COST-EFFECTIVENESS OF ANTI-MALARIA ACTIVITIES IN SRI LANKA

by
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Thesis submitted to the University of London in fulfilment of
the requirement for the degree of Doctor of Philosophy
in the Faculty of Science

London School of Hygiene and Tropical Medicine

November 1994

ABSTRACT

Cost-effectiveness of anti-malaria activities in Sri Lanka was examined from a societal point of view using Matale district as a case study. Intermediate level cost-effectiveness indicators were measured for curative care and preventive care separately. In measuring cost-effectiveness indicators, community acceptance of and compliance with control measures were incorporated into the analysis particularly for preventive measures with a view of focusing on community effectiveness of control measures and strategies. Based on community perceptions, the household level illness rate of malaria (HLIR) was used to measure effectiveness of the combinations of preventive and curative measures; it was an attempt to widen the scope of the cost-effectiveness analysis in its application to ongoing programmes in the absence of a control area or randomized control trials. The main preventive measure of residual spraying was found to be a waste of resources because there was low acceptance and no evidence that those accepting the spraying subsequently had a lower prevalence rate. Knowledge, attitudes, practices and socio-economic factors underlying community behaviour were analyzed particularly to identify policy options to increase the efficiency of the control programme. Self preventive measures were common among all community groups. The community demonstrated a high sensitivity towards illness and considerable use of the private sector for curative care. However the public sector tended to be the final resort for severe illness, irrespective of socio-economic background. Supply deficiencies were a prime cause for the tendency towards the private sector. The cost implications and possible outputs of two alternative policy options were examined in detail. Incorporation of community behaviour into the cost-effectiveness analysis to assess community effectiveness should urge economists and epidemiologists to work together, particularly in assessing the validity of community perceptions of illness prior to undertaking an economic evaluation.

Dedicated to late Professor T.J.Ramaiah
who made me what I am now

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ABBREVIATIONS

ai	- Active ingredient
ABER	- Annual blood examination rate
AC	- Average cost
ACDT	- Augmentation of case detection and treatment
AMAs	- Anti-malaria activities
AMC	- Anti-Malaria Campaign
ANOVA	- Analysis of variance
ACD	- Active case detection
APCD	- Activated passive case detection
API	- Annual parasite incidence rate
BF	- Blood filming
BFF	- Blood filming facilities
BH	- Base hospital
BT	- Blood testing
BTF	- Blood testing facilities
CBA	- Cost benefit analysis
CBF	- Cost per blood film
CC	- Cost of compliance with treatment
CD	- Central dispensary
CD&MH	- Central dispensary and maternity home
CEA	- Cost-effectiveness analysis
CEI	- Cost-effectiveness indicator
CFSH	- Cost per fully sprayed house
CL	- Coils/leaves/husks or a combination of them
CPC	- Cost per positive case
CPCD	- Cost per case detected
CPCR	- Cost per patient recovered
CPCT	- Cost per case treated
CPIT	- Cost per inpatient treated
CPNI	- Cost per net impregnated
CPPP	- Cost per person protected
CPV	- Cost per visit
CUA	- Cost utility analysis
DAMC	- Directorate of Anti-Malaria Campaign
DDHS	- Divisional Director of Health Service
DH	- District hospital
DHB	- District health budget
DIO	- Discussions, interviews and observations
DMB	- District malaria budget
DPDHS	- Deputy Provincial Director of Health Services
EMPC	- Employer's clinic
FA	- Field Assistant (AMC)
FHW	- Family Health Workers
FOPC	- Fixed public outpatient clinic
FRP	- Fully recovered patient
FS	- Fever surveys
FSH	- Fully sprayed house
GDP	- Gross domestic product

GN	- Grama Niladhari (Village Officer)
GND	- Grama Niladhari division
GPD	- Government western doctor engaged in private practice
HA	- Health area
HIA	- Health Information Assistant
HIO	- Health Information Officer
HIS	- Health Information System
HH	- Household
HHS	- Household survey
HLIR	- Household level illness rate of malaria
IC	- Incremental cost
ICCD	- Incremental cost per additional case detected
ICCT	- Incremental cost per additional case treated
ICIT	- Incremental cost per additional inpatient treated
IDVC	- Integrated vector control
IHA	- Integrated health area
IMN	- Impregnated mosquito net
INP	- Inpatient
KAP	- Knowledge, attitudes and practices
MBC	- Mobile clinic run by Anti-Malaria Campaign
MBCO	- Mobile clinic run by a medical officer of an MC
MBS	- Mass blood survey
MC	- Medical centre
MIC	- Microscopist
MN	- Mosquito net
MNI	- Mosquito net impregnation
MNIP	- Mosquito Net Impregnation Programme
MoH	- Ministry of Health
n.a.	- not available
n.ap.	- not applicable
NMEP	- National Malaria Eradication Programme
OP	- Outpatient
PCD	- Passive case detection
PD	- Private western doctor
PDAMC	- Provisions from the Directorate of Anti-Malaria Campaign
PDHS	- Provincial Director of Health Services
p.f.	- Plasmodium falciparum
PFR	- Perceivably fully recovered
PFRP	- Perceivably fully recovered patient
PHC	- Primary health care
PHI	- Public Health Inspector (AMC)
PHS	- Public Health Supervisors
PHW	- Public Health Worker
PMC	- Police mobile clinics
PO	- Policy option
PO1	- Policy Option 1
PO2	- Policy Option 2
PIR	- Parasite incidence rate
PRFI	- Perceived recovery from illness

PRP	- Partially recovered patient
PRS	- Perennial residual spraying
PRSP	- Perennial Residual Spraying Programme
PRT	- Prophylactic treatment
PSH	- Partially sprayed house
PST	- Perennial spraying team
PSH	- Partially sprayed house
PU	- Peripheral unit
p.v.	- Plasmodium vivax
RC	- Cost of receiving formal treatment
RH	- Rural hospital
RIMI	- Reported incidence of malaria-like illness
RMO	- Regional Malaria Officer
RMOM	- Regional Malaria Office in Matale
RMOMC	- Clinic at Regional Malaria Office in Matale
RS	- Residual spraying
RST	- Residual spraying team
SC	- Surveillance centre
SD	- Standard deviation
SFA	- Supervisory level FA (AMC)
SMO	- Spray Machine Operator
SP	- Special programmes
SSP	- Special spraying programme
SPR	- Slide positivity rate
SRSP	- Selective Residual Spraying Programme
SSMO	- Substitute spray machine operator
TAQ	- Time allocation questionnaire
TAS	- Time allocation study
TC	- Total cost
VHH	- Village health helper
VHW	- Voluntary Health Worker
VU	- Vigilance unit

ACKNOWLEDGEMENTS

Field work of this study (Sri Lanka) and the subsequent writing-up period in London were financed by a research training grant from the World Bank/UNDP/WHO Special Programme for Research and Training in Tropical Diseases (TDR). It gives me great pleasure to express my gratitude to the TDR. I am foremost in the debt to Dr.Julia Fox-Rushby, my supervisor, for her guidance, encouragement and patience which enabled me to get started, develop and bring this study to fruition. I also wish to express my special gratitude to Dr. Anne Mills, the Head of the Health Policy Unit, as she has been of invaluable assistance during my writing-up period. She not only clarified certain problematic issues but also read the first draft of the thesis and provided me with invaluable comments which I have accepted with great appreciation. My appreciation also goes to Mr.Sarath Vidanagama, the Head, Department of Economics, University of Colombo, for the tremendous support he gave me without which it would have been impossible for me to continue. I also must offer my heartfelt thanks to my friend Jayantha Weerawikrama for his continuous help.

The whole community in the Matale District where I conducted my field work and both the sample families and malaria victims too deserved special appreciation here as they unhesitantly furnished information pertaining to the disease and particularly their experiences of it which they might well have wished to keep for themselves for personal reasons.

CHAPTER 1.INTRODUCTION AND AIMS

1.1 Resurgence of Malaria

Anti-malaria activities in Sri Lanka have a long history of over one hundred years. Packets of quinine powder were distributed through government dispensaries and post offices at a price little over the cost even in the later part of last century (Uragoda 1987). Some preventive measures were first introduced in 1911 in Kurunegala in the North Western Province; island-wide operations were begun in 1921. The plantation sector also inaugurated an anti-malaria programme called Ceylon Estates' Proprietary Association Malaria Control Scheme in 1926 in collaboration with the government. However, the greatest pestilence in recent history caused the malaria epidemic of 1934-35, killing over 75,000 people. The epidemic was controlled by strenuous efforts of the Medical Department, and social, political and private organizations. As a result, the Anti-Malaria Campaign (AMC) was formally established in 1946 with the introduction of DDT spraying in dwelling houses in the North Central Province by mobile units in November 1945.

Spraying of DDT in six month cycles to all structures in malarious areas and the WHO introduced eradication programme resulted in a near eradication of malaria in early 1960s. In 1963, the incidence of malaria fell to just 17 cases (Table 1A.1). The resurgence of malaria was, however, evident in the late 1960s and the incidence rose to nearly half million by 1970. In August 1977, the insecticide was changed to Malathion and spraying was intensified by introducing a three month cycle. Although resistance by the vector to DDT could be a prime reason for the resurgence, the reasons for its continuation are likely to have had other causes. Clearance of forests, provision of irrigation water and setting up of new human settlements in the dry zone[1], particularly under the Mahaweli Project[2], could have enhanced transmission in those areas. Inhabitants for the new settlements were selected from various parts of the island and this led to intensified internal migration among regions. Such population movements coincided with the malaria epidemic of mid 1980s (Amarasinghe et al 1991). However, no conclusive research has yet identified the specific causal factors of the resurgence or

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[1] The island is divided into three agro-climatic zones called dry, intermediate and wet.

[2] The Mahaweli Project is the biggest multi-purpose irrigation project in Sri Lanka.

annual oscillations of malaria during the past two decades.

1.2 Prevalence of malaria

A recent survey of morbidity patterns showed that 9 % of all outpatients and 6.6 % of "infant" outpatients at public medical centres (MCs) in three representative districts were malaria cases[3] (Ministry of Health 1987). According to Ministry of Health (MoH) figures, malaria was the cause of hospitalization of 5.1 % of inpatients at all public MCs in 1992 (MoH 1992). Across districts, however, the prevalence of malaria varied substantially. In 1992, malaria was among the first five leading causes of hospitalization in 14 districts and the first in five of those districts, namely, Mannar, Vauniya, Mullaitivu, Anuradhapura and Moneragala(Table 1A.2); all of them are in the dry zone. Malaria was not among the first ten leading causes of hospitalization in 7 districts, although it was the fifth overall leading cause of hospitalization. Malaria was, however, not an important cause of hospital deaths. One exception was that it was the leading cause of hospital deaths in 1989 in Mannar, Vauniya and Mullaitivu districts. Similarly, malaria was the 7th leading cause of hospital deaths in Moneragala district in 1992. The rank of malaria with respect to hospital mortality was well below ten in all other districts in 1992 (Table 1A.3).

The AMC uses three indicators to indicate incidence: Slide Positivity Rate (SPR), Annual Blood Examination Rate (ABER) and Annual Parasite Incidence (API) - (Table 1A.4). In general, these three indicators cover all malaria patients treated at any type of public source of treatment with blood filming or testing facilities. According to the API, the five districts[4] rated as highly endemic in 1991 were Matale, Puttalam, Kurunegala, Moneragala and Anuradhapura with their APIs at 89.5, 82.9, 74.6, 67.8 and 65.2, respectively; three of these districts and the highly endemic areas of other two districts are in the dry zone. With respect to SPR, Puttalam district, which is also in the dry zone, reported the highest rate (43.0) followed by Moneragala, Kurunegala, Matale and Ratnapura districts with 35.2, 34.6, 33.3, and 32.7, respectively[5]; among them only Ratnapura is entirely in the wet zone.

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[3] No method exists to record morbidity pattern of outpatients.

[4].Normally health districts and administrative districts have similar boundaries. A province is consisted of a few districts. The only exception is Vauniya which covers three administrative districts called Mannar, Mullaithivu and Vauniya.

[5] According to hospital data although the health district of Vauniya in the Northern Province was highly endemic, the AMC to does not carry out its operations in that area amidst the war of the Tamil separatist movement.

1.3 Functions of the AMC

With the initiation of devolution powers to Provincial Councils in 1989, the AMC was also decentralised, and almost 95 percent of its employees were released and absorbed by the Provincial Health Ministries (AMC 1989). Thus functions of the headquarters of the AMC, which was renamed as the Directorate of the Anti-Malaria Campaign (DAMC), were confined to formulation of policies and technical guidelines, monitoring field activities, training, international collaborations, research, and procurement and distribution of insecticides, drugs and equipment.

With the new system, Provincial Health Ministries are responsible to formulate their own plans within the policy framework of the DAMC and implement them under the supervision of Provincial Directors of Health Services (PDHSs). While a Provincial Malaria Officer serves in a technical advisory capacity at the provincial level, district level activities are under the direct supervision of the Deputy Provincial Director of Health Services (DPDHS). At the activity level, however, the responsibility of supervision is primarily shared between the Regional Malarial Officer (RMO) and the Divisional Directors of Health Services (DDHSs), who are in charge of all preventive health services of a Health Area (HA)[6].

