CHAPTER 6

DISCUSSION

This chapter is mainly concerned with the discussions on the implications of the research and the proportion of cost items in the two schemes in China in comparison to other counties. In addition, the accuracy of the cost analysis and the limitations of the research are discussed.

6.1 The Implications of the Results

6.1.1 Factors Affecting the Performance

Evaluation of the performance (in terms of the number of slides examined and the number of positive cases detected) was limited by practical necessity in this way: even though the two counties have similar incidence rates, differences in slides examined and positive cases detected between the two counties may vary with several factors which influence how the patients consume the health services. These factors may include accessibility to the service points, education status, information about the disease and the service itself, the value of the quality of life and so on.

Malaria incidence rate as an indicator of the malaria situation is the result of the dynamic reaction between human, mosquito and parasite. Obviously, the two counties can not have the exact same health service points, staff and malaria incidence rates. So there is less possibility to compare the two schemes in different situations. This is why an attempt was made to compare the two schemes in the same county.

The attempt was to compare the unit costs of the two schemes in the same county in terms of cost per slide examined and cost per positive case detected; an effort was also made to investigate the direct costs to institution and outcomes of the two Schemes.

The number of slides taken by each scheme varied markedly (County A, 5597 for three kinds of fever patients, 37 for two kinds of fever patients; County B, 111 for two kinds of fever patients), because Scheme A included FUO, which usually constituted the majority of fever patients. This difference in number of patients had a direct effect on costs.

6.1.2 The Costs of Personnel

According to the results of the research, a very high proportion of the costs was attributable to estimated manpower cost. In County A, when Scheme A was implemented, the costs of personnel occupied 75.84% of the annual institutional cost. In County B, where Scheme B was carried out, it was 96.17% of the aggregated costs.

It was not surprising that this occurred. One explanation may be that in the low endemic areas, because of few positive cases detected, in comparison with the fixed number of health personnel, the few cases detected would absorb a great amount of resources, especially manpower. Another reason may be the imprecise factors used to allocate the costs of physicians, pharmacists and assistants in the anti-malaria teams. Because the nonproductivity costs of the personnel have been included in the institutional costs the actual costs may have been overestimated and they may have had an effect on the total institutional costs for providing malaria diagnosis and treatment. But for the purpose of considering the approximate savings due only to implementation of Scheme B in the same areas, any overestimation of costs should not have a significant effect on the conclusion.

If Scheme B were to be substituted for Scheme A nationwide, there would be major implications with respect to personnel policy in malaria control. While some dedicated malaria personnel (microscopists and assistants in anti-malaria teams) may be re-trained and re-allocated to other health service functions, some may be made redundant. These potential social costs need to be ascertained and considered in the overall benefit / cost ratio.

6.1.3 The Costs per Slide Examined

In County A, when Scheme A was carried out, the cost per slide examined was 10.39 Yuan, the cost per positive case detected was 5816.53 Yuan. When Scheme B was implemented , the cost per slide examined was 269.78 Yuan and cost per positive case detected was 998.18 Yuan. In County B, the cost per slide examined was 134.36 Yuan and cost per positive case detected was 304.36 Yuan.

The unit costs incurred by providers in the two schemes varied widely, indicating variations in efficiency. However, the lower costs per slide examined in Scheme A probably occurred for different reasons. In Scheme A, the low cost per slide examined arose because of the high number of fever patients tested for malaria and possibly less manpower was involved per patient to provide services. Manpower costs accounted for 75.84% to 96.17% of the total direct operating costs. It is therefore likely that staffing patterns and overall patient load will most affect the relative efficiency of the study schemes expressed as cost per slide examined.

6.1.4 The Costs of Presumptive Treatment

For the costs of presumptive treatment in Scheme A, they were 19.25 % of the total; in Scheme B, they were only 1.49%. Comparing the real figure, in Scheme A drugs for presumptive treatment cost 11,194 Yuan, the Scheme B, only 222 Yuan. Investigating the annual institutional cost items for different types of diagnoses of fever outpatients in Scheme A (Table 5-5) carried out in different counties, FUO consumed a high proportion of the resources of drugs for the presumptive treatment. The judgment on the cost items for different clinical diagnoses would be made when these results were combined with the performance - such as number of positive cases detected.

In the light of the results of the study, there were no positive cases detected in the FUO group in County A. The use of presumptive treatment for FUO seems unnecessary even if the drugs are provided freely to the patients; from the point of view of society, actually, it is waste. Presumptive treatment only helps to manage a few real malaria cases who had no typical malaria symptoms, but it can't act as a kind of panacea. On the one hand, if the SPR is very low in these FUO patients, that means this effect would be very limited; on the other hand, the incorrect use of drugs may cover up the real causes of fever and delay the optimal treatment. At the same time, in order to deal with these patients, the society will incur costs for providing and consuming the services. Even though there are few reports about the resistance of P.vivax to chloroquine, more attention should be paid to this problem. It is suggested that correct treatment could be given to FUO patients with respect to the costs incurred by the provider and community, but this would require on-the-spot rapid diagnosis.

