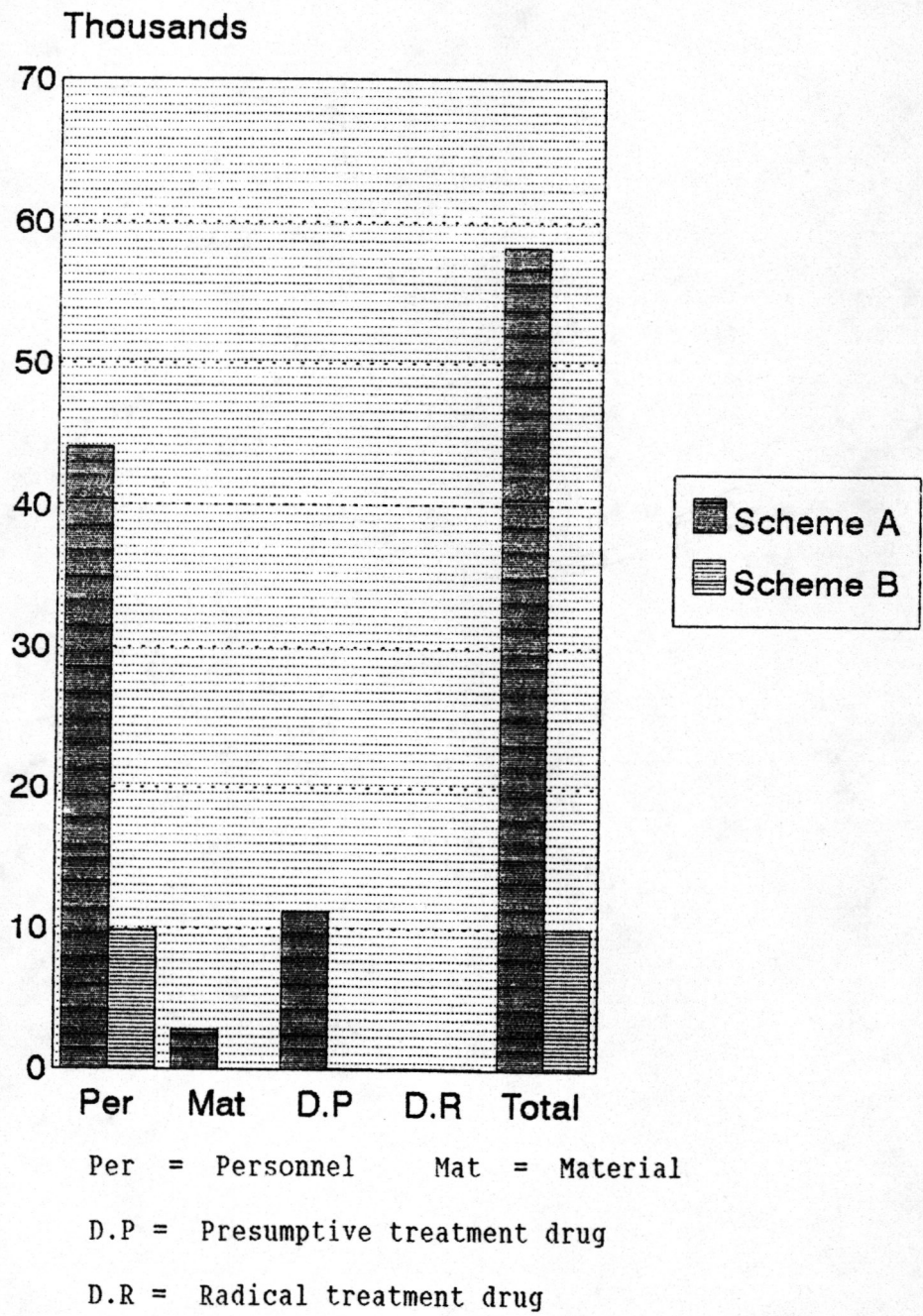


Figure 5-1 shows that if Scheme B rather than Scheme A was carried out in County A, the institution would have some cost saving in terms of personnel, material, drugs for presumptive treatment. Because fewer fever outpatients were dealt with, less resources were used up. The saving would be: 34283.47 Yuan for the costs of personnel, 2780 Yuan of material, 11120 Yuan of drugs for presumptive treatment (Figure 5-1).

5.7 Performances of the Two Schemes

The percentages of malaria cases detected in different clinical diagnosis for fever outpatients in two counties are presented in Table 5-6 and Table 5-7. The slide positive rate (SPR) for typical malaria in two counties were both of 100%. The SPR for suspected malaria in Scheme A was 10%. In Scheme B, it was 26.19%. The SPR for FUO in Scheme A was 0.

