

COST AND PERFORMANCE OF MALARIA SECTOR: A CASE STUDY AT MALARIA SECTOR 11, TAK PROVINCE, THAILAND

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Abstract. The objective of this study was to assess the cost and performance of each operational unit at the malaria sector level and to calculate the unit cost of each activity accordingly. Data were collected at Malaria Sector No.11 situated at the western border of Thailand with Myanmar during the fiscal year of 1995. The unit cost was calculated by dividing the total cost of each activity by its output using appropriate units of analysis. The result showed that 67% of the total cost of malaria sector was labor cost and 45% of the total cost was allocated to diagnosis and treatment activities. Unit cost in terms of cost/visit, cost/case found, cost/case of falciparum malaria treated, cost/case of vivax malaria treated, cost/house spray and cost/impregnated net were US\$1.85, 8.21, 10.07, 8.46, 2.24 and 1.54 respectively. The results of this study will provide important information as to the best use of limited available resources to determine which activities should be stopped, continued, increased or decreased at the malaria sector level.

INTRODUCTION

Thailand has been successful, to a certain extent, in its malaria control efforts. The malaria incidence and death rates have markedly dropped. But the problem remains serious in the border areas in Tak, Mae Hong Sorn, Kanchanaburi, Chantaburi and Trad Provinces with high incidence and drug resistance. The Malaria Division Department of Communicable Disease Control, Ministry of Public Health, Thailand is constantly searching for means and ways to improve performance, to increase effectiveness and to optimize operational efficiency of malaria control (Malaria Division, 1996). It is argued that costs must be considered in addition to performance. The organizational structure of the Malaria Division of the Ministry of Public Health in Thailand (Fig 1) shows that costs may be incurred by four levels of management (*ie* divisional, regional, zonal and sectoral). At the malaria sector office, costs may be incurred by operational units, namely : diagnosis and treatment, vector control (DDT spraying and impregnation of nets, surveillance and evaluation, and training and education. However, costs have

limited meaning unless related to some measure of performance. Traditionally, the overall performance in a malaria control program is estimated from the reduction of both the mortality due to malaria, and the annual parasite incidence. However, the performance of different operational units of malaria sectors will be evaluated differently.

The unit cost of each activity at the malaria sector will provide important information as to the best use of limited available resources (Kaewsonthi and Harding, 1989) to determine which activities should be stopped, continued, increased or decreased at the malaria sector level. Therefore, the objective of this study was to study the cost and performance of each operational unit at the malaria sector and to calculate the unit cost of each activity accordingly.

MATERIALS AND METHODS

Study area selection

Malaria Sector No.11 (Mae Jarao) is located in the Mae Jarao sub-district, Mae Ramat district, Tak Province, western border of Thailand with Myanmar. This malaria sector was selected as the study area because it was part of the network of health care facilities under the comparative study of pyrethroid impregnated mosquito nets with DDT residual spraying for malaria control in Thailand

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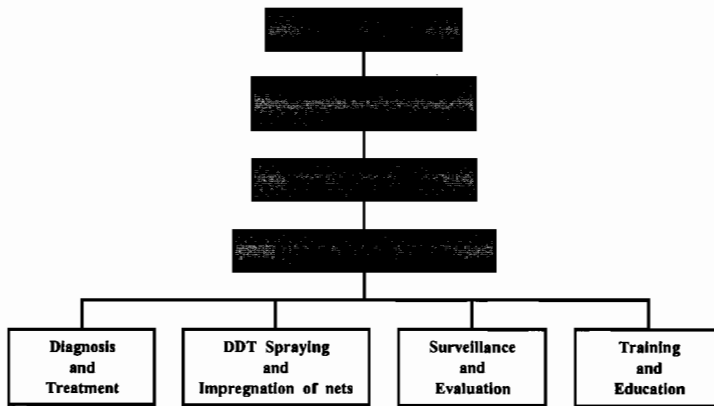


Fig 1—Organization and activities of the malaria sector.

(Malaria Division, 1995).

Identifying and measuring provider costs

Total provider cost was calculated from labor costs, material costs, and capital costs at Malaria Sector No. 11, during the fiscal year of 1995 (October 1, 1994 to September 30, 1995). Upon summing up all these cost components, we arrive at the total direct cost. The cost to the provider was the true cost of delivering the service to patients or target populations (Kaewsonthi and Kamolratanakul, 1994). This study applied the direct distribution method as a method of cost allocation (American Hospital Association, 1968; Berman and Weeks, 1976).

Determination of output of each activity

Outputs of four activities at Malaria Sector No. 1 were obtained from the health record. The validity of these data was checked by direct observation and in-depth interviews.

Unit cost calculation

The average cost or cost per unit of output of each activity was calculated by dividing the total cost of each activity by its output using appropriate units of analysis, eg cost/visit, cost/case found, cost/case of *Plasmodium falciparum* (Pf) treated, cost/case of *Plasmodium vivax* (Pv) treated, cost/house sprayed, cost/impregnation of 1 net, etc.