At the HA level, activities of the AMC could be basically divided into five main categories: surveillance, vector control, treatment, supportive activities and other activities. Surveillance is undertaken as Active Case Detection (ACD), Passive Case Detection (PCD) and Activated Passive Case Detection (APCD). According to the record keeping system of the AMC, APCD refers to the cases detected from the patients who make visits to public MCs with at least blood filming facilities. PCD refers to the cases detected from the blood films collected by the AMC employees while they are engaged in a field activity, of which the prime purpose is not case detection; e.g., collection of blood films by field assistants during residual spraying or by a public health inspector when inspecting spraying units. Detection of cases by making purposive visits to the patient's residence through fever surveys, mass blood surveys etc. is termed as ACD. In practice, APCD continued as the main screening methodology since the posting of microscopists (MICs) at public MCs in 1984 and is responsible

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[6] Supervision of curative care at fixed public MCs is primarily in the hands of the respective medical officer in charge of each MC; DPDHS has the final responsibility and RMO also has the responsibility of issuing drugs in time, facilitating case detection etc.

for almost 95 % of case detections (AMC 1990 and 1991).

Vector control is focused on adult mosquito control and larval control. Adult control includes three main activities, namely, spraying, fogging and the recently introduced mosquito net impregnation. Spraying takes three forms: perennial, focal and seasonal. A spraying team consists of a Field Assistant (FA), who supervises the team, Spray Machine Operators (SMOs) and Substitute SMOs (SSMOs). Larval control mainly consists of larvicides spraying, source reduction and crude oil spraying and is largely carried out in epidemics along with a Mobile Malaria Control Team, which consists of a Mobile Laboratory as well.

Treatment is primarily carried out at public MCs. Normally most of the MCs in highly endemic areas have a MIC and an FA (to get blood films) and some of the other MCs have an FA; blood films collected at those MCs are sent to the regional laboratory for testing. A blood report is normally available within twenty minutes at a MC with a MIC. Presumptive treatment is no longer given at public MCs. Prophylactic treatment and alternative drug therapy (for resistance cases) are also given at those MCs. FAs attached to spraying teams, Voluntary Health Workers (VHWs) and Public Health Workers (PHWs) have also been trained to treat patients in the field.

Supportive activities encompass all activities which are indirectly related to field activities; i.e.,entomological investigations, data collection, health education, training and supervising VHWs and research. "Other" activities include inter-sectoral collaboration (e.g., with local government councils and the Gem Corporation[7]) and vector control programmes of Japanese Encephalitis and Dengue Haemorrhagic Fever.

1.4 Effectiveness of the control programme and research potentials

The resurgence and subsequent aggravation of malaria in Sri Lanka still appears to be a challenge to the AMC. Although the total number of positive cases declined significantly during the later part of the 1980s, in 1992 it was well over twice that in 1983 (Table 1A.1). Continuous efforts of the AMC still seem to be insufficient to control the disease to a satisfactory level. The MoH, however, continuously allocates a considerable proportion of its resources to the AMC. In 1989, it was 62.2 % of the total expenditure on Community Health Services and 11.6 % of the total health budget (MoH

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[7] This means source reduction at abandoned gem pits.

1989)[8]. Indeed, the AMC receives priority over all other community health programmes in making budgetary decisions. Out of the total expenditure it normally spends about 60 % for malathion and 20 % for personal emoluments and travelling (AMC 1981-1991).

When looking at AMC reports it seems that most of its decisions were taken in an ad hoc manner by adjusting its organizational structure and work schedules to meet current requirements. Economic considerations were not a significant issue in making agendas of both planners and managers of the AMC. Although the budgetary decisions and financial management procedures of the AMC were based on a programme budgeting system, it appeared to be yet another routine procedure which put little emphasis on performance aspects. Questions like how much it costs to spray a house, to treat a patient and to examine a blood film were still unanswered questions for the AMC. Thus the AMC appeared to be not in a position to make any conclusion about the cost-effectiveness of its own strategies and measures. Nevertheless, it conducted regular epidemiological reviews and completed a few entomological studies; entomological studies largely focused on the level and distribution of insecticide resistance (AMC 1989, 1990 and 1991). In explaining changes in prevalence rates in 1989, the AMC emphasised a cyclical behaviour pattern and an important role played by natural factors (AMC 1989).

In explaining the escalation of the number of cases at the end of 1990, however, the AMC pointed out drawbacks of its own operations: the falling standards of supervision, particularly after the introduction of decentralization in 1989 (AMC 1990). Thus improper supervision had led to widespread pilferage of insecticide, poor standards of spraying and faulty relationships with the community, all of which contributed to increase transmission. Especially, the pilferage of malathion at a higher rate in certain areas[9] could have resulted in inadequacy in the malathion content of spraying mixer.

Under these circumstances, it is essential to examine what is really happening in the field (or, more specifically, in the community) in implementing the strategies of the AMC in order to assess their cost-effectiveness in a more realistic and

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[8] From 1990 onwards, a proportion of allocations, which was previously made to the AMC, is diverted to Provincial Health Ministries. Thus, their expenditure statements have to be screened to estimate the total expenditure of the AMC.

[9] According to the Administration Report of the AMC for 1989, " There is no doubt that pilferage of malathion is occurring fairly extensively particularly in areas where cultivation of crops is the main activity, the malathion being used as a pesticide by farmers. All attempts directed at controlling this problem have been unsuccessful and will continue to be so unless more co-operation is extended by the public".

useful manner. How does the community react to each control strategy? What is the acceptability of the AMC services within the community? Do the community members have enough accessibility to its services? What other sources of care do they use ? It is not only the entomological studies, but also studies focused on community behaviour that are critically important in evaluating the cost-effectiveness of the strategies and measures of the AMC.

One important issue which emphasises the significance of focusing on community behaviour is the refusals and closed houses encountered by spraying teams. In 1991, only 52.75 % of the 1.1 million targeted houses were fully sprayed and another 21.67 % of houses were partially sprayed (AMC 1991). The AMC appeared to be in a dilemma to answer the question, " Why does the community refuse spraying ?". Does this necessarily mean that the community does not need a malaria control programme, whether the community has its own preventive measures, or must the AMC adapt its strategy ? In this context, the AMC appeared to be facing with some discomfort policy decisions which involved community participation: for instance, whether the community is willing to bear the cost of nets to introduce a mosquito net impregnation programme (AMC 1990).

With respect to treatment, however, the most important issue is the apparent tendency towards use of private practitioners. Although no regular source of data is available on private treatment, some recent studies and surveys showed that about fifty percent of all outpatient visits, including malaria cases, were made to private practitioners (Attanayake & Silva: 1987 and 1992, Central Bank of Sri Lanka: 1984 and 1991). Western private treatment is available throughout the island, including interior rural areas. After the introduction of private practice by government doctors in the early 1980s, a clear decline is observable in outpatient attendance at public MCs[10]. Thus it is likely that a significant percentage of malaria patients obtain treatment from private sources. In this context, an assessment of the effectiveness of the AMC strategies and measures should go beyond what was presented in the reports and records of the MoH and the AMC. For instance, the extent to which the official figures should be adjusted to obtain proper estimates of the incidence of malaria in each district still remains as an unanswered

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[10] While outpatient attendance at public MCs declined from 2162.6 in 1980 to 2115.9 in 1992 per 1000 people, the figures for inpatient attendance moved up from 158.3 to 173.7 (Ministry of Health, 1992).

question. This is simply because both AMC and MoH figures are based only on patients' attendance at public sources of treatment. Moreover, the AMC seemed to be in a difficulty in explaining the reasons for the apparent movement of patients towards private practitioners and just expressed its distress over their treatment practices (AMC 1989):

> "The situation is probably worst in the private sector where it is no exaggeration to say that the treatment prescribed and adopted varies from one medical practitioner to another. It is regretted that such phenomena can only lead to confusion in the minds of the public and the early emergence of drug resistance."

With these problems and issues related to the implementation of AMC policies, there is a good pasture as well as an urgent need from the policy makers' point of view to undertake an economic evaluation of the AMC strategies and measures.In general, the effectiveness of any health care programme is dependent on the decisions taken by health managers; those decisions are closely linked with resource allocation and utilization. In making managerial decisions, not accounting for economic consequences, as in the case of the AMC, would inevitably lead to irrational decisions and result in wastage of resources and, hence, less cost-effectiveness. However, one implication of the above sections is that community decisions play a vital role in determining the cost-effectiveness of AMC activities. It is quite clear, that in order to make any economic evaluation of the AMC more fruitful and meaningful from the policy point of view, special attention should be given to community behaviour with particular respect to acceptance, compliance and access. An economic evaluation on these lines would not only help to formulate some guidelines to be used by policy makers and planners to review control strategies, organizational structure and management procedures of the AMC, but also to make some contributions to enrich the scope of cost-effectiveness analysis.

1.5 Aims of the study

On the basis of the above exploration of anti-malaria activities in Sri Lanka, the study was designed with the purpose of focusing on three aims as follows:

1. to undertake a cost-effectiveness analysis (CEA) of the AMC in Sri Lanka, through means of a case study in a selected district, with respect to its various control strategies, measures and the programme as a whole;
2. to examine socio-economic factors underlying community behaviour in relation to acceptance of and compliance with preventive and curative care for malaria with a view to enrich the economic evaluation methodology of communicable disease control programmes in developing countries;

3. to explore policy implications from the application of cost-effectiveness analysis along with a community behaviour analysis relevant to the malaria control programme in Sri Lanka.

1.6 Progression of the thesis

The second chapter of the thesis has two parts: the first will review literature on economic evaluations of malaria control programmes with special emphasis on CEAs; the second part will look at a wide range of studies which examined community response to malaria in relation to curative and preventive care.

After presenting the specific objectives of the study, chapter 3 will briefly explain the methods used to achieve them. A detailed description of the methods adopted in policy analysis will be presented separately in Appendix 2.

Chapter 4 will be entirely devoted to present the findings of the analysis of provider's cost of anti-malaria activities (AMAs). The cost analysis will be undertaken at activity level and health area level.

The community cost of curative and preventive care will be presented in chapter 5 separately. In that chapter, both direct and indirect cost will be presented for each control measure.

In chapter 6, community response to the disease will be examined in detail. An attempt will be made to understand the knowledge, attitude and practices of the community with respect to control measures as well as to identify the socio-economic factors underlying community behaviour.

As a synthesis of the findings of chapters 4, 5, and 6, chapter 7 will assess the cost-effectiveness of AMAs from a societal point of view. For preventive measures, in particular, the CEA will focus on community effectiveness by incorporating both acceptance and compliance into the analytical framework.

Two well defined policy options will be examined in chapter 8 with a view of finding feasible ways and means to improve economic worthiness of the AMC control programme. The cost as well as projected intermediate outputs/outcomes of the policy options will be presented.

The main findings of the study will be discussed in chapter 9 along with an examination of how far the study was able to achieve its aims and specific objectives and the limitations of the study. This leads to the final chapter which briefly presents the conclusions of the study by highlighting the areas on which further research should be focused.

CHAPTER 2. LITERATURE REVIEW

This review will focus on two aspects of malaria control: cost-effectiveness of malaria control programmes and community behaviour in response to the disease. Literature on these two aspects will be reviewed separately in the two parts of this chapter, respectively. By undertaking this review it is expected to lay down a foundation to identify the methods through which the specific objectives of the study could be achieved. Further, the review will bring out the areas where a gap of knowledge exists with respect to the aims and specific objectives of this study.

PART I: COST-EFFECTIVENESS ANALYSIS OF MALARIA CONTROL PROGRAMMES IN DEVELOPING COUNTRIES

Based on the objectives and forms, Mills (1985) broadly categorized health sector economic evaluations into six types: cost description/analysis, outcome description/analysis[1], cost-minimization analysis, cost-effective analysis (CEA), cost-benefit analysis (CBA) and cost-utility analysis (CUA). Drummond et al (1987) categorized health care evaluations as partial and full evaluations on the basis of the extent to which cost and consequences are examined, and comparisons made. This review will examine both full and partial evaluations simply due to the lack of literature on full evaluations. It will, however, focus on CEAs. CBAs and other evaluations will also be taken into consideration, especially for the purpose of examining how those studies handled questions related to the valuation of cost elements and consequences. However, review will not be strictly confined to economic evaluations. Certain studies, which attempted to look at some economic dimensions of malaria control programmes (to some extent), will also be subjected to the review.

A description of the studies reviewed is presented in Appendix 1 under four headings: focus group/ country/ area and time, main economic aspects examined by the study, control methods examined, and the nature of economic evaluation (with remarks for some studies). The last column explains the nature of the economic component of each study with respect to the Drummond et al (1987) framework. This

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[1] This will address questions such as what economic benefits are associated with improved health.

categorization should, however, be treated with caution because examination of economic aspects of the control programme was not a main objective of many of those studies. For instance, although Mills (1989, 1992 and 1993a), Barlow (1967) and Ramaiah (1980) specifically mentioned that their prime objectives were to undertake a CEA and CBA, respectively, MacCormack et al (1989) and Stephens et al (1991) just looked at economic implications of the intervention concerned as a partial objective of the study.