Table 5-6 The Proportion of Malaria Cases Detected in Different Clinical Diagnosis for First Visit of Fever Cases in County A (Scheme A)

Clinical diagnosis	No. of slide examined	No. of positive cases detected	Slide positive rate(%)
Typical malaria	7	7	100
Suspected Malaria	30	3	10
FUO	5560	0	0
Total	5597	10	0.18

Table 5-7 The Proportion of Malaria Cases Detected in Different Clinical Diagnosis for First Visit Fever Cases in County B (Scheme B)

Clinical diagnosis	No. of slide examined	No. of positive cases detected	Slide positive rate(%)
Typical malaria	27	27	100
Suspected Malaria	84	22	26.19
Total	111	49	44.14

5.8 The Cost per Slide Examined and Cost per Case Detected

Linking the costs of resources consumed by providing malaria case detection and treatment and the immediate outcomes - the number of slides examined and positive malaria cases detected, the cost per slide examined and cost per case detected in the two counties were obtained (Table 5-8).

Table 5-8 Annual Direct Costs for Malaria Case Detection and Treatment and Performance in Two Schemes

	County A (Sa)	Count B (Sb)	County B (Sb)
Total Direct Cost (Yuan)	58165.30	9981.80	14913.50
Performance			
No. of slide examined	5597	37	111
No. of positive cases detected	10	10	49
Average cost per slide examined (Yuan)	10.39	269.78	134.36
Average cost per positive case detected (Yuan)	5816.53	998.18	304.36
	Sa - Scheme A	Sb - Scheme B	

The average cost per slide examined in County A (Scheme A) was the cheapest due to the largest number of slides examined and the most resources consumed. But the average cost per positive case detected in County A was the most expensive one because of the least number of positive cases detected.

5.9 Additional Direct Cost for Additional Positive Cases Detected

Comparing Scheme A with Scheme B, the additional direct operating cost is the difference in the costs of the resources used for diagnosing and treating malaria cases when Scheme A or Scheme B was performed in the same county, respectively. The additional direct operating cost is not simply equal to the costs of resources consumed by the FUG group in the present study. The reason is that the costs of assistants in the anti-malaria teams contributing to the malaria case detection didn't change with the number of slides examined under the assumption that 20% of their costs were always allocated to the studied activity. If we can exactly allocate their costs, the additional direct operating costs should be equal to costs of resources consumed by the FUG group.

In the study, in County A where Scheme A was carried out, the total direct operating costs of the resources used by three kinds of fever outpatients were 58165.3 Yuan (Table 5-3). If Scheme B was performed in County A, the total direct operating costs of the resources used by two kind fever outpatients were 9981.79 Yuan (Table 5-5). The additional direct operating costs were 48183.5 Yuan (Table 5-9).

The additional cases detected was the cases detected in the FOU group when Scheme A rather than Scheme B was implemented. Comparing the performance of the two schemes in County A, no positive cases were detected in the FOU. So additional cases detected was 0 (Table 5-9).

Table 5-9 Additional Costs for Additional Cases Detected

	Direct Operating Cost	Positive Cases Detected
Scheme A	58165.46 Yuan	10
Scheme B	9981.79 Yuan	10
Additional costs	48283.67 Yuan	
Additional cases detected		0

If we assume the SPR of FOU in County A were the same as the average SPRs of FOU in the nationwide research in 1992 and 1993, the total costs for FOU and the number of FOU were certain. The estimated additional costs per positive case detected in FOU could then be obtained (Table 5-10). This figure would be more representative.

Table 5-10 Estimated Additional Cost per Positive Case Detected from FOU

No. of FOU	SPR of FOU (%) in		Estimated No. of positive cases detected in		Additional cost (Yuan)	Estimated additional cost per positive case detected in	
	1992	1993	1992	1993		1992	1993
5597	0.026	0.030	1.46	1.67	48183.5	*33002.4	**28852.4

* = According to the SPR in FOU patients in 1992

** = According to the SPR in FOU patients in 1993

If, for example, there were one and two positive malaria cases in FUO in County A according to the SPR in 1992 and in 1993, respectively, the estimated additional cost per positive case detected would be 48183.5 Yuan and 24091.8 Yuan.

5.10 The Relation Between the Changes of the SPR and the Cost per Positive Case Detected

In order to compare the effects due to the change of conditions, data from County A when Scheme A and Scheme B were implemented were used as the baseline data.

5.10.1 Assumptions

Assume the following were constant in County A.