A rapid on-the-spot diagnostic test would improve the efficiency of malaria treatment. Introduction of such a test would involve costs for training the related personnel to perform the test and the material costs of the new test.

6.1.5 The Cost per Positive Case Detected under Changes of SPR

The total actual direct operating costs for implementing Scheme A (ATC_A) could be expressed as

$$ATC_A = TD_b + TD_{fuo},$$

where,

TD_b - the total direct operating costs of resources used for diagnosing and treating malaria cases from fever outpatients whose clinical diagnoses are typical malaria and suspected malaria, respectively.

TD_{fuo} - the total direct operating costs of resources used for diagnosing and treating malaria cases from fever outpatients whose clinical diagnoses are FUO.

The total actual operating costs for implementing Scheme B (ATC_b) could be presented as

$$ATC_b = TD_b + T_{m.f}$$

where,

TD_b - the total direct operating costs of resources used for diagnosing and treating malaria cases from fever outpatients whose clinical diagnoses are typical malaria and suspected malaria, respectively.

$T_{m.f}$ - the total operating costs of resources used for dealing with the missed malaria cases from FUO groups in the future.

From the formulae 5.1 and 5.2, it can be known that with the increasing SPR, the cost per positive case detected would decrease. But in the present calculations, $T_{m.f}$ was not included in the calculation of the total direct operating costs for implementing Scheme B.

If $T_{m.f}$ were included in the ATCb, the conclusion would be changed. When SPR increases, there will be more cases missing from FUO groups and it will require more resources to deal with the missed cases. So the $T_{m.f}$ per positive case detected in Scheme B will tend to increase with increasing SPR while the TD_b per positive case detected in Scheme B will decrease with increasing SPR (Formula 5.2). When summing TD_b and $T_{m.f}$ together, the relation between ATCb and SPR may thus tend to be a U curve. However, this shape will be modified by FUO returning to township health centers and /or village clinics for diagnosis as clinical malaria / suspected malaria and thus reducing the number of missed malaria cases.

The total direct operating costs per positive case detected in Scheme A will decrease with increasing SPR (Formula 5.1). When comparing the two curves, i.e. ATC_A and ATC_b per positive case detected in Scheme A and Scheme B, respectively, it could be found that when SPR is less than a particular critical value (V_{spr}), the cost per positive case detected in Scheme B is lower than that in Scheme A, so Scheme B should be implemented. But when SPR is larger than V_{spr}, cost per positive case detected in Scheme A would be lower than that in Scheme B, so Scheme A should be selected, and vice versa. However, the V_{spr} may he vary high to set the breakeven point between Scheme A and Scheme B, in practice as in China where the SPR will always be below the SPR (V_{spr}), so reservations noted above should be borne in mind.

Obviously, with increasing SPR, the costs per positive case detected in Scheme A and Scheme B have similar declining trends due to more positive malaria cases detected (Formulae 5.1 and 5.2). It implies that at the higher SPR values, the two schemes for malaria case detection would be more efficient since there would be more positive cases detected from fever outpatients at the low value of average costs in terms of cost per case detected. But at the same time, if the SPR is high and we only carry out Scheme B (it implies that the SPR in FUO is high), $T_{m.f}$ will be high and the actual operating costs per positive case detected will be high. Under this situation, it may be argued Scheme A should be used, and vice versa.

Since Scheme A includes Scheme B as a subset, when FUO is included in the studied activity, the resources used up increase remarkably. However, the number of cases detected didn't change much when implementing Scheme A rather than Scheme B because the SPR in Scheme A was influenced markedly by FUO, which was lower than in Scheme B. So, at the same value of SPR, the cost per positive case detected in Scheme A is higher than that in Scheme B when the two Schemes are carried out in the same areas and the assumption is made that the same personnel serve them.

6.1.6 The Unit Costs under Conditions of Change of the Number of FUO

Considering the relation between the changes of the number of FUO, the cost per slide examined and cost per positive case detected, when the number of FUO increased, the cost per slide examined showed a declining trend, reflecting greater apparent efficiency (Figure 5-4). But the cost per positive case detected showed an increasing trend (Figure 5-5); this means that, with the assumptions made, the rate of increase of the costs (actually, the increasing cost parts are contributed by the increasing the costs of physicians, pharmacists and drugs with the increasing number of FUO) is greater than the increase in number of positive cases detected from FUO because the SPR is very very low in FUO. So, even though the number of FUO increases, the increasing number of positive cases detected has a slower increasing trend. This implies that it is not really a matter of low efficiency. But if given different assumptions (the personnel will be in excess capacity when the total number of three kinds of fever outpatients is at a certain point), then more personnel will be needed in order to deal with more patient visits. In this case, the cost per positive case detected with increasing SPR will change shape but the trend will be positive.