2.1. Topics, focuses and important findings

Very recently Gomes (1993) made a review of both economic and demographic research on malaria. But, along with a review, it was Mills (1991) who suggested a framework to review studies on cost-effectiveness of malaria control strategies. It involved a two way table with various combinations of strategies and choices: i.e., sector, intervention/technique, delivery strategy, target group, place of intervention and time of intervention.

a.Focusing on the whole programme

Most of the earlier studies were very difficult to fit into Mills' framework directly, particularly since their emphasis was largely on the control programme as a whole. In this way, Griffith (1961) and Pampana (1963) reviewed eight and eleven national and regional control programmes, respectively. The former author looked only at the provider's cost[2] and estimated cost per capita per year particularly for surveillance; one exception was the cost per contact[3] in Thailand. The author, however, estimated the total cost of surveillance and spraying separately for all countries except Greece and Sarawak. Based on some reports, records and studies (e.g., Sinton for India and Quo for Philippines) Pampana (1963) presented a set of economic indicators. The evaluations were, in general, cost-descriptions, cost-outcome descriptions and just outcome descriptions. Unlike Griffith, Pampana payed little emphasis to control strategies except the Indian study (1952), which focused on spraying, and the studies in Southern India (1942) and the Philippines (1957), which looked at treatment. However, the economic aspects examined by Pampana had a wide range: users' cost per episode; increase in land value and net gains from irrigated land due to control; provider's cost; cost of eradication; and social cost per person.

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[2] Provider is the government or the government agency which implements the malaria control programme.

[3] Cost for each contact with each member of the population.

Some recent studies, too, appeared to be similar to the previous studies. One good example was Cohn (1973): an attempt to review the Indian national control programme at unit level under the control and eradication phases separately. Spraying and surveillance were the main strategies. Although most of the costs and benefits of the programme were identified, no comparison was made since benefits were not measured in monetary terms; this made it a cost analysis rather than a CBA.

Hedman et al (1979) made some estimates of total annual cost and per capita cost of the control programme of the mining company in a mining town called Yekeba in Liberia. Although the total costs of spraying, larvicides and chemoprophylaxis were measured separately, they were not compared with health effects.

The confinement of almost all earlier studies to cost-descriptions and cost analyses appeared to have resulted from deficiencies in data sources coupled with the underdevelopment of evaluation methodology at that time. Although data deficiencies still obstruct economic evaluations (Shepard et al 1991), with the development of the cost-effectiveness methodology, a new trend has appeared in evaluation studies; focusing on some selected strategies, interventions, focus groups etc.

b.Selected aspects of control

Gandahusada et al (1984) attempted to estimate the provider's cost per capita per year for full coverage and selective coverage of residual spraying. The insecticide considered for the evaluation was fenitrothion with two different dosages. Study took the form of village scale trials in Central Java. Measuring cost-effectiveness was, however, not the prime objective of this study; it was to examine the effectiveness of fenitrothion. Thus the economic indicators, which were largely cost indicators, could be considered merely as a by product of the main study. This tendency was quite common for many studies chosen for this review. In examining the role of chemotherapy in primary health care, Jeffery (1984) just estimated the increase in the cost of drugs used in presumptive treatment during a short period of time without mentioning any particular location or area. Similarly Bruce-Chwatt (1987) in an analysis of control programmes, which covered a wide range of topics, estimated the cost of chemotherapy per person per year for Africa. This estimation was done by excluding many cost items related to the delivery of drugs and services: this was simply a cost-description. Heymann et al (1990) in an attempt to evaluate antenatal chloroquine chemoprophylaxis in Malawi, estimated the cost per case prevented - a cost-outcome description. Curtis (1994) in an examination of the viability of further use of DDT just compared the relatively lower transport cost

involved in lambda-cyhalothrin (Icon) as a substitute for DDT. He highlighted the findings of the partial cost analysis of Kere and Kere (1992) in Solomon Islands which compared the operational cost of spraying and permethrin-impregnated bednets and found the latter was cheaper.

MacCormack et al (1989) estimated the cost of permethrin treated nets and chemoprophylaxis, along with back up treatment, for The Gambia coupled with a study on expenditure preferences of the villagers in 16 villages. Lin (1991) compared the cost of impregnated bed nets with deltemethin or permethrin and the cost of DDT residual spraying in two provinces in China -a very abstract cost analysis. In another study, Njunwa et al (1991) compared the cost of bed net implementation with spraying in a set up in Tanzania with some emphasis on the time requirement for each technique. Although the study did not value time, its findings implied that bed nets impregnation consumed relatively less time.

Focusing on a specific intervention, Stephens et al (1991) estimated the cost of bead operation on per unit basis in Dar es Salaam, Tanzania. A comparison was made between two alternatives: expansion of beads in a factory and by residents. To elaborate the cost implications of beads, users' cost of four alternative domestic control methods (i.e., mosquito coils, insecticide spray, bed nets and window gauze) was also measured on an item/monthly basis. The cost analysis of Foster (1991) was also on the same lines. But it provided much information on the cost of the drug component of control although no reference was made to a particular method or location. Based on the observations of researchers for a large number of developing countries, it reviewed various treatment patterns including self-medication and their economic implications with respect to the cost of drugs.

The diversification of economic evaluations of control programmes into selected strategies, techniques, interventions etc., had gone far by the end of the last decade. Most of those studies, however, looked at the cost implications of the subject concerned as a sub objective (or merely a supplementary study) of the study of which the prime objective was a non-economic one; hence, cost calculations, too, seemed to be incomplete (this will be examined in detail in section 2.2 a). However, certain researchers attempted to evaluate some selective aspects of control programmes with a broader economic point of view compared to the studies mentioned above.

As one part of a broad study on economic and social consequences of malaria in new colonization projects in Brazil, Sawyer (1993) calculated average direct

and indirect costs per family on a set of assumptions on average cases per family per year, family income and employment pattern of a family. The author seemed to have used a still untabulated data set of a study in making such assumptions. Jayawardana (1993) also made such an attempt in a study among new settlers of the Mahaweli irrigation project in Sri Lanka. The author calculated the direct cost of treatment per episode. A rough estimate of indirect cost of illness was also measured for illustrative purposes. She highlighted a set of indirect economic burdens of malaria patients without quantifying them; e.g., indebtedness to illness.

Focusing of the attention of researchers on indirect cost was highly visible during the past few years. Bonilla and Rodriguez (1993) examined household time lost due to malaria for different age groups and genders in La Tola community in Colombia. Although they identified time lost in productive, domestic and study activities, no attempt was made to value them. They found that the illness of an adult male placed the whole household at risk which they called the disease burden. But, indirect economic burden of the disease was greater for women due to the effect of the illness on domestic work, caring of sick person and need to attend foregone farm work. Nur (1993) moving beyond Bonilla and Rodriguez, looked at the manner in which economic losses were minimized through family labour substitution in Gezira area in Sudan. They went beyond the family boundaries and looked at social obligations, and a traditional mutual aid system called *nafeer* as well. Although Jayawardana (1993) just treated indebtedness as a loss from illness, Nur indicated that it could be measured for his study population as a reciprocal exchange of community help. Although the author did not value the indirect cost of illness, he provided some valuable guidelines to measure them.

Moving on a similar line, Mills (1993b), too, examined household costs of malaria in Nepal and avoided the complex exercise of valuing time due to the need for more information about length of the period of disability and its variation between individuals. Picard and Mills (1992) used the data of time lost due to malaria in two Nepali districts to undertake a pairwise differences analysis. The study focused on identifying factors underlying the effect of malaria on work time rather than valuing the loss of time.

Referring to the bio-environmental project in Kheda district in India, Sharma et al (1990) compared the economic loss to malaria patients in the area with a control area of four villages. Economic loss was defined as the sum of the value of man days lost and the expenditure incurred in treatment. Bio-environmental measures had been

implemented in the experimental villages within a framework of an integrated vector control (IDVC) programme. Although the mean daily income of patients was almost the same in two areas, the number of man days lost was significantly higher in the control area; thus its patients had to incur a higher economic loss. The high dependency of the patients in the control area on private doctors also aggravated their economic losses. The authors surmised that these differences could be due to the impact of the health education component of the IDVC, and the prompt and better services available in experimental villages.

Now the discussion moves away from the studies which looked largely at indirect cost to the studies which focused on some other aspects of control programmes. Using actual expenditure figures of one sub district in India, where a bio-environmental control programme was implemented, Sharma and Sharma (1986) estimated the cost of implementing the project for the whole district and compared it with the cost of three alternatives: spraying DDT, HCH and Malathion. Cost estimates of spraying were based on official records. Capital cost was, however, not included into the cost calculations. They concluded that the total cost of bio-environmental control was smaller than all other alternatives and, among other things, it would generate extra income sources to the district from the plantation of fruit bearing trees, and introducing fish and prawn culture. Prevention of pollution, generation of employment etc. were also pointed as other benefits.

Another such study was undertaken in Nepal on the operational cost of residual spraying (Phillips and Mills 1991). It examined in detail the extent to which operational cost varied for DDT, Malathion and Ficam and made a comparison with respect to cost per structure. In making comparisons, average cost figures were disaggregated into operational components: external costs, internal operational costs such as transport, manpower, weighing, materials, nozzles, safety measures etc. The authors found that although the transport cost of Ficam was higher than for the other two insecticides, both DDT and Ficam had substantially lower operational costs than Malathion.

Helitzer-Allen et al (1993) looked at the chemoprophylaxis compliance among pregnant women in Malawi and called it a CEA. They compared the total cost and observed compliance levels of three different interventions with the current antenatal programme; the interventions involved three combinations of providing coated/ uncoated chloroquine phosphate and an improved/original health education system. Only the

"incremental cost" was considered for the cost estimations; i.e., additional cost incurred in undertaking each trial. In this partial cost analysis, however, the authors concluded, without looking at intermediate outputs of the interventions, that CEA was an important addition to the decision maker's analytical tool kit. The previously mentioned Kere and Kere (1992), however, directly concluded that for practical purposes, cost analysis was often adequate evidence for decision makers.

A study undertaken in Saiyok District in Western Thailand (Fungladda and Sornmani 1986) estimated the cost borne by patients to receive treatment from malaria clinics. Components of the average cost per patient were estimated, which included cost before visiting the clinic, and transport cost of patients and relatives. The only comparison made was the cost borne by the patients who did not suffer from malaria during the past twelve months with the patients infected during the same period. The study, however, put much emphasis on the behaviour pattern of patients with respect to seeking treatment.

In an study among migrant workers in eastern Thailand, Kamolratanakul et al (1993) attempted to examine both cost-effectiveness and cost benefit of permethrin impregnated bed nets in a randomized, double-blind field trial. The authors adopted the view point of the Malaria Division of the MoH as it was the final decision maker and administrator of control activities. This seemed to be close to the view of Kaewsonthi (1988) which will be reviewed later. However, cost of absence of work due to illness was included in the cost estimates. The authors avoided measuring any cost-effectiveness indicators because the total and average costs of the group with impregnated programme were less than others, and a decreased attack rate was observed for them. Instead they undertook a controversial CBA; i.e., net saving of using a treated net for the Malaria Division and a migrant worker. While the former was merely the difference of the provider's cost per worker between treated and untreated groups, the latter referred to the difference of the user's cost per worker.

One of the most complete studies on a particular technique of malaria control was done in the Gambia (Picard et al 1993) on impregnated bed nets which could be considered as a CEA. It involved a comparison of cost-effectiveness ratios between impregnated bed nets, chemoprophylaxis and the combination of them. The study focused on children below five years. Cost per case/ death averted, cost per discounted healthy life year gained and cost per child year protected were used for the comparisons. Some comparisons were made with different health interventions in other countries which

led the authors to conclude that bed nets impregnation was an efficient means to improve the health of rural Gambian children.

c.Recent trends

Irrespective of the tendency of economic evaluations reviewed in the previous paragraphs to look into one or a few aspects of control programmes, there were a bunch of studies which focused on the programme as a whole; as in the early stage of economic evaluations but in a more versatile manner. Among them one noteworthy study was the well known CBA of Barlow (1967) on economic effects of the eradication of malaria in Sri Lanka. Some attempts on the same lines, with notable variations in methodology, were Mills (1993c), Castro and Mokate (1988), Brown (1986) and Ramaiah (1980). But, the second and third studies could not be considered as good candidates of CBA. While Castro and Mokate looked at costs and benefits at the household level, Brown did not express both costs and benefits in monetary terms; just a description of them in relation to eradication of malaria in Sri Lanka and Sardinia. Ramaiah (1980) estimated cost-benefit ratios for the Indian National Malaria Eradication Programme (NMEP) for 24 years (1953/54-1976/77) in a with and without NMEP framework. He looked at it from a societal point of view by considering cost of private treatment as well. The author largely relied on NMEP records as well as other studies and reports in estimating social costs/benefits figures. Mills (1993c) made an attempt to quantify both costs and benefits of malaria control in the Terai of Nepal to the greatest possible extent and tried to relate them with economic development. However, particularly due to the inability to value certain items such as loss of marginal product of land in certain areas, ecological damage, and gains and losses of indigenous population in settlement areas, measurement of a cost-benefit ratio was ruled out. Nevertheless, without making much quantification, the author showed the extent to which malaria control affected economic development in Nepal.

Among the researchers who attempted, in recent years, to evaluate the control programme as a single entity without decomposing both cost and consequences by control strategies, techniques etc., one example was Vosti (1990). Without making reference to control strategies, the author estimated the cost borne by patients on medical treatment and their income lost due to abstaining from work as part of a study focused on determinants of individual costs among gold miners in Southern Para, Brazil.

Sauerborn et al (1991) estimated the provider's cost, and direct and indirect cost of users in a rural district called Solenzo in Burkino Faso for case detection and

treatment. The analysis was largely based on a household survey (Sauerborn et al 1989) which revealed that about 80 percent of malaria episodes were treated at home or by a traditional healer. The study, which could be regarded as a cost-decomposition did not attempt to decompose the total cost per case into the types of treatment; it showed only the percentage of total cost borne by community and health system per case irrespective of the type of treatment. But, it estimated output loss per case, per worker and per capita as well. Further adjustments were made to incorporate seasonality in agricultural production in estimating output loss.