RESULTS

Cost of each activity at the malaria sector level

Table 1 shows the cost allocation for each activity at the malaria sector level. Sixty-seven per-

cent of the total cost of the malaria sector were labor costs, while 29% are material and 4% were capital depreciation costs.

Nearly half (45%) of the total cost was allocated to diagnosis and treatment activities at 3 malaria clinics, 34% to vector control, 11% to surveillance and evaluation and training and education.

The malaria clinic consumed most of the labor costs (50.7%), while vector control activities consumed the largest proportion of the material costs (66.7%).

Performance of diagnosis and treatment activities

The performance of these activities was measured in terms of the number of patients examined and the number of malaria cases found, including *Plasmodium falciparum* and *Plasmodium vivax* infections (Table 2). There were two types of patients (Thais and foreigners) seeking care at this malaria sector. Most foreigners came from Myanmar. The number of foreigners at the Mae Jarao Malaria Clinic was quite high when compared with Thais (1:2.3). The percentage of Pf at Mae Jarao, Joppi and Lape was 63.7%, 79.5% and 73.7%, respectively. It was also found that foreigners tended to have a higher proportion of Pf when compared with Thais.

Performance of vector control

Two major activities of vector control in this malaria sector were DDT spraying and impregnation of bed nets (Table 3). DDT was sprayed twice a year at 6-month intervals. The output of this activity was measured in terms of number of houses or huts sprayed and number of impregnated nets. The results showed more than 90% of the houses and huts in the target areas having been sprayed which could cover more than 93% of the target population. Impregnation of nets also exceeded the expected target, especially during the first cycle of impregnation.

Performance of surveillance and evaluation

Surveillance services of Malaria Sector No.11 comprised 2 activities, special case detection and fixed schedule malaria clinic. The output of surveillance services was similar to malaria clinics. The percentage of Pf and Pv was 68.4 and 31.5 respectively. Furthermore, among the foreigners, the per-

Table 1
Cost allocation for each activity at the Malaria sector.

Budget item	Total cost before allocation (%)	(1) Diagnosis and treatment		(2) DDT spraying and impregnation of nets		(3) Surveillance and evaluation		(4) Training and education	
		Amount allocated	% allocated	Amount allocated	% allocated	Amount allocated	% allocated	Amount allocated	% allocated
1) Labor cost	1,355,724.00 (66.75)	687,872.85	50.7	320,903.40	23.7	147,107.19	10.9	199,842.56	14.7
2) Materials Supplies	557,029.41 (28.41)	181,527.39	31.5	315,907.78	54.7	69,835.73	12.1	9,758.51	1.7
3) Public utilities	12,000.00 (0.59)	6,720.00	56.0	1,440.00	12.0	1,320.00	11.0	2,520.00	21.0
4) Depreciation of instruments	81,740.46 (4.02)	28,996.51	35.5	46,349.36	56.7	3,855.72	4.7	2,538.87	3.1
5) Depreciation of buildings	4,685.28 (0.23)	2,342.64	50.0	852.72	18.2	1,063.56	22.7	426.36	9.1
Total cost	2,031,179.15 (100.00)	907,459.39	44.7	685,453.26	33.7	223,179.20	11.0	215,087.30	10.6

Table 2
Performance of malaria sector: (1) diagnosis and treatment.

Malaria Clinic	Patients' nationality	No. examined	No. found	<i>Pf</i>	<i>Pv</i>	Mix	Fg
Mae jarao	Thais	3,741	548	316	232	0	8
	Foreigners	1,616	871	588	281	2	47
Joppi	Thais	3,917	707	548	159	0	20
	Foreigners	558	206	178	28	0	15
Lape	Thais	1,876	275	201	74	0	13
	Foreigners	130	56	43	13	0	14
Total		11,838	2,663	1,874	787	2	117

Table 3
Performance of malaria sector: (2) DDT spraying and Impregnation of nets.

	1 st cycle	2 nd cycle	Total
DDT spraying			
- No. of houses	1,101	750	1,851
- No. (%) of houses sprayed	1,018 (92.5)	683 (91.1)	1,701 (91.9)
- No. of huts	2,921	2,852	5,773
- No. (%) of huts sprayed	2,734 (93.6)	3,293 (115.5)	6,027 (104.4)
- No. of population covered	5,113	3,444	8,557
- No. (%) of population potentially prevented from spraying DDT	4,771 (93.3)	3,219 (93.5)	7,990 (93.4)
Impregnation of nets			
- No. of nets			
- No. (%) of nets impregnated	425	983	1,408
	873 (205.4)	617 (62.8)	1,490 (105.8)

Table 4
Performance of malaria sector: (3) Surveillance and evaluation (Special case detection and fixed schedule malaria clinic).

Patients' nationality	No. examined	No. found	<i>Pf</i>	<i>Pv</i>	Mixed	Fg
Thais	25,157	1,727	1,143 (66.2%)	583 (33.7%)	1	90
Foreigners	5,937	1,301	929 (71.4%)	370 (28.4%)	2	75
Total	31,094	3,028	2,072 (68.4%)	953 (31.5%)	3	165

centage of *Pf* and *Pv* was 71.4 and 28.4 respectively (Table 4).