6.1.7 The Costs Saving due to Implementing Scheme B

When comparing the total annual estimated costs of the two schemes, from the viewpoint of the health providers, at present the institutions can save some resources by implementing Scheme B rather than Scheme A. The saved resources would include manpower (especially

microscopists), material and drugs for presumptive treatment, no matter where it was carried out. The micro-level and macro-level studies gave similar answers. When considering all the counties where malaria incidence rates are less than 1 per 10,000 population, the cost saving would be considerably greater when implementing Scheme B rather than Scheme A.

The same implication would be obtained from analysis of the relationship between the additional costs and the additional cases detected from FUO. It is very expensive to find one positive case in this group. The estimated cost is 28852.40 Yuan to 33002.40 Yuan. On this basis, it seems that it is not necessary in future to include this group: a great deal of costs of personnel (microscopists , assistants who provided the services to them) and of the drugs given as presumptive treatment were wasted. The drugs may also be harmful to health and may mask the real causes of the fever. Of course, the fact that there was no positive malaria case found in this group of fever patients in the particular county examined is probably anomalous and a small number of cases would normally be expected.

But one problem remains, that of the missed malaria cases from FUO when Scheme B is carried out. When local transmission and susceptible people (especially children, pregnant women) exist, the missing malaria cases from FUO may act as infectious sources, so that new malaria cases may occur.

The infection process involves several steps and the overall probability (P) of transmission from a single malaria patient is low.

$$P = P_1 * P_2 * P_3 * P_4.$$

Where,

P_1 = the chance of vector (female mosquito) biting infected malaria cases in FUO.

P_2 = the chance of parasite to develop to sporozoite.

P_3 = the probability of the infected mosquito biting susceptible people.

P_4 = the probability of the bitten individual to develop clinical malaria.

Since P_1 P_2, P_3, P_4 are each < 1, the value of P would be $<< 1$. A more complete estimation of the real likelihood of a transmission event occurring would require close approximation of each step in an appropriate computer model.

Another issue related to the malaria cases occurring in the FUO category is that a proportion may re-present at Township Health Centers and /or Village Clinics one or two days later with symptoms that would now be classified as typical malaria or suspected malaria, so that they would fit into Scheme B. Thus the true number of " missed " cases presenting as FUO and thus excluded from slide examination under Scheme B would be considerably reduced.

Taking these two points together (low transmission probability, re-presentation of FUO), the danger of serious epidemics due to implementation of Scheme B is probably low.

However, when the population is large enough, the actual number of new cases may be considerable. In order to deal with new cases and eliminate new foci, the following work needs to be done: treatment for new infected case's family members and spraying insecticides around neighboring houses when there is a new case; when there are two cases, all village members will get preventive treatment and spraying the whole village is needed. These will be the costs related to missed cases in the future: they will include the costs of manpower, drugs, materials for focus management.

From the viewpoint of the society, they will have to bear the potential costs due to Scheme B being carried out. Thus, in order to get correct diagnoses and correct treatment, they will need to be encouraged to come to the health service points again. The potential costs incurred by the society will therefore include the costs of transportation and working time lost, as well as the costs of the relatives who accompany them to visit health service points.

If we can analyze the cost in the future due to missing cases from FUO with the help of transmission models and cost models, then comparing the cost saving at present due to not dealing with FUO and the continued costs in the future in order to eliminate foci and diagnose and treat new cases, a trade-off will be obtained , which will be very helpful to decision-makers to choose the optimal scheme for malaria case detection under different malaria situation.

6.2 Comparison the Cost Proportion in China to Other Counties

There have unfortunately been few detailed studies of the cost analyses of Schemes for malaria case management by passive case detection. As Barlow and Grobar (1985) stress, the results of similar researches should be treated with some caution because the source documents often provide inadequate information for judging the quality of the cost and efficiency estimates. In particular, cost estimates are liable to be incomplete, for instance, they often omit investment

costs, administrative costs, private costs and costs of drugs for presumptive and radical treatment.

In addition, some estimates come from particular small scale trials ,eg Ettling et al (1991), who compared the costs of several types of malaria clinics in the southern part of Maesot District, Tak Province in north-west Thailand, and some from national malaria control programs, for instance, Kaewsonthi and Harding (1983), who analyzed data from Thailand, and the Nepal study done by Mills(1988).