The study of Ettling and Shepard (1991) in Rwanda was also a cost-description. Depending on the most readily available cost data and known number of cases, it estimated both direct and indirect cost per capita and per case treated. However, the authors based on a set of assumptions on patients' behaviour, health care services, production etc. in making these estimates; the assumptions were based on the findings of some previously conducted studies, and discussions held with MoH officials. Based on the estimates of the study along with further assumptions on the behaviour of the economy and population, they made projections for 1995 on both direct and indirect cost per case and per capita expenditure, and on the impact of the disease.

Moving on the same lines Shepard et al (1991) made estimates of direct and indirect cost per capita for Mayo-Kedhi District in Chad and Brazzaville in Congo. According to the authors themselves, the "simpler model" used to make those estimates was a limited one in which several factors were held constant. Some extreme assumptions were made to obtain required estimates: e.g., case fatality rate for the district in Chad was based on Gambian rates; adult deaths were just assumed to rise to 10 % of all deaths; seasonality and age adjustments were made on the basis of a document on Burkino Faso. The authors made projections (for 1995) not only for Chad and Congo but also for the whole of Sub-Saharan Africa.

As mentioned earlier, the three studies presented above were no more than cost-descriptions in essence though they could not be rated as the same as the earlier cost-description studies. These studies appeared to be severely handicapped by lack of proper health and financial information sources which is a common problem in many developing countries especially at district level (Waddington et al 1989). This made authors rely on extreme assumptions which were also eventually based on available limited information. However, these studies could be regarded as some initial attempts to fill the gap of knowledge of malaria (Mills 1991), particularly in the Sub-Saharan environment.

Developing methods to overcome these data obstacles and in some instances, using the available data sources in a more efficient manner, a few studies recently have gone deeper in undertaking economic evaluations of control programmes showing the way ahead for further research. This includes the studies of Ettling et al (1991), Kaewsonthi and Harding (1984), Kaewsonthi (1988) and Mills (1989, 1992 and 1993a). The prime features of these studies are examined below.

Ettling et al (1991) examined costs of three types of malaria clinics in a district in Thailand: a mobile, a peripheral and a central clinic. They attempted to compute institutional cost, community cost and social cost of each clinic and three combinations of them. Social cost of each clinic combination was determined on a set of assumptions about patients' behaviour; these assumptions were based on the findings of two other studies (Ettling et al 1989a and 1989b). They concluded that the combination of village-based clinics and a fixed-scheduled mobile clinic could reduce the overall social cost of malaria. This study confined its analysis to intermediate outcomes of surveillance, case detection and treatment making it a partial CEA and largely a cost analysis; thus it was somewhat difficult to directly fit it into the Drummond et al (1987) framework.

Kaewsonthi and Harding (1984) attempted to determine how cost and performance of anti-parasite activities of malaria surveillance and monitoring processes in Thailand could be measured and the results could be used by managers in decision-making. They selected two zones, A and B, for the study. Because of 1) existence of complementarity, and non-existence of the same targets and the same level of effectiveness among operational services, and 2) differences in environmental conditions in study areas, they ruled out the undertaking of a CEA in a retrospective manner. Instead they used a set of performance criteria for the analysis: e.g., percentage of the achievement of each target, time (days) taken to complete an activity, relative contribution by each activity to achieve some targets and unit cost per activity. One of their main conclusions was that Zone A was less efficient than Zone B simply due to the poorer performance in terms of spraying, collecting blood slides, providing radical treatment etc. In a follow up study, Kaewsonthi and Harding (1986) examined patients' behaviour in terms of cost borne by them in seeking treatment including self treatment and cost of the time of illness. These findings were related to the first phase of their study. With the completion of the study, provider's cost, users' cost as well as man days of malaria prevented by spraying, case detection and treatment were measured (Kaewsonthi 1988). She measured both types of costs related to case detection and

treatment at various delivery points called activity levels. The author, because of the lack of reliability of API as a measure of prevalence, developed a pool of infection model and a case prevented model to measure health effects of control measures. Although the number of man days prevented were measured by that model, the author explained the limited applicability of such models with the lack of epidemiological data on identified and unidentified cases together with recrudescent and relapsed cases. Apart from this attempt, the author placed her emphasis more on intermediate outputs and arbitrarily decided performance indicators such as percentage of houses visited from the number of houses that should have been visited. For the author, however, the analysis was not a CEA but a cost and performance analysis.

In general, both of the studies mentioned above were cost analyses although they were cost and performance analyses for the authors. They compared the cost of the provision of services at various delivery points. But the authors did not intend to go beyond certain limits in measuring both cost and consequences by purposely confining the analysis to the periphery of the control programme. Their prime attempt was to look at the performance of the control programme from the point of view of the managers; thus all attempts were made to estimate the cost borne by a) the programme to provide services and b) the users to utilize those services. The methodological aspects of these studies will be examined later.

Among the studies examined in this review the analyses of Mills (1989, 1992 and 1993a) on the control programme in Nepal could be considered as the most complete CEAs. They could easily be regarded as complete evaluations according to the Drummond et al framework. All available control measures were considered by the studies: various delivery points in case detection and treatment, and both DDT and malathion in residual spraying were considered for the first two studies. The third one looked at the malaria control programme as a whole compared to other interventions. Unlike Kaewsonthi (1988), in the first two studies, the author measured cost of intermediate outputs of various strategies at various levels such as delivery points, districts, regions and headquarters. In measuring intermediate outputs, she used a set of indicators like cost per capita, cost per case/unit (i.e. for spraying), and cost borne by patients and their families per case (1989 and 1993a). Cost effectiveness indicators included cost per case/death prevented, discounted days of healthy life gained, government/ total net savings of costs, and net savings per case/ death prevented (1989 and 1993a). The author came to a set of conclusions on various control strategies and

measures as well as means of each control measure using intermediate outcomes as well as health effects.

The review of the topics and focuses along with important findings of the economic evaluations directly leads to some conclusions. A clear tendency appeared in the literature to confine the evaluations much more to intermediate outputs/outcomes rather than health effects except in a few studies. Secondly, although some attempts were made in a seemingly sporadic manner to evaluate control programmes from community/societal point of view, provider's cost was still tending to dominate the focus of evaluation studies. This reiterates the need to focus on the users as well in evaluating control programmes with the view of testing the social validity of the findings derived on the basis of provider's perspectives. Thirdly, instead of evaluating the control programmes as a whole, along with an assessment of the contribution made by its sub components to achieve its objectives, evaluations were tending to focus much on micro level analyses by confining themselves to some selected control strategies, methods, techniques, target groups etc. However, the subject areas covered by the studies reviewed clearly indicated that the methodology of CEA has so developed that with an additional effort it could be easily applied to different circumstances in developing countries in a more productive manner by adapting a holistic approach.

2.2 Methodological issues

This section will examine the methods used by the studies reviewed in the preceding section to measure both costs and consequences, and to compare them to reach conclusions on economic viability of programmes, interventions, strategies etc. concerned. However, references will be made to certain other materials as well, whenever necessary, to elucidate some important issues. The purpose would be to identify most appropriate methodologies, and important areas in which conventional methodologies should be further developed to strengthen the application of CEA.

a.Costs

Costing approaches

Costs have been measured from different angles. Most of the earlier studies such as Griffith (1961), Hedman (1979) and some studies reviewed by Pampana (1963) measured only the provider's cost. This approach could, however, be observed in many recent studies as well. Bruce-Chwatt (1984), Gandahusada et al (1984), Heymann et al (1989), Phillips and Mills (1991), Kere and Kere (1992), Helitzer-Allen et al (1993) and, indeed, Walsh and Warren (1980) made their cost estimates entirely from the provider's

point of view.

The other extreme approach was the users' point of view. Not many studies have been entirely based on this approach. Some exceptions were Fungladda & Sornmani (1986), Ettling et al (1989a), Sharma et al (1990), Vosti (1990), Jayawardana (1993) and Mills (1993b). One deviation from this approach was Castro and Mokate (1988) which measured cost from the point of view of the household - a broader view.

The recent trend of the costing approach was, however, to look at the cost implications of control programmes from both provider's and users' points of view. By the initiation of Mills (1989) and Kaewsonthi (1988) this approach was followed by Ettling et al (1991), Shepard (1991) and some other authors (Kamolratanakul et al 1993 and Picard et al 1993).

It is necessary to mention, at this point, that the extending of the costing boundary beyond providers and users would tend to produce a CBA which would incorporate intangible costs as well; this was attempted in some studies reviewed here (Mills 1993c).

Measurement levels

Costs were measured at various levels ranging from national level through activity level to individual level. However, national level was the most popular one in earlier studies. Griffith (1961) did it for several countries and disaggregated the national figures into per capita level. This could be observed in recent studies as well. Both Ettling et al (1991) and Shepard et al (1991) made such estimates; they expressed the national level cost as a percentage of GDP as well. However, a significant difference in those studies was the inclusion of a wide variety of cost elements including users' cost.

Presentation of cost figures was done by some authors at regional or district levels. This was the most popular level of the studies considered for this review. Except the few studies which adopted a cost benefit approach such as Barlow (1967), Cohn (1973), Ramaiah (1980) and Mills (1993c), or looked at a particular aspect of a control programme such as operational cost of spraying (Phillips and Mills 1991) most of the other studies focused on a particular region. It appeared that, being micro level evaluations, most of the studies which were confined to a particular area were able to present their findings in more detail than others. Some studies which looked at national level had to rely on extreme assumptions just for the purpose of generalization. Ettling and Shepard (1991) had to make such unrealistic assumptions: e.g., only adults were considered as economically active; all adults were economically active 365 days per year.

Once again it is necessary to mention that the lack of proper health and financial information systems in developing countries led these authors to make such assumptions when dealing at the national level. The studies focused at regional level and based on first hand observations, in addition to the provision of information on both providers and users, were in a position to make policy guidelines in a very live manner.

Few studies made cost calculations at activity levels or delivery points. The studies that looked at a particular intervention such as impregnated bed nets (Njunwa et al 1991 and MacCormack et al 1989), alternative domestic preventive measures including bed nets, mosquito coils, insecticide spray, window gauze and beads (Stephens et al 1991) and antenatal chloroquine chemoprophylaxis among pregnant women (Heymann et al 1990) measured cost at activity level. Cost measurements at the point of delivery could be observed only in four studies: Ettling et al (1991), Mills (1989 and 1992), Kaewsonthi and Harding (1984) and Kaewsonthi (1988). Mills presented her cost measurements broadly at four levels: headquarters, region, district and point of delivery. Further she disaggregated them into individual levels as per capita/item/case etc. The two studies of Kaewsonthi, too, measured per item/case indicators.

Elements of cost

The preceding two sections indicated that the cost elements measured by an evaluator would depend on the adopted costing approach and the level of provision of services concerned for the study. Thus the mostly used method was to estimate cost elements of the delivery of services by the provider. These elements normally consisted of the financial values of administration, supervision, supplies (including chemicals, drugs, insecticides etc.), salaries, transportation etc., depending on the intervention, strategy or technique evaluated by the researcher. Most of those studies could not, however, be considered complete with respect to the inclusion of all relevant cost elements in measuring provider's delivery cost. For instance Heymann et al (1990) and Foster (1991) included only the cost of drugs and Hedman et al (1979) did not include the portion of salaries of supervisory level employees because the cost calculation was confined to "the obvious and easily calculated" expenditures. Bruce-Chwatt (1987), too, included only the cost of drugs. May be due to the adopted definition of "internal cost" Kaewsonthi (1988) did not include the cost of volunteers, who assisted the provider to deliver services, in her cost analysis. Although Phillips and Mills (1991) mentioned the dumping sites which were vulnerable to wastage of insecticides, no provision was made for wastage in their study. In general, most of the studies attempted either to take

monetary values of the items involved in the provision of services directly from service budgets/expenditure statements and other financial records/reports, or to include the cost elements for which figures were readily available in the routine information sources. The methods adopted in valuing input elements will be examined in the next section.

The next element involved in the cost analyses was the cost borne by users. Authors of recent studies interpreted this concept in different ways and made their estimates accordingly. Fungladda and Sornmani (1986) in estimating the cost of treatment for patients visiting clinics looked at the cost borne by patients for treatment before visiting the clinic including self treatment, and the cost of travelling for patients and their relatives to visit the clinic where treatment was provided free of charge. MacCormack et al's (1989) cost measurement of impregnated bed net users also seemed to be partial; according to the authors, at least the cost of the local type of mattresses, which were required to tuck the net, was not considered for the cost analysis. Ettling et al (1989) measured only the cost of travelling to attend the clinic, cost of treatment before attending the clinic (including private treatment) and cost of treatment of non attenders. Stephens et al (1991) measured the cost of several types of alternative domestic mosquito control methods which would have been borne by the users. Both Kere and Kere (1992) and Kamolratanakul et al (1993) seemed to have assumed that the users did not incur any cost to accept and use impregnated bed nets.

Most of the above mentioned studies appeared to have included only directly measurable cost elements into the category of users' cost. However, Pampana (1963) reported that the study of Russell and Menon (1942 Ref. Author) measured not only the treatment cost of various sources of treatment (including quacks), but also the loss of income due to illness. In evaluating economic loss due to illness, Sharma et al (1990) also included similar items into their users' cost component. Taking one episode as the denominator they included treatment cost of various sources, travel, special food, quacks etc., and loss of income due to illness. Moving on the same line Vosti (1991) included both the medical expenses and loss of income due to illness into his economic evaluation. Both Sauerborn et al (1991) and Ettling and Shepard (1991) included three cost elements borne by the users into their analyses: cost of treatment; time lost due to illness; and death occurred due to illness. These studies clearly showed that the cost borne by patients varied within a long range from cost of drugs to loss of life at the individual or household level.

The most important question that came up in this context was which cost

elements should be included under the cost borne by patients; i.e., what was the demarcating line in measuring users' cost. This erupted into a controversy among authors. It was implied from Kaewsonthi's (1988) analysis that the demarcating line could be drawn by considering all "external" costs related to the utilization of services. Although she, herself, claimed that her study was not a CEA but a cost and performance study, it should not have hindered the examination of her views about users' cost. She marked her demarcating line of external cost by including only five elements into patients' cost: a) travel time, and travel cost and waiting time, b) food in travel, c) cost of the accompanying person, d) treatment prior to the visit and e) sick leave before the visit. One question in this context was that if external cost was the cost borne by patients to receive services the d) and e) cost items should not necessarily get a place in the cost analysis. One may argue that patients had to bear these costs just because other sources of treatment were not as effective as the control programme. In that sense, such cost items could easily be neglected as economic loss imposed on patients by sources other than the Malaria Division. Thus the only way to include such cost elements into the analysis would be to make the episode as the point of reference in measuring cost. But, it naturally widens the horizon of analysis far away from the provider and, of course, the demarcating line imposed by the concept of "external cost"; in this sense even if the cost analysis was confined to the utilization of services, certain cost items such as the prescribed nutritional and supplementary food consumed by the patient should also be included into the external cost analysis of Kaewsonthi; but, such cost items were not visible in her analysis. Ramaiah (1980) clearly pointed out the need of including cost of special food into the cost analysis of malaria.

In the cost analysis of Kaewsonthi (1988), the time cost of patients was also valued up to the point of receiving radical treatment and not up to the point of complete recovery or resuming normal work. Kaewsonthi was forced to do so because her study was based on a patients' survey and not on a household survey due to her seemingly narrow definition of cost. Therefore no data were available on patients after receiving radical treatment. Mills (1989) made an attempt to cover this gap by undertaking a household survey. In general, Kaewsonthi attempted to focus only on the cost borne by patients to receive services and not on the cost borne by them due to an episode of malaria. By attempting to evaluate the programme from the point of view of the provider, as she clearly stated, Kaewsonthi appeared to have mixed up various cost elements borne by patients due to illness. However, a recent study in Thailand handled

this problem by employing a cost-finding team to collect information on the total number of days lost due to illness (Kamolratanakul et al 1993).

Ettling et al (1991), too appeared to have made the same mistake in measuring cost borne by users. They apparently based their analysis on a patients' survey omitting what happened to the time consumption of patients after the receiving of treatment from a government clinic. The study was primarily based on the findings of a sample survey of patients who attended government clinics. In measuring the users' cost and then, social cost, these findings were mixed up with the findings of another two separate surveys, which were carried out among all patients having malaria like symptoms in one village. In that exercise, they further made a set of assumptions about the community behaviour in relation to the attendance at three types of clinics. However, one question that arose was the validity of making such generalizations, as assumptions, on the whole patient population by using the findings of a survey in one village which appeared not to be a valid representation of the study population. Moreover, the study did not explicitly show the components of patients' cost. Based on the way Kaewsonthi (1988) and Ettling et al (1991) included the time cost of patients, one may surmise that they had made an implicit assumption that the diagnosis procedures at the clinics were perfect with no misidentification of cases and there was no drug resistance among users.

The preceding discussion suggests that an analyst should not attempt to make an arbitrary demarcating line in deciding the elements of users' cost. From economics point of view, all cost elements of this nature, as much as possible, should be identified and included into the analysis. However, this does not necessarily mean that the questionnaires administered on patients should be open ended ones, but there should be at least one open ended question on all other relevant cost elements, if any, to be identified and expressed by respondents. Undertaking of in-depth interviews among users will also assist the researcher to identify such cost elements. Certain cost elements which have not yet been captured by economic evaluations should be attempted to identify and measure by this way or a better method. Some examples are side effects of drugs, impregnated bed nets (Njunwa et al 1991) and prophylaxis on pregnant women (Parker 1988), and indebtedness due to illness (Jayawardana 1993[4] and Nur 1993). Measurement of

[4] The author made an interesting point that some families in the new settlement area, where the study was undertaken, were penalized by the authorities by depriving them of food-rations. The simple reason was their inability to complete houses, latrines and homestead gardens in time due to illness.

these cost elements would certainly go beyond the cost borne by patients to just receive the services of control programmes.

In this context, Mills (1989 and 1993b) made an attempt to widen the scope of users' cost. Picard et al (1993) included the direct cost of death (i.e.,funeral expenses and time cost of mourners) into the cost analysis in evaluating impregnated bed nets implementation. An earlier attempt of this nature (i.e., measuring value of life of the dead person due to the illness), was reported for the Philippines by Pampana (1963).

The main implication of the above discussion is that the most reasonable ways to identify the cost elements is to confine the analysis into the cost borne by providers and users, with some consideration drawn to the cost incurred by the "near" family/ community members such as relatives and volunteers. But the issue raised at the beginning of this section still remains as a controversy - what is the demarcating line of users' cost ? Hammer's (1993) comment on the true cost of the disease may provide a good summing up note for this section:

> "The true cost of the disease exceed the costs of seeking treatment for two reasons. First, there is a pain and suffering before treatment is sought. Second, there are people who have decided that the costs of seeking treatment are too high relative to letting the disease run its course."

Valuation of costs

After the identification of cost elements, authors used different methods to value them which were largely dependent on the focus of the study and the type of cost elements included in the analysis.

Most of the studies which looked at the national programmes as a whole or at a particular intervention took costing figures directly from the implementing agencies. Some examples were Griffith (1961) and Cohn (1973). However, both the authors made attempts to decompose total figures into two control methods: spraying and surveillance. It appeared that, although it was not explicitly mentioned, they first identified the cost elements of national budgets which related to each method and then made separate calculations for each of them. This raised the question of validity of cost measurement especially due to the existence of certain cost elements such as administration, supervision etc., which did not relate to one control method alone. Yet with the limited availability of information on cost at the time these studies were undertaken, the methodology of those authors should be questioned with some reservation. Dependence on the actual expenditure figures was very clearly observed in

Gandahusada et al (1984) and Hedman et al (1979). Since it was a single intervention, the former authors took the whole budget of the project to estimate cost figures which represented the provider's cost. The latter authors, too, followed the same method but faced a problem as how to apportion the contribution of certain health personnel who had multi functions; thus they avoided such cost figures making both total and per capita figures underestimated.

The studies of Sauerborn et al (1991), Ettling and Shepard (1991) and Shepard et al (1991), too, took the cost of the provider directly from the financial statements of providers. No attempt was needed for them to make them decomposed or apportioned into control methods or activities because the providers were involved in a single function: case detection (implicitly passive) and treatment.

The studies which looked at some control measures or some elements of control measures at macro level such as drugs (Foster 1991), chemotherapy (Bruce-Chwatt 1987 and Jeffery 1984) based their estimates on the available international or local market figures and made some general cost statements.

It was difficult to generalize the costing methodologies adopted in the studies mentioned above but it seemed that direct measurement was used in certain studies (e.g. Gandahusada et al 1984). This method involved the valuation of identified cost items by quantity or volume and multiplying them by relevant prices. MacCormack et al (1989) and Heymann et al (1990) followed this method by using market prices of respective cost items. Kere and Kere (1992) and Helitzer-Allen et al (1993) too used a similar method for spraying and impregnation, and chemoprophylaxis, respectively.

Stephens et al (1991) adopted the same method to value the implementation of beads. But their estimates of monthly expenditure on domestic mosquito control methods appeared to have a different dimension. They measured those figures on the basis of what they heard from the respondents through focus group discussions; respondents stated that if they had money they would buy, for instance, one spray can in every five days. The estimates based on such responses did not seem to represent either the willingness to pay or the actual spending of users, but the felt need which was not realized partly or fully due to limited family budgets. Thus what the authors did was to express the felt need of target groups in monetary terms using market prices. Contrary to the authors, some further assumptions are needed to treat such an expenditure pattern as a choice reflection of respondents because choices should be based not only on knowledge but also on affordability as well. A similar question arose with the expenditure

preferences of MacCormack et al (1989) because an implied assumption of their table of users' and non users' expenditure preferences was that both groups had an adequate knowledge of the benefits of impregnated bed nets.

The above discussion indicates that attempts to adopt the method of direct cost measurement may lead to some extremes especially when the study has a broader approach (not necessarily economic) to the problem concerned. In such a study, when an attempt is made to make direct cost estimates, questions of incompleteness and less validity of cost figures may occur. Sharma and Sharma (1986) was another good example to demonstrate this tendency which could be extensively observed in the literature. By envisaging that the monitoring of activities at district level would be carried out by a sampling procedure, they assumed that the monitoring cost would remain almost the same both at the sub-district and district levels; they increased the actual monitoring cost of a sub-district with a .35 million population by just 4 percent to get an estimate for the whole district with a 2.7 million population. They did not include the capital cost as well into the cost estimates although it accounted for about 65 percent of the recurrent cost. Another missing item was the cost of 2 million fast growing/fruit bearing trees which were supposed to be planted during the project period. Although the authors were arguing for the high cost effectiveness of bio-environmental control, in their cost analysis they looked only at the provider's cost; even those estimates were not complete.

Phillips and Mills (1991) used the direct measurement method to estimate the operational cost of spraying in Nepal. Based on official records including transport, manpower etc., they first decided the input requirements of each type of residual spraying and then estimated total cost figures by taking into account the actual performance of each activity and prices of inputs. Measurement of operational cost was largely straight forward; but certain inputs such as management, planning and evaluation, and spray tanks were not valued on the assumption that while the former two elements were not different in making choices of insecticides, the latter likely had a similar useful life irrespective of the type of insecticide used.

In recent studies, authors used two costing methods, particularly, to measure the provider's cost: direct measurement for direct costs and cost apportionment for overheads and other joint costs. Kaewsonthi and Harding (1984) and Kaewsonthi (1988) used a set of criteria to apportion the cost from divisional to regional and zone levels, and finally to activities based on staff allocation, salaries, population covered, area covered, time allocation etc. It was, indeed, a very complicated method. Kaewsonthi

(1988) repeatedly attempted to check the consistency of two types of estimates and refine the criteria for apportionment until cost figures obtained from both methods showed no difference at the 95% significance level. Ettling et al (1991) used cost-apportionment as well as direct measurement to estimate institutional cost. For instance, cost of supplies was calculated by multiplying the cost per smear by the number of attenders at each clinic and market prices were used to value drugs which were supplied to the programme free of charge. The wage bill was taken from the zone accounts and allocated to clinics on the basis of log books - a seemingly substitute method for a time allocation study. Both studies managed to capture almost all elements of provider's cost into the analysis. Kamolratanakul et al (1993), too, used a combination of both methods, but not many details of the costing method were presented in that paper.

Although Picard et al (1993) also used both methods, the cost-apportionment methods used in this study were somewhat different from the studies mentioned above. What the authors attempted, for instance, was to identify the proportion of time spent by some employees (of the implementing agency) from their normal duties on the activities concerned, and to value it by using their gross wages and employer's national insurance contribution. A similar method was adopted for PHC workers and helpers as well. Official records of the implementing agency were used to value the cost of insecticides.

A combination of both methods was used in a balanced manner by Mills (1989 and 1992). Although the problem encountered by Kaewsonthi (1988) was the unavailability of a recording/ accounting system for expenditure figures at activity level, Mills' problem was much more complicated; it was the non-availability of certain cost figures. This problem was serious in certain districts where the control programme had been integrated. Thus the author had to make direct measurements of many cost items including drugs and insecticides, equipment, vehicles etc. Cost-apportionment was undertaken particularly to measure the cost at district levels. A Malaria index which reflected both the size of the district population and the number of cases was used for this purpose. Apportionment of costs at activity level (or means of the provision of services) was assisted by a time allocation study which was largely based on the interviews and observations made during field visits. The author made all possible attempts to measure cost elements in a consistent manner with a seemingly handicapped data base.

The preceding discussion focused much on the cost borne by the provider. The other important element of the cost analysis related to users. However, very few

authors, as indicated above, attempted to measure those cost elements especially in the earlier literature. One exception was Russell and Menon (Ref. Pampana 1963) who undertook a micro level study, presumably a household survey, to measure out-of-pocket expenditure of users. Certain recent authors, too, attempted to measure users' cost directly. One example was Shepard et al (1991); an attempt to use findings of another study to make direct cost estimates assuming that they reflected the study area as well.

In this endeavour, however, the dominant trend apparent in the literature was the undertaking of household surveys, depending on the scope of study. Castro and Mokate (1988) did such an attempt to measure cost at household level. Ettling et al (1991), Kaewsonthi (1988) , Mills (1989 and 1992) and Picard et al (1993) could be considered as other good examples of undertaking surveys of either patients, households, carers or a combination of them to measure users' cost. Fungladda and Sornmani (1986) and Sharma et al (1990) also made such attempts but compared to the above mentioned studies they seemed to be limited cost analyses, especially, in the latter study; they appeared to have made some unacceptable calculations at least on mean daily income and, hence, the value of the man days lost due to illness. Specifically, if the aggregations of the daily income figures presented in their Table 4 were measured, for instance, by just multiplying the lower class limits of each income group by the number of earners in the respective class interval, the average daily income so obtained for the experimental area would exceed the number presented in their Table 4; this figure was used to calculate economic loss. No explanation could be traced out in the paper for this seeming contradiction. In this context, Kamolratanakul et al 's (1993) cost-finding team interviewed confirmed patient workers and their key employees, and reviewed hospital/ clinic records to estimate the duration of illness; but not many details were given in the paper to make any assessment of the reliability of this method.