Cost per output of malaria sector

When compared with other health care facilities (malaria clinics, local health centers and 30-bed district hospital) in the study area (Malaria Division, 1995), diagnosis and treatment activities at

the malaria sector tended to have the highest cost in terms of cost/visit (฿ 64.60 vs ฿ 20.92 vs ฿ 51.88 vs ฿ 93.00 respectively), cost/case of *Pf* treated (฿ 352.52 vs 174.45 vs 117.21 vs 158.33) and cost/case of *Pv* treated (฿ 296.10 vs 118.03 vs 60.79 vs 101.91). The unit cost of DDT spraying was also relatively high when compared with its effect (Table 5).

Table 5
Cost per output of malaria sector.

Cost per Performance	Unit cost (฿)	Unit cost (\$)
1. Diagnosis and treatment		
- Cost/visit	64.60	1.85
- Cost/case found	287.19	8.21
- Cost/case of <i>Pf</i> treated	352.52	10.07
- Cost/case of <i>Pv</i> treated	296.10	8.46
2. DDT spraying and impregnation of nets		
- Cost/house or hut sprayed	78.31	2.24
- Cost/impregnated net	53.86	1.54
3. Surveillance and evaluation		
- Cost/visit	5.96	0.17
- Cost/case found	61.24	1.75
- Cost/case of <i>Pf</i> treated	126.57	3.62
- Cost/case of <i>Pv</i> treated	70.15	2.00

(US\$ 1 = ฿ 35)

DISCUSSION

In principle, the unit cost would appear to provide a basis for improving the use of resources; unfortunately it is not that simple. First, unit costs are not only affected by demand but also by the costs for supplying each type of service. Second, unit cost is not the only factor to be considered in the supply of services since a service with a high unit cost can be justified if that service plays a key role in preventing the re-occurrence of malaria in a potential malaria area. Third, while high unit cost may indicate the need to switch resources to other activities, there can be real social and organizational constraints in moving personnel and closing established services.

There are 3 levels of the consequence of health care programs, namely, output (intermediate level), outcome (secondary level) and impact (tertiary level). Therefore, measurement of performance by using only output as in this study can reflect only early effects of health care programs (Kamolratanakul, 1995).

Despite mounting evidence of decreasing effectiveness the systematic spraying of houses continues, with performance still measured as the number of houses sprayed (output) rather than the effect on the vector or the pool of infection (outcome). Clearly the costs and benefits of spraying in each area have to be reviewed and where appropriate,

these resources should be switched to more effective activities.

Labour cost accounted for 67% of the total cost of the malaria sector indirectly indicating that the cost allocation at the malaria sector may not be efficient. This picture is quite similar to that prevailing in most public sectors in this country. This study applied the direct distribution method of cost allocation because the services at the malaria sector are fairly homogeneous.

The viewpoint adopted in this study was that of the Malaria Division, Department of Communicable Disease Control, Ministry of Public Health. This perspective was selected because the Malaria Division was the ultimate decision maker responsible for control program, as well as organization and administration of all medical and public health services for malaria patients in the country. However, a patient's perspective or society's perspective should also be considered.

Health facilities along the border areas have to serve many foreigners which is one of the major obstacles in malaria control. Moreover, the occupational migration of populations, both internal and external, particularly along the western and eastern borders, caused resistant *P. falciparum* to spread over most of the country (Malaria Division, 1997)

Cost and performance of each malaria sector should be compared within or between zones to improve efficiency, especially the unit cost per malaria sector when located in different areas of endemicity (high, moderate and low). As the intensity of the problem is not the same in different areas, the activities of each sector should be adjusted to the magnitude of health problems.

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REFERENCES

- American Hospital Association. Cost finding and rate setting for hospital. Chicago: American Hospital Association, 1968: 74-90.

- Berman HJ, Weeks LE. The Financial Management of Hospital. Michican: Hospital Administration Press, 1976: 110.
- Kaewsonthi S, Harding AG. The economics of malaria control in Thailand. *Parasitol Today* 1989;5: 392-6.
- Kaewsonthi S, Kamolratanakul P. Health Economics: Research Principles and Procedures for Evaluation of Health Services, 2nd ed. Bangkok: Chulalongkorn University Press, 1994.
- Kamolratanakul P. Concept of monitoring and evaluation in vector control, prepared for the Inter-country Workshop on Planning and Implementation of Vector Control for Malaria in South-East Asia Region, Bangkok, Thailand, 4-14 December, 1995.
- Malaria Division. Efficiency of lambda-cyhalothrin-treated mosquito nets compared with DDT spraying for malaria control. Final Report, Bangkok, Thailand; 1995.
- Malaria Division. Annual malaria report. Department of Communicable Disease Control, Ministry of Public Health, Bangkok, Thailand, 1996.
- Malaria Division. Annual Malaria Report. Department of Communicable Disease Control, Ministry of Public Health, Bangkok, Thailand, 1997.