A final reason for cautious interpretation relates to the malaria situation in terms of malaria morbidity rate or incidence rate at the time of the studies. Even though some estimates relate to the costs of passive case detection in the maintenance phase in areas where control had been established for some time but the morbidity rate was about 31.5 per 10,000 population (Ettling, 1991), some estimates focus on very low morbidity areas where it is less than 1 per 10,000 population (the study presented here). The infectious pool will affect the number of patients, the number of slides examined and positive cases detected.

Despite these cautionary words, some useful comparisons can be made from the orders of magnitude of the figures from similar research. Comparing the breakdown of costs per slide examined, the manpower costs occupied 70 - 86% of the total institutional costs and supplies 3 - 5 % of the total for passive case detection in malaria clinics in Thailand (Ettling, 1991). Similar results were obtained in the present research : the costs of personnel took up 75.84 -96.17% of the total institutional costs and the costs of material 0.37 - 4.81% of the total from the viewpoint of the provider.

Direct comparison with the results of other research is hindered by the scarcity of comparable figures. What data there are suggest that passive case detection in low incidence areas in China is a very expensive means of diagnosing and treating malaria cases.

6.3 The Accuracy of the Cost Analysis

Any imprecision in the efficiency (input per unit output, such as the cost per slide examined) and performance estimates may be outweighed by inaccuracies in the cost estimates.

6.3.1 The Accuracy of Costs of Drugs and Material

The method of cost analysis used in this research may produce certain inaccuracies: drugs for presumptive and radical treatment have been computed on the basis of numbers of fever outpatients concerned or positive cases detected. So have the materials used for parasitological

purposes. To the extent that wastage of supplies occurs, this is likely to be an underestimate of actual costs.

6.3.2 The Accuracy of Costs of Personnel

For the microscopists, their activities are only one - taking, preparing and examining the slides and all of these are related to the activity being studied. So, the entire costs of them can be assigned to the diagnosing and treating the malaria cases. But their productivity and non-productivity were included in the cost calculation. It meant the costs would be overestimated in relation to the studied activity. Physicians and pharmacists usually deal with patients having different diseases. The physicians treat several internal diseases such as respiratory system diseases and digestive system problems. Only a fraction of their clients are the fever patients. Since the amount of time that manpower are occupied increases with the number of patient visits, the percentage fitting into the categories studied should be used as the basis to allocate the related manpower costs. In our case, we assessed what proportion of the total internal-medicine and the total outpatient visits were by patients with clinical diagnoses of typical malaria, suspected malaria and FUO.

The assumptions made here are that a visit for fever has involved the same amount of manpower time as visits for other internal diseases and approximately the same proportion of manpower time is spent on diagnosing and treating the fever patients concerned. In reality, this is a very crude approximation and allocating the costs of the manpower in this way means the exact contribution of the manpower to the activity of interest is not measured, because a proportion of the nonproductive time is also included. So the costs of the manpower contributed to the activity will be underestimated.

A similar problem remains in allocating the costs of assistants in the anti-malaria team due to cruder factors used to allocate their time to malaria case detection and treatment.

For the problem of underestimating or overestimating the costs of manpower, if the same method for allocation is used throughout the same study, it will have little effect on the result, as in the present research.

6.3.3 The Concept of Cost Used in the Research

The appropriate concept for valuing resources in an economic analysis is that of social opportunity cost - the value to society of a particular resource in relation to its next best alternative use, or what has to be given up by using the resource in its current activity. Market prices (price actually paid) may not accurately reflect social

opportunity cost, and where necessary are adjusted to produce "accounting prices" or "economic prices". If all the related materials and drugs are valued or adjusted in terms of a common yardstick, it may reflect social opportunity cost of these resources very well and provide more opportunities to compare the results of the similar studies carried out in different countries and areas.

The main focus of the study is to investigate the magnitude of direct costs and the unit costs of the two Schemes in terms of cost per slide examined and cost per positive case detected. Even though the accounting prices of materials and drugs are not used in this study due to incomplete information, the objectives in this study would not be affected because the market prices were used in both schemes and the study areas were from the same country. Certainly, it is desirable that further study should try to use accounting prices.

6.4 The Limitations of the Research

In this study, only direct operating costs incurred by institutions - health providers - are considered. The most appropriate concern for evaluating the costs of the two schemes is to consider both operating costs from the viewpoint of providers and community costs from the perspective of consumers, which was not feasible in this study due to the limited time of study and the limited data available.

Even though, in the operating costs, indirect costs were not included in the study, however, the two counties were in the same province, the management support costs from the upper level (national and provincial levels) is similar, and can be essentially regarded as "constant". They will not influence the conclusion of the research.