Out-of-pocket expenditure could be a direct estimate of the findings of a household survey but the indirect cost items such as value of the time lost due to illness, value of the time spent by carers or people (normally family members or relatives) who accompanied the patient to the treatment centre and, indeed, the value of loss of life due to illness cannot be directly estimated from a household survey (or other surveys). Although Mills (1989 and 1992) and the other authors (mentioned above) measured the number of days lost due to illness either from the patients' or household surveys, all of them made some attempts to identify the opportunity cost of time by using other information as well. This issue will be discussed in the following section.

Adjustments of costs

Value of the time lost due to morbidity, loss incurred due to debility and loss of life due to illness appeared to be a controversial issue in the literature reviewed. Most of the authors, however, did not attempt to look at this aspect at all. Some of them made a very simple adjustment to make cost calculations.

Kaewsonthi (1988) made two assumptions to make her time valuation: loss of time due to illness was equal to the minimum wage of the study area; and, there was no labour substitution. But the author herself mentioned the over optimistic nature of the results obtained through her computations by drawing attention to the results of some recalculations made on the basis of a household survey just for illustrative purpose. The author, however, seemingly justified her using the minimum wage rate by arguing that the cost borne by the patients did not appear to be a constraint when a positive case was seeking care at a malaria clinic. Nevertheless, this question still appeared to be an unanswered one because the author did not make any attempt to examine the determinants of patients' behaviour as it was not an objective of the study.

Another simple procedure was adopted by Shepard et al (1991) by just multiplying the calculated output per day by 100% and 30% of the duration of illness of adult cases and child cases, respectively. This again implied the non existence of labour substitution. Ettling and Shepard (1991), however, used a different method by taking the average wage rate and multiplying it by a percentage (i.e., 85%): what they called a ratio of shadow to market wage rate. They made same assumptions about the time of illness: adults lost three days of work at home and for child caring it was only one productive day. Further, they assumed no care taker remained with a hospitalized adult case. These authors, too, made no adjustment for labour substitution. Sauerborn et al (1991) attempted to make adjustments to reflect seasonal changes in income by taking into consideration the maintenance period, where no field work had to be done, and the cultivation periods. For the cultivation period, average product per person was calculated by dividing the annual productivity by the known number of agriculturally active individuals. A separate marginal productivity of labour was calculated for the maintenance period by considering non-farming activities. They, too made assumptions about the duration of illness similar to above mentioned studies; but, an additional assumption was made on the severity of illness by making five days for severe illness and one day for mild illness, and one third of them for children. This study also made no allowance for labour substitution.

Picard et al (1993) used the estimates made by another study on the marginal value of working on the cultivation of several crops during dry and wet seasons and, after making adjustments for the year those estimates were made, valued the time lost by both carers and mourners (in the case of death). These estimates were used to measure the time spent by village health workers and other helpers as well for the implementation of the net impregnation project. For the dry season, however, those values were adapted by taking into account the productivity of their activities.

The method adopted by Mills (1989 and 1992) was different from all the studies examined above. Based on the findings of a household survey, the author used the mean loss per worker per day of disability after making an adjustment by using a conversion factor for unskilled labour. She, too, checked the validity of the use of minimum or average wage rates and found significant differences between the two approaches. But, unlike Kaewsonthi (1988), she adopted the method mentioned above for her cost estimates. Allowances were made for labour substitution and hired labour but non-financial production losses were not considered in her estimates. Complete disability as well as partial disability were taken into consideration in estimating the number of working days lost.

As mentioned at the outset, no similarity could be found among the methods adapted by different authors to estimate the value of time. Especially, the seasonal changes in labour productivity in rural areas play an important role in determining the value of time. In Kenya it was found that for the poorest strata of the population, the value of one time unit in the rainy season was nearly eight times than the dry season (Mwabu 1986). Cohn (1973) made a suggestion that since the impact of the release of one person due to illness on total productivity was zero in an economy with surplus labour, the opportunity cost of labour should also be zero - an extension of Arthur Lewis's famous argument to the health sector.

Two important questions propped up in this examination were the time lag of agriculture productivity and quality of output. The absence of a farmer from cultivation in his/her land even during the maintenance period could affect the total output as well as the quality of it with a time lag, if no proper labour substitution was employed. Can this loss be measured by the average, marginal or minimum wage rates ? Although these questions were not directly raised, Mills' (1989) attempt to get a direct feed back from the households exemplified a good method to overcome this problem. Such a method could be used after making necessary modifications on the basis of the

circumstances under which a household survey is conducted. Indeed, the loss of output or income should primarily be valued on the basis of the response of the household. The method suggested by Goldschmidt - Clermont (1987) after reviewing the literature on domestic and related activities, and their economic implications also focused much on the actual economic behaviour at household level. The author suggested an output related evaluation method to be used for this purpose: an evaluation of value added derived from the price of equivalent market products. The information on the variables related to this methodology can be basically obtained from a household survey and adjustments for market prices can be made by using a standard shadow pricing system.

The next cost element which needs some adjustments is the cost of death due to illness. This cost element was not considered and measured in almost all studies reviewed, except four. The most important reason for it was the extremely low malaria mortality rates in most of the areas/ countries where the studies were undertaken. For the studies which were undertaken in areas where the mortality rate was high, the focus of the studies prevented authors looking at the cost of death. The studies which measured this cost element used almost the same method with some modifications; one exception was an early study by Quo (Ref. Pampana 1963) who used the Philippines Civil Code to value the life of a dead person and made it equal to $1500. After estimating the discounted productive life expectancy, while Ettling and Shepard (1991) used yearly adult marginal product to obtain the total value of premature death, Sauerborn et al (1991) used the annual total product of labour in the study area to measure the same. Shepard et al (1991) used a method which was previously used by the principal author (Shepard et al 1986), but the valuation was done on the basis of discounted present value of the marginal value of labour from age 15 onwards. It seemed that the value of death was largely dependent on the discount rate used for future earnings and the value used on the annual productivity of the people who died. Nevertheless the method used to measure the length of productive life lost, too, would affect the measurements as Sauerborn et al (1991) used the conditional probability of survival at each year to handle this problem.

Finally, adjustments made to correct the price distortions caused by trading practices of the country concerned were examined briefly. This aspect was, indeed, not dealt by any of the authors except Mills (1989 and 1992), although Ettling and Shepard (1991) made such adjustments for certain cost items. This avoidance could be largely attributed to the focus of studies examined in this review. Most of them were, as mentioned earlier, confined to analyze provider's cost, users' cost or operational cost

without making a full economic evaluation. Some of the adjustments made by Mills (1989) in this respect were discussed above. She clearly identified both traded and non-traded items, and made adjustments for all cost items accordingly. The method adopted by the author was the conversion factor originally proposed by Little and Mirrlees (1974). Depending on the foreign exchange component of each non-traded item, the author made adjustments to the standard conversion factor, which was used in Nepal for appraising projects, to make calculations for each item.

b.Consequences

The consequences examined by the studies reviewed so far were largely confined to process and intermediate indicators. But, as mentioned, some of those studies could not be considered as economic evaluations just because they examined economic aspects of malaria control as part of the study, of which the prime objective was a wider one. Jeffery (1984) just examined the requirement of chloroquine as part of an analysis of the role of chemotherapy through PHC. Bruce-Chwatt (1987), too, made a similar attempt related to drug requirements. Foster (1991) examined prices, distribution, procurement, prescription, availability etc. of anti malaria drugs and these indicators did reflect some constraints encountered in the provision of services which were indirectly related to the consequences of control programmes and, hence, the study could be considered as a one which placed emphasis on process indicators. Both Lin (1991) and Griffith (1961) did not make any reference to the effect of the programme on the target population but they took the total population as a whole and just expressed total cost in terms of per capita.

Some further examples of the heterogeneity of studies, which did not look at intermediate outcomes, could be found from MacCormack et al (1989), Njunwa et al (1991) and Stephens et al (1991). Although Njunwa et al (1991) in the 2nd and 3rd parts of the study assessed the effectiveness of bed net impregnation using field trials, in the paper concerned here they looked only at the acceptability of the subject by receivers. MacCormack et al (1989), too, looked at expenditure preferences related to bed nets impregnation implicitly assuming they were effective on the basis of the findings of some other study. Stephens et al (1991) similarly looked at the effectiveness of various domestic control methods from a community perspective.

The reliance on primary level effects of interventions/ programmes or, more precisely, on process indicators implied that the authors seemingly assumed that the control programmes concerned for the studies were effective in terms of attaining the pre

specified health objectives (e.g., Kere and Kere 1992 and Helitzer-Allen et al 1993). They looked only at the cost components of the intervention, strategy, programme etc. Moving on the same line, Kamolratanakul et al (1993) specifically stated that it was "not necessary to report cost-effectiveness" because cost-saving and the reduction in attack rate were showed by the results of the trial.

Most of the reviewed studies used intermediate indicators for the analysis. Among them Kaewsonthi and Harding (1984) and Kaewsonthi (1988) appeared to have used a larger number of intermediate output indicators or indicators closer to them. In the previous study authors used 28 indicators ranging from, % of number of blood slides taken from the number of blood slides that should be taken, to, % of no. of cases cured within the target time to the number of cases to be cured in the target time. While the indicators of the former nature were rated as performance indicators, the latter type were rated as effectiveness indicators by the authors. Similar indicators were used by Kaewsonthi (1988) as well; in both the studies these indicators were then expressed in monetary terms for different delivery points. However, in making monetary indicators Kaewsonthi (1988) emphasised much on cost per case treated. This meant the cost borne by both the provider and the patient in treating a positive case.

Similar cost-output indicators, particularly cost per case treated, were used by many authors such as Sauerborn et al (1991), Shepard et al (1991) and Ettling and Shepard (1991) as well. Ettling et al (1991), too, made a similar attempt but they went a little further by estimating the additional number of cases treated at different clinic combinations. Moving on further they measured what they called the incremental cost-effectiveness of each possible combination of clinics on the basis of additional institutional cost for an extra case treated. Phillips and Mills (1991) made a comparison among three types of residual spraying in terms of the number of structures sprayed by each insecticide - an expression of intermediate indicators for residual spraying.

The other studies which focused on intermediate outputs appeared to have employed different approaches. Hedman et al (1979), just calculated the per capita cost figures, but as a separate exercise compared a set of indicators which measured malaria endemicity, some epidemiological aspects and haematocrit among children with a control area to show the effectiveness of the programme concerned. Such an approach could be seen in the study of Gandahusada et al (1984) as well. Their indicator was the cost per person protected per year. But using SPR, P.falciparum index and some other entomological indices they compared the effectiveness of the two types of interventions

between themselves and with a control area.

Sharma et al (1990) used utilization rates of malaria workers and other available sources of treatment to illustrate the effectiveness of the intervention and by making a comparison of those figures with the control area; which seemed to be process rather than intermediate indicators.

The authors who looked at the impact indicators basically measured the cases of death prevented from the control programme. Barlow (1967), Cohn (1973) and Brown (1980), and the authors who participated in the debate on Newman's (1965) controversial book on the eradication of malaria in Sri Lanka (e.g., Gray 1974), attempted to measure the impact of eradication particularly on mortality. Nevertheless, impact of the control of malaria on mortality rate and increasing fertility rates still appears to be a controversial issue. It seems to be dependent on the circumstances under which malaria control occurred; and, hence, a complex mix of factors, other than malaria control, could lead to reduced mortality as in the case of Nepal (Mills 1993c).

In measuring health effects of an existing control programme rather than on a situation where the disease was eradicated, a simple measure of number of cases prevented by antenatal chloroquine chemoprophylaxis was estimated by Heymann et al (1990) based on clinical findings. Although Sharma and Sharma (1986) did not make any estimate of cases prevented for their economic evaluation of a bio-environmental project, later Sharma (1991) made some estimates of the cases prevented from the same project but it was challenged by Curtis (1991). Walsh and Warren (1980) also used an estimate of the number of deaths averted from malaria control to elucidate their proposed strategy of implementing PHC on selective basis. However, only two studies made worthwhile attempts to estimate the health impact of an ongoing control programme. Picard et al (1993) estimated four health impact indicators: deaths/cases averted, discounted healthy life years gained; and child year protected, under bed net impregnation and bed net impregnation with chemoprophylaxis together with a further estimate on the incremental value of cases/ deaths averted by the introduction of chemoprophylaxis. However, the fourth one was largely an intermediate outcome indicator rather than an impact indicator. Estimates were made on the basis of a comparison with a control area. Thus the method of making estimates was straight forward though, according to the authors, there were some problems in making these estimates such as migration of children, seasonal variations in some variables, effect of some factors other than impregnation on effectiveness and the existence of some uncaptured cases in the study area. Yet the study

very clearly showed how the impact of a control programme on health status could be incorporated into an economic evaluation.