- the number of personnel whose work is related to passive case detection (diagnoses and treatment) of malaria surveillance (physicians, pharmacists, microscopists and assistants in the anti-malaria group)
- the total number of typical malaria, suspected malaria and FUO fever outpatients
- the total number of outpatient visits
- there is no variable economic scale for the drugs for radical treatment

5.10.2 Variables

- SPR in Scheme A
- SPR' in Scheme B
- Cost per positive case detected

5.10.3 Estimation of the Relationship between the Changes of the SPR and the Cost per Positive Case Detected in the Two Schemes.

Using the data obtained from County A when Scheme A or Scheme B was carried out, C_a and C_b were obtained when changes of SPR were given between 0.09% to 0.44. The $C_{d,r}$ was 6 Yuan which was used in the calculating the costs of the two counties before.

$T = 58165.26$ Yuan (Table 5-4), $T' = 9981.79$ Yuan (Table 5-5),
 $N = 5597$, $N' = 37$ (Table 5-6)

$$C_a = 6 + 10.39 / \text{SPR} \quad (5.1)$$

$$C_b = 6 + 269.78 / \text{SPR}' \quad (5.2)$$

These two Formula 5.1 and Formula 5.2 show the relationship between the changes of the SPR and the cost per positive case detected in the two schemes. Which scheme will have higher cost per positive case detected will depend on the value of SPR and SPR'. According to the result of the micro-level study, SPR' in Scheme B was 150 times SPR in Scheme A, so at this point of SPR, cost per positive cases detected in Scheme A was higher than that in Scheme B. But when the SPR' in Scheme B is less than 27 times of SPR in Scheme A, the conclusion is opposite.

5.11 The Relation Between the Changes of the Number of FUO and the Cost per Slide Examined and the Cost per Positive Case Detected

5.11.1 Assumptions

Assume the following were constant in County A.

- the number of personnel whose work is related to passive case detection (diagnoses and treatment) of malaria surveillance (physicians, pharmacists, microscopists and assistants in the township anti- malaria group)
- the total number of typical malaria, suspected malaria fever outpatients
- the total number of outpatient visits
- there is no economy of scales for the drugs for radical treatment
- the total number of positive malaria cases (At) detected from typical malaria and suspected malaria fever outpatients
- only township health centers existed, so patients in the rural areas needed to go to there to get services
- the capacities of microscopists and assistants in anti-malaria teams were not used in full capacity. Even though the number of slides examined and positive cases detected increased, their cost contributed to malaria case detection would not increase.
- the SPR of FUO is 0.0003 (nationwide research)

5.11.2 Variables

- Cost per positive case detected
- Cost per slide examined
- Number of FUO fever outpatients

5.11.3 Estimating the Cost per Positive Case Detected and Cost per Slide Examined with Changes of Number of FUO

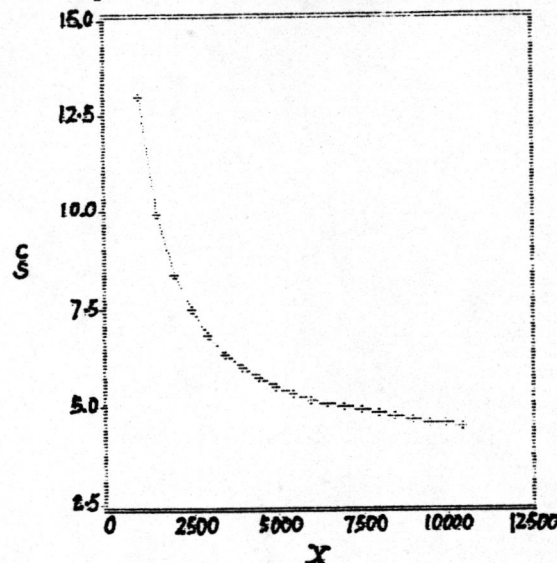
$T' = 9981.79$ (Table 5-5), $N' = 37$ $N_{t,s} = 10$ (Table 5-7). A_1 was obtained by using the formulae for allocating the physicians' and pharmacists' salaries to the FUO outpatients and material cost per slide examined, cost of drugs for presumptive treatment per fever patient and cost of drugs for radical treatment per malaria case.