Mills (1989 and 1993a) developed a very sophisticated method not only to estimate the cases/deaths prevented but also to estimate savings in work days and discounted days of healthy days gained along with some other economic consequences such as net savings in total/ government/ private curative/ preventive costs. However, for the author herself, most of the CEA ratios were highly speculative because these measures were made on a hypothetical situation where present (at the time of study) control activities were assumed to be adequate to maintain incidence at current level; thus "cases (deaths) prevented are then the cases (deaths) without the programme minus cases (deaths) with the programme" (Mills 1989). The assumptions of the CEA undertaken within this framework were based on the receptivity of areas and a sensitivity analysis was carried out in relation to different case fatality rates and APIs. This exercise had to be done in this way because of the absence of a control area to compute relevant numbers as normally done in many experimental trials. This, indeed, raised an important problem encountered by researchers in different circumstances in applying the CEA to control programmes. The author, however, concluded that except for some economic parameters like discount rates, economic parameters were less important than epidemiological parameters in the sensitivity analysis. She further mentioned that a CEA of this nature could help in determining whether the control programme was worthwhile per se rather than which activities were most efficient means of malaria control, implying that intermediate indicators would serve for that purpose.

Concluding remarks

The first part of the review looked at the literature on economic evaluations of malaria control programmes with special reference to CEAs. One of the most important observations was the tendency among authors to undertake micro level evaluations on some selected strategies, methods, techniques, etc. of control programmes in a specific location, instead of looking at the programme as a whole. Another seeming tendency was the assessment of the economic implications of control programmes or some aspects of them just as a supplementary exercise of a study in which the main objective was not an economic one.

Only a very few studies were found to have attempted to look at the economic implications of control programmes as their main objective. However, most of those studies were partial evaluations. Only two studies were found to have the main

characteristics of a CEA.

The seeming trend of the focus of economic evaluations into sub-elements of control programmes, however, did not necessarily raise a question of the validity of CEA methodology in evaluating control programmes as a whole. The reviewed CEAs (both complete and partial) attempted to handle many practical problems encountered by researchers with respect to the lack of a proper data base for evaluations. This raised an important question of the possibility of undertaking CEAs focusing on final outcome indicators. It seemed that to incorporate final outcome indicators into a CEA, certain extreme assumptions had to be made in the absence of a control area and an extensive data base, which were not common for many environments in which the CEAs were undertaken. This led to a conclusion that a CEA, which is not confined to some selective aspects of a control programme, would have to be focused much on intermediate outcomes rather than final health effects. Moreover, under circumstances where the prevalence of the disease is relatively high, undertaking a CEA focusing on intermediate outcomes (and obviously on process indicators) would certainly help the policy makers.

In measuring both cost and consequences in the reviewed studies, only a few studies attempted to develop the methodology to overcome practical problems. Issues such as valuing the loss of time and output due to illness still appeared to have been handled partially; among other things, no generalizations could be made on the findings or methods used in those studies. However, the ways through which those issues should be handled are dependent on the circumstances under which a study is undertaken. Therefore the evaluators have to make their own in-depth investigations on these issues and develop the methodologies of other authors to handle those issues. Certain costing procedures such as discounting and shadow pricing should also be given special emphasis by a researcher as they, too, depend on the environment of the study area. The only study which clearly incorporated these costing concepts into the analysis was Mills (1989, 1992 and 1993a).

In general, most of the studies attempted to narrow down the focus of study either to the provider or to the users. Focusing on only one of them could lead to some extremes by ignoring the very purpose of CEA; which may also lead to distort the framework of economic evaluation as well. Such possible distortions could be systematically avoided if a supplementary study was undertaken on any of them while keeping the CEA framework intact; and the effects of the policy options derived from those supplementary studies could be examined and tested by undertaking a sensitivity

analysis within the CE framework by making necessary adjustments to the variables which could be affected by the implementation of those policy options. Thus findings of an analysis of the productivity of the employees belong to the providing agency or the behaviour of users/ community can be easily incorporated into the CEA framework in this manner. No study in the present review made such an attempt within the CEA framework. This indeed, provides a good pasture for the present study to develop the scope of CEA.

PART II: COMMUNITY BEHAVIOUR IN PREVENTIVE AND CURATIVE CARE

The literature reviewed in the first part of this chapter brought out a set of variables which affect the cost-effectiveness of malaria control programmes. Not much attempt was made to identify factors other than control measures which affect health effects. In an earlier attempt to broaden the scope of CEA Berman (1982), in his comments on Walsh and Warren's (1980) controversial article on selective primary health care, argued that, in making a comparison between alternatives using cost-effectiveness indicators, analysts must consider the sources of variation in those indicators. While delivery mix, service mix and utilization affect cost, both service mix and utilization affect effectiveness as well in a different way. In this context, the author pointed that acceptability, availability, accessibility and demographic factors could be considered as factors which influence cost-effectiveness through utilization; technology, appropriateness to needs and quality were brought out as the factors which influence effectiveness through the determination of service mix. Thus on the one hand, it is possible to identify a set of variables related to the demand side which influence health effects through utilization of services. On the other hand, some factors related to the supply side also determine utilization to a certain extent.

Moving on a similar line but with a different focus, Vlassoff and Tanner (1992) elucidated the need to pay attention to improving community effectiveness rather than focusing exclusively on increasing efficacy of disease control tools. According to them, community effectiveness is determined by three factors other than efficacy of control tools, namely, coverage, diagnostic accuracy and compliance (of both the provider and the user). In this context, there may be many other factors such as socio-economic, cultural, demographic and geographical etc. which determine coverage and compliance, and hence community effectiveness of control measures.

From the economics point of view, at least, the identification of factors which influence demand for treatment and prevention are extremely useful for policy making (Mills 1991), especially to reallocate resources to enhance efficiency of control programmes. To reach the second aim of the study, here onwards an attempt will be made to identify the factors which affect community behaviour in response to the disease with respect to both curative and preventive care; in this review special emphasis will be drawn to economic factors. It begins with an identification of a conceptual framework to

undertake the review as this is an area to which little attention has been paid by researchers. The rest of the review will be presented as a follow up to that framework.

2.3 Framework

Many authors have suggested analytical frameworks for community behaviour but most of them focused on risk behaviour (Sornmani and Manderson 1992, Castilla and Sawyer 1993). However, Hongvivatana (1986) suggested a very broad framework by emphasising the "human behaviour" plays an important role in determining effectiveness of malaria control. It is concerned with knowledge, attitude and beliefs underlying human behaviour and encompassed three major components: human behaviour in disease transmission and control; illness behaviour; and, human behaviour in control bureaucracies. The latter one was directly related to the personnel of malaria control programmes.

Before moving further, it is necessary to mention that the present study focuses on community behaviour rather than human behaviour which Hongvivatana emphasised. The concept of community can be defined as a "dynamic, fluid, geographical, political and social entity comprising individuals of various kinds, many interest groups, and a range of political concerns" (WHO 1991). In this study, behaviour of individuals in seeking health care will be analyzed within a broader framework with a view of making some generalizations of community behaviour. Rosenfield et al (1984) argued that analysing health seeking behaviour at the isolated individual level was a oversimplification of reality; expenditures made in order to save a life, or to avoid or reduce morbidity and debility were likely to include contributions from the wider community. Thus the behaviour of individuals, community groups such as households, occupations etc. as well as the community as a whole have to be examined in a community behaviour analysis. In this context, the human behaviour framework of Hongvivatana (1986) will be broadly redefined for this review by replacing the term "human behaviour" by "community behaviour".

Hongvivatana (1986) categorized community behaviour in both transmission and control into one component. Population movements and acceptance were taken as explanatory factors of this behavioral component. Although it is clear that the factors affecting transmission can be inversely related with control, the present review will examine these two aspects separately. Given the aims of this study, however, more emphasis will be placed on control rather than transmission.

To make the review a more complete one and also to provide a basis for

a detailed examination of community behaviour in controlling the disease the review will begin with a brief look at community behaviour related to the transmission of malaria. It may lead to identify factors which could be used in assessing control measures or in explaining demand for control measures as well. Singhanetra-Renard (1993) elucidated this point in a illustrative manner after an investigation of malaria transmission among mobile people in northern Thailànd:

> "The current measures of residual insecticide spraying, the use of mosquito nets and the application of insect repellent become unsuitable as control measures, partly because they deal with the vector from the expectation that the vector will come to the host, rather than from the standpoint that the host may be continually on the move through the habitat of the vector".

With this background the review will, in general, be looking at factors underlying community behaviour in controlling the disease with some emphasis on transmission or risk behaviour. Thus entomological, parasitological, and immunological factors will be excluded from the review. Some indirect factors such as meteorological and macro environmental factors (Onori and Grab, 1980) will also be excluded from the review as they go far beyond the community boundaries. However, certain micro environmental factors such as house type, living conditions etc. (Subramanian et al, 1991) could be indirectly related with the demand for services. Thus a probable guideline for this review would be to focus it on understanding demand and the major determinants of health, disease and health-seeking behaviour in the community (Tanner 1991). Special emphasis will be drawn to the identification of factors affecting acceptance and compliance through a review of literature on community behaviour. This, indeed, makes the focus of this review much more slender.

Following the brief review of risk behaviour, the review will examine community behaviour in relation to control measures. Its first section will examine preventive measures: acceptance of and compliance with preventive measures provided by control programmes; and, self preventive measures. The second section will look at community behaviour with respect to curative care or illness behaviour.

2.4 Risk behaviour of the community

Several authors identified a set of factors related to community behaviour, which could be considered as causes of transmission: migration to endemic areas outside the country (Goh 1986); migration of fishermen to various fishing camps in different locations in different seasons (Rajagopalan et al 1986); occupation in forested areas (Singhanetra-Renard 1986 and 1993, Banguero 1984, Fungladda and Sornmani 1986,

Kalra 1978, and Fungladda et al 1987); and, outdoor occupation (Fernandez and Sawyer 1988, Vosti 1990, Castro and Mokate 1988, Lipowsky et al 1992 and Sevilla-Casas 1993). Further, Jayawardana (1993), Amarasinghe et al (1991), and Hiramani and Sharma (1987) related transmission with population movements to endemic areas due to irrigation projects. Harinasuta (1986) pointed to malaria prone behaviour such as relaxing outside houses in the evenings ignoring mosquitos as cause of transmission. Castilla and Sawyer (1993) found that economic status, and knowledge of the importance and behaviour of the mosquito in transmitting malaria, were significant factors in determining prevalence risk. Rosenfield et al (1984) linked economic activities like farming in non-irrigated areas, wood gathering etc. with the transmission of the disease.

Among the authors who looked at risk behaviour, Castilla and Sawyer (1993), Castro and Mokate (1988), Vosti (1991), Butraporn et al (1986), Fernandez and Sawyer (1988), Fungladda and Sornmani (1986), Fungladda et al (1987) and Banguero (1984) developed mathematical models to associate socio-economic characteristics at individual and/or household level with transmission and/or prevalence of malaria. Among them as mentioned earlier, Singhanetra-Renard (1986 and 1993) ruled out the suitability of conventional control methods for mobile people. This clearly indicated the necessity of focusing control activities, both curative and preventive, towards the demand of target communities rather than imposing them on the community by just neglecting its socio-economic, cultural and behavioural characteristics.

Apart from that, many authors categorized malaria as a disease of the poor (e.g., Castilla and Sawyer 1993, Hiramani and Sharma 1987, Castro and Mokate 1988, and Butraporn et al 1986). Low family income along with malnutrition and poor living conditions including inadequate sanitation and poor house construction were mentioned as reasons for transmission by many authors (e.g., Fungladda and Butraporn 1992, and Rosenfield et al 1984).

Based on the findings of an entomological study in a rural area in Sri Lanka Gamage-Mendis et al (1991) strongly argued that house construction itself was an important determining factor of exposure to malaria. Butraporn et al (1986) stressed that a large number of houses of malaria cases had incomplete walls, poor construction, and no bedrooms. Both Castro and Mokate (1988), and Hiramani and Sharma (1987) mentioned the effect of poor dwelling types on transmission. Sawyer (1986) referring to a survey in Brazil pointed that the majority (i.e., 80 %) of houses were simple huts or shelters without walls capable of retaining DDT. Subramanian et al (1991) found a strong

relationship between the level of the completion of house construction and malaria incidence. Only Banguero (1984) found no significant association between these two variables. In this way, housing conditions appear to have a direct impact on effectiveness of control measures at household level. It can further be considered as an approximate measure of socio-economic status and living condition, which could influence the level and pattern of demand for health care of a given household.

This brief review of transmission has highlighted that among other things, the risk behaviour of the community was largely related to socio-economic variables such as income, occupation and living standards. With a final remark that this issue still remains as an area for further explorations, the review will now turn to community behaviour in controlling the disease.

2.5 Community behaviour in controlling the disease

a.Preventive measures: acceptance and compliance

Among preventive measures, residual spraying, bed net impregnation and prophylactic treatment will be examined in detail as the most important control tools in many countries. An examination of acceptance will be followed by compliance along with reasons underlying those behaviour patterns. For this review, the term acceptance is broadly defined as the physical acceptance of publicly provided anti-malaria measures by community members. Compliance is referred to the acceptors' adherence to the provider-prescribed utilization methods and patterns of anti-malaria measures.

Residual spraying

Hongvivatana et al (1982) made a valuable contribution by undertaking a study on acceptance of DDT house spraying in Thailand. "Unco-operation" of the villagers was attributed to their perception of insecticides as harmful to the health of children, pregnant women and domestic animals, and lack of knowledge or disbelief in the benefits of spraying. The study indicated that refusals were much more common among higher socio-economic strata. But the study emphasised much on malpractice of spraying teams and supervisors, and defects of the management of spraying operations as possible causes of low coverage.

Sharma and Sharma (1986) indicated that the villages were unwilling to allow spraying because side effects such as relief from nuisance insects no longer resulted after spraying. However, many authors revealed bad effects resulting from residual spraying as a main reason for refusals. In a remote village in the Philippines, although 63.9 % of dwellers did not disagree with the smell of DDT and another 73.07 % did not

want to wipe it off their walls, about half of them had the suspicion of bad effects of insecticide on pets and the health of family members (Lariosa, 1986). In a study in Colombia, although only 25 % of the respondents reported displeasure with residual spraying, 48.3 % reported having had problems due to DDT application in their houses (Lipowsky et al 1992). Their main complaint was that DDT spraying was fatally poisoning domestic animals: 38.1 %, 28.6 % and 2.2 % of households in the urban area covered by this study reported losses of cats, chicken and dogs, respectively. Both Dhillon and Kar (1961) and Harinasuta (1986) found that there was a belief among the respondents that DDT spraying would increase other nuisance insects. The latter author further mentioned about the belief that DDT would harm children and domestic animals. Fernando's (1983) findings in Sri Lanka on the refusals of DDT spraying (before introducing malathion) were also similar: after spraying, the bed-bug menace increased and the bugs had the run of the house because the predators were killed and it was an intolerable situation for the inhabitants, thus they tended to refuse spraying.

The reasons for refusals indeed spread over a wide range. In the villages of northern Thailand once the families changed from living in bamboo huts to wooden houses, they were reluctant to allow their houses to be sprayed (Singhanetra-Renard 1986). The author further mentioned that people living in houses with thatch roof had discovered that spraying ruined their roofs. They had to change them every year, instead of every three years, because DDT caused the leaves to become brittle. In houses with metal roofs, DDT made their corrugated tin roof rust within only two years. Harinasuta (1986) also found the fearfulness among Thai villages of damages caused to a zinc roof by DDT spraying.

Inconvenience and time consumption due to the removal of all furniture out of the house was another reason for refusals (Fernando 1983, Harinasnta 1986, and Dhillon and Kar 1961). Along with these reasons, dirtiness was also found as another cause of refusing (Harinasuta 1986, Dhillon and Kar 1961, and Kalra 1978). The latter author found that, in rural India, refusals were mainly on the grounds of festivals, religious beliefs, caste barriers, cleanliness and, in certain areas, due to particular occupations like sericulture. Religious and cultural barriers appeared to be a reason for refusals among Lahu and Lisu tribesmen in Thailand as well (Singhanetra-Renard 1986). During the new year celebrations they did not allow spraying or blood smears for seven days.

Even though a section of the target population allowed the sprayers to

perform their duties with reluctance, it consequently led to poor compliance as was observed by many authors. Dhillon and Kar (1961) reported an interesting point that, among the tribal population in Orissa, India, residual spraying was accepted due to fear of prosecution. Thus the immediate reaction of the dwellers was to replaster the walls just after spraying. While the villages in a higher socio-economic strata were in a position to refuse spraying, others reacted to spraying by replastering immediately after spray (Kalra 1978). Sharma et al (1990) referring to a village in India pointed out that spraying was ineffective as 86 % of the houses in their study area were mud plastered houses and villages had a practice of mud plastering soon after spray. In a rural area in Colombia, Lipowsky et al (1992) found that people reacted to spraying in various ways: by open hostility towards spraying teams, absence from home on the announced spraying days or washing off DDT from walls after spraying.

Hlaing and Maung (1990), however, attributed non-acceptance of and poor compliance with DDT spraying in rural Myanmar to disbelief in the effect of spraying on mosquitos; 70 % of the respondents had such disbelief. This seemed to be largely due to their extremely poor knowledge about malaria causation as revealed from the same study. Fernandez and Sawyer (1988), however, found their most unexpected result that the prevalence of malaria among the unsprayed houses was the lowest among the categories considered. For them, this unexpected result might be due to the selectivity in spraying which focused much on highly endemic areas and the unavailability of DDT paste (!) to apply to better built houses; thus it did not have any significant relationship with acceptance.

In a recent examination of the viability of DDT for malaria vector control Curtis (1994) highlighted that the suppression of nuisance pests, together with the lack of a visible deposit on walls, led to better acceptance of pyrethroid applications (and hence higher coverage rates) than with DDT. But no studies were found for this review on community perceptions of other insecticides. Most of them were still being introduced in some developing countries on an experimental basis. The available reports on those experiments were normally emphasised more on the effectiveness of the insecticide concerned than on community perceptions.

Impregnated bed nets and curtains

Acceptance of and compliance with impregnated bed nets and curtains were examined by only a few authors. In five Tanzanian villages, a great enthusiasm was shown by the villages for using impregnated bed nets by bringing them for re-

impregnation at the appointed time (Njunwa et al, 1991). However, theft and surreptitious selling of nets were also reported. Repairs had not been undertaken by many people in spite of the provision of pieces of netting to make patches; 17.6 % of bed nets were badly damaged in one village. Procacci et al (1991) pointed to sub-optimal utilization of protective measures as a reason for less effectiveness of impregnated curtains; it was observed that up to 50 % of adults and children were staying outside until 2300 hours and up to 40 % of houses had their curtains raised during the hot season. This made the authors conclude that community perceptions on control measures should be considered in implementing control trials.

MacCormack et al (1989), and MacCormack and Snow (1986) found some cultural factors affected the use of impregnated bed nets in The Gambia. The former authors concluded that the differences between ethnic groups in using bed nets were not only due to economic constraints but also due to cultural factors such as sleeping habits and need for privacy. They further showed that there was a practice among one ethnic group called Mandinka to provide bed linen including a net as part of marriage exchange by husbands. Acceptance of impregnated bed nets among other ethnic groups could be largely attributed to satisfaction in using them after the first intervention; yet the authors did not find health was given a high priority among expenditure items through their expenditure preference survey. Aikins et al (1993) found the positive impact of the satisfactory results of the previous interventions on further acceptance of impregnation; 93 % of respondents in those villages expressed their willingness to pay for the insecticide. In this study, although the authors extensively examined socio-economic variables related to the bed net usage, in the analysis (except the above elaboration) no differentiation was made between the responses from the villages in which impregnation was undertaken and the other villages. Because of this, the finding of the preceding two studies should also be treated with caution as they largely elaborated on the reasons for using bed nets rather than accepting impregnation.

Jambulingam et al (1989) mentioned that, in Orissa state in India, a health education programme had to be undertaken prior to the distribution of impregnated bed nets as the villagers had never used bed nets. In this trial, poor compliance was observed as the main obstacle for proper implementation. In a survey after six months, it was found that in one village, only 41.13 % of nets were in good condition and 28.9 % were totally damaged. More than 57 % of bed nets were washed three or more times during those six months. In another village 22.6 % of bed nets were missing. Moreover, 37 %

and 12.5 % of bed nets in two villages were used as blankets and bed sheets, respectively.

In a trial of permethrin impregnated curtains and bed nets in western Kenya, two unannounced visits were made and compliance was found to be only 70 % and 73 %, respectively, although 85 % of those families had claimed that they used them during the preceding seven days (Sexton et al 1990). In several houses rats or cats had torn holes in the curtains. But the authors expected that the compliance would increase during the rainy season as the study was done in the dry season. They reiterated the need to look at acceptance, compliance and maintenance in future studies. In a trial in eastern Thailand, Kamolratanakul et al (1993) found that among the two types of migrant workers considered for the study, while long-term migrants had a compliance rate of 70-80 %, it was 95-100 % for seasonal migrants. But the authors did not elaborate on the reasons for the differences in compliance rates.

As mentioned earlier, only a few studies were undertaken on impregnated bed nets and curtains from community perspectives. These studies indicated that while acceptance had so far not been a serious problem especially in field trials, compliance and maintenance still appear to be important areas for further investigations. Moreover, willingness to purchase bed nets for impregnation and pay for impregnation has not yet been investigated sufficiently; only a very recent study found that although people expressed their willingness to pay, in practice only a few paid for them (Mills et al forthcoming). Yet as it was mentioned in an administration report of the AMC in Sri Lanka (AMC 1990), control programmes were still facing a quandary about the willingness to pay for impregnated bed nets.

Prophylactic medicine

Prophylactic measures have been studied among three categories: most of those studies focused on children below five years and/or pregnant women; a few studies on all community members. One study on all community members (Pribadi et al 1986) attempted to study acceptance of and compliance with chemoprophylaxis administered through a method of community participation in a village in Indonesia. Although the effectiveness of the intervention was shown with reductions in spleen rates and parasite rates, no attempt was made to explore reasons underlying irregular compliance.

Fernando (1983) brought up a point, by referring to Sri Lanka, that although the community members were knowledgable about the disease they did not appreciate either the use of prophylactic therapy or the continuation of drug treatment

when they were symptoms-free. Findings of a study on a chemoprophylaxis programme in the National Railways and two large farm labour forces in Zimbabwe also came to similar conclusions (Taylor and Mutambu 1978). The authors showed the differences between the claims to have taken prophylaxis and the results of urine tests. Although no concrete reasons were found for poor compliance, lower effectiveness of the implementation of chemoprophylactic protection through PHC programmes was raised and the need for strict supervision was strongly recommended by the authors.

Except for these studies, almost all other studies on prophylactic measures looked at children and/or pregnant women. Heymann et al (1990) evaluated the role of chloroquine resistance and compliance in the protective efficacy of the government chloroquine prophylaxis programme among pregnant women in Malawi. Non-compliance was clearly observed by the authors but no attempt was made to examine the reasons for it. They referred, however, to the findings of a follow up study in which bitter taste was shown as one of the causal factor of non-compliance because bitter taste was associated with traditional herbs which cause abortion; pregnant women were advised by traditional birth attendants and family members to avoid all bitter-tasting medications during pregnancy. Bitter taste was not mentioned by other authors but fear of chloroquine associated pruritus was found as a reason for poor compliance among pregnant women (Kaseje et al 1987a and Brabin et al 1990). Both Matola and Malle (1985), and Kaseje et al (1987a) found itching, and fear of abortion as reasons for non-compliance; advice of the Village Health Helper (VHH), "not sick", fear of vomiting/nausea and negligence were other main reasons for non-compliance stressed by the respondents. But both the studies raised the issue of non-availability of tablets as a reason for the failure of compliance; this was mentioned by 60 % of respondents in Tanga region in Tanzania in the study of Matola and Malle (1985). Thus many chemoprophylaxis programme were found to have this supply side deficiency. But Kaseje et al (1987a) made an important point that the difficulty of understanding benefits of chemoprophylaxis as opposed to treatment was a reason for poor acceptance and compliance. Most of the authors indicated that a more organized delivery system with direct supervision and/or a health education programme was essential for better implementation of a chemoprophylaxis programme among pregnant women.

Among the studies which focused on children, Menon et al (1990) found that in a rural area in The Gambia the drug (i.e., Maloprim) was administered only on 60 % of the occasions it should have been given. However, the author did not attempt

to find out the reasons for poor compliance except indicating that a monitoring system and a survey for the reasons for non-compliance should have encouraged mothers to participate in the programme. Bitter taste was not regarded as a reason for poor acceptance and compliance by Menon et al (1990) or by Allen et al (1990) in the case of The Gambia as Maloprim was tasteless. This was, however, found as a reason in the studies undertaken in Tanzania, where chloroquine was used as a malaria chemosuppressent (MacCormack and Lwihula 1983, and Matola and Malle 1985). In the latter study in a sample of children with malaria, 78 %, 21 % and 31 % reported bitterness, vomiting and nausea, and itching, respectively. In almost all those studies, a majority of mothers showed willingness to administer the drug to their children. MacCormack and Lwihula (1983) found that 71 % mothers had a favourable view about chloroquine. But Matola and Malle (1985) raised a suspicion about mothers' views as although 72.1 % of them claimed to have given chloroquine to their children, only 23.8 % of those children were positive with chloroquine in urine tests.

Allen et al (1990) had a broader view about the reasons underlying poor compliance. They made them into two categories as village level and individual level factors. They showed that the villages with political divisions or family rivals had low compliance. Support of the village head played a decisive role in accomplishing a high compliance level. At individual level, loss (or tearing) of the child card and distance to the drug administration points forced some mothers into non attendance. In this context, 38.1 % of mothers in Tanga region, Tanzania did not bring their children to the clinics as they had already completed the immunization schedule, and considered chemosuppression was useless due to poor knowledge about it (Matola and Malle 1985). They further found that irregular supply of drugs was a prime reason for poor compliance: 32.4 % of mothers reported that the tablets were not supplied. In North Mara in Tanzania 72 % of mothers supplemented supplies from other sources (MacCormack and Lwihula 1983).

The literature reviewed in this section has revealed some important aspects of non-compliance arising from the provider's side as well as the users' side. Irregularity in supply was found in many studies. Side effects and bitter taste caused poor compliance among chloroquine users. Poor knowledge about prophylaxis as a preventive measure was also observed. This led some sections of the community to hoard the drug for use in malaria episodes. Even the drugs given for children were stored and shared among all family members in later treatment. Both MacCormack and Lwihula (1983), and Matola

Figure 2.1: Use of self preventive measures by study area and type of measure#

Author/s	Country and area, and the nature of study or focus group	Type of study area and sample size	PREVENTIVE MEASURES (as % of users)						
			Prophylactic medicine	Bed nets	Repellent coils	House screening	Space spraying	Other repellents	Unspecified
Gardiner et al (1984)	Southern Ghana (Household survey)	Urban n=413	37.00	9.00	49.00 (R)* 32.00 (O)*		49.00 (R)* 32.00 (O)*		
		Rural n=137	3.00						
Edirisinghe