$$C_s = (9981.79 + 3.6 * X) / (37 + X) \quad (5.3)$$

$$C_p = (9981.79 + 3.6 * X) / (10 + 0.0003 * X) \quad (5.4)$$

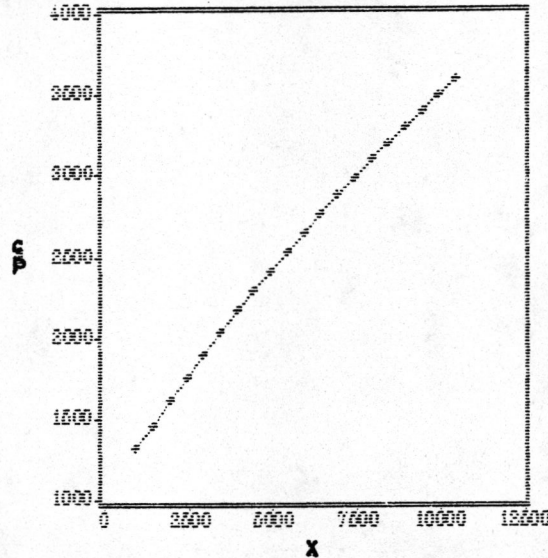
Figure 5-2 shows the relation between the changes of the number of FUO and the costs per slide examined. With the increasing number of FUO, the cost per slide examined shows a decreasing trend. Because under the assumptions, with the increasing number of FUO fever patients, the number of blood slides examined increases correspondingly. The costs of microscopists and assistants in anti-malaria teams were shared by more slides. According to the method used to allocate the costs of microscopists and assistants in anti-malaria teams, the effect of their costs on the average cost per slide examined was like that of capital cost.

Figure 5-2 The Relationship Between the Changes of Number of FUO and the Costs per Slide Examined in Scheme A



C_s = Cost per Slide Examined X = Number of FUO

Figure 5-3 The Relationship Between the Changes of Number of FUO and the Costs per Positive Case Detected in Scheme A



CP = Cost per Positive Case Detected X = Number of FUO

Figure 5-3 shows that the costs per positive case detected rose with increase in the number of FUO. It implies that total direct operating costs under the assumptions increase more quickly than that of the number of positive cases detected (the SPR in the FUO was very low) due to increasing the number of FUO.

5.12 Macro Level Study for the Cost Saving Due to Only Scheme B Implemented under Several Assumptions

5.12.1 Assumptions:

- For one internal-medicine outpatient visit, the physician spent 15 minutes per patient no matter what kind of internal-medicine diseases the patients suffered from.
- The physician's average salary was 300 Yuan per month
- For giving one outpatients's prescribed drugs, the pharmacist took 5 minutes no matter what kind of drugs the patients would get.
- For the microscopist, one blood slide would take him 30 minutes to prepare and examine .
- The salaries of pharmacists and microscopists were 250 Yuan per capita per month.
- Only the township health centers existed.
- The physicians, pharmacists, microscopists worked very

efficiently. It implied that they worked all the working time.

- The costs of assistants in anti-malaria teams contributed to PCD (Passive Case Detection) would not vary with the changes of the number of three or two kind of fever outpatients. So, for the two Schemes, this part of costs would be unchangeable. For simplification, the costs of assistants in anti-malaria teams were ignored.
- One day the working time was 8 hours; one work, they worked 6 days; there were 26 working days per month.

5.12.2 Criteria for Allocating the Manpower Costs

The time spent on the patient's visit was used as the basis to compute the manpower costs to malaria case detection and treatment.

5.12.3 Unit Costs

According to the assumptions mentioned above, the following were obtained :

- the cost of the physician for one patient's visit was 0.36 Yuan.
- the cost of the pharmacist for one patient's visit was 0.10 Yuan.
- the cost of the microscopist for one slide was 0.60 Yuan.

The following has been used in the micro-level study:

- the cost of the material per slide was 0.50 Yuan
- the cost of the presumptive drugs per fever patient was 2.00 Yuan
- the cost of the radical drugs per positive malaria case detected was 6.00 Yuan.

5.12.4 Performances of the Two Schemes in 23 Counties

The proportion of malaria cases detected in different clinical diagnoses for fever outpatients in 23 counties of 12 provinces in China in 1992 and 1993 are given in Table 5-11 and Table 5-12.

Table 5-11 The Proportion of Malaria Cases Detected in Different Clinical Diagnoses for Fever Outpatients in 23 Counties of 12 Provinces in China in 1992

Clinical diagnosis	No. of slide examined	No. of positive cases detected	Slide positive rate(%)	Percentage of the total positive cases detected(%)
Typical Malaria	307	200	56.02	63.90
Suspected Malaria	8510	81	0.95	25.88
FUO	121819	32	0.03	10.22
Total	130686	313	0.2	100.00

Table 5-12 The Proportion of Malaria Cases Detected in Different Clinical Diagnoses for Fever Outpatients in 23 Counties of 12 Provinces in China in 1993

Clinical diagnosis	No. of slide examined	No. of positive cases detected	Slide positive rate(%)	Percentage of the total positive cases detected(%)
Typical malaria	286	171	59.79	59.58
Suspected Malaria	4031	92	2.28	32.06
FUO	90757	24	0.026	8.36
Total	95074	287	0.3	100.00

From these two tables (Table 5-11 and Table 5-12), it can be seen that the slide positive rates in typical malaria group was 56.02% in 1992 and 59.79% in 1993; the suspected malaria groups had a 0.95% of SPR in 1992 and 2.28% in 1993; the SPR in the FUO groups were the lowest in these three groups : 0.03% in 1992 and 0.026% in 1993. In the total positive cases detected from the fever outpatients, 63.90% in 1992 and 59.58% in 1993 were obtained from the typical malaria group; 25.88% in 1992 and 32.06% in 1993 were detected from suspected malaria fever outpatients; only about 10% were obtained from FUO group. If Scheme B rather than Scheme A was performed, according to the results of the performances in the 23 counties in the two years, approximately 10% of positive cases may miss.

5.12.5 The Estimated Direct Operating Costs for Malaria Case Detection and Treatment in 23 Counties

If Scheme A or Scheme B was implemented in the 23 counties in 1992 and 1993, the total estimated costs for malaria case detection and treatment may be estimated (Table 5-13 and Table 5-14).

According to the results calculated above, if Scheme B was implemented in 1992, the total cost savings were 433,867.64 Yuan. Among them, saving for the physicians, pharmacists, microscopists, drugs for presumptive treatment, drugs for radical treatment, material are 43,854.84 Yuan, 12,181.90 Yuan, 73,091.40 Yuan, 243,638 Yuan, 192 Yuan, 60,909.5 Yuan, respectively. If Scheme B was carried out in 1993, the total cost saving would be 323,247.94 Yuan (Figure 5-4).

In fact, only the costs of microscopists, drugs for presumptive treatment, drugs for radical treatment, material could be saved. Because no matter whether the patients were diagnosed as typical malaria and suspected malaria or other diseases, the physicians should give diagnoses and prescribed some drugs for the patients. In this way, the actual saving would be 377,830.90 Yuan. In the same way to calculate the cost savings, were Scheme B implemented in 1993, the cost savings are 281,490.70 Yuan.

Table 5-13 The Estimated Direct Operating Costs for Malaria Case Detection and Treatment When Scheme A was Implemented in 23 Counties in 1992 and 1993

Item Year	Phy* (x100) (Yuan)	Pha* (x100) (Yuan)	Mic* (x100) (Yuan)	Mat* (x100) (Yuan)	D.P* (x100) (Yuan)	D.R* (x100) (Yuan)	Total Cost (Yuan) (x100)
1992	470.5	130.7	784.1	653.4	2613.7	18.8	4671.2
1993	342.2	95.1	570.4	475.4	1901.5	17.2	3401.9

Phy* - Physician
 Pha* - Pharmacist
 Mic* - Microscopist
 Mat* - Material
 D.P* - Drugs for presumptive treatment
 D.R* - Drugs for radical treatment

Table 5-14 The Estimated Direct Operating Costs for Malaria Case Detection and Treatment When Scheme B was Implemented in 23 Counties in 1992 and 1993

Item Year	Phy* (x100) (Yuan)	Pha* (x100) (Yuan)	Mic* (x100) (Yuan)	Mat* (x100) (Yuan)	D.P* (x100) (Yuan)	D.R* (x100) (Yuan)	Total Cost (x100) (Yuan)
1992	31.9	8.9	53.2	44.3	177.3	16.9	332.5
1993	15.5	4.3	25.9	21.6	86.3	15.8	169.5

Phy* - Physician

Pha* - Pharmacist

Mic* - Microscopist

Mat* - Material

D.P* - Drugs for presumptive treatment

D.R* - Drugs for radical treatment

Both of the micro and macro level studies summarized in Figure 5-4 examine fractions of the total malaria picture. To gain a more appropriate view of the potential savings if Scheme B were to be used nationwide in low incidence areas, it is necessary to carry out some approximate extrapolations. According to the national malaria situation report in 1993 (Advisory Committee on Malaria in China), there are 858 counties where malaria incidence rate is less than 1 per 10,000 population. Since $858 = 37.03 \times 23$,

If we assume that the 858 counties average conditions (health services, transportation, population, malaria incidence rate) were similar to the average of the 23 counties in the test situation (macro-level study), the estimated national savings from using Scheme B (verses Scheme A) would be of the order of 12,000,000 Yuan.

Figure 5-4 Differences Between the Costs of the Two Schemes Implemented in 23 Counties in 1992 and 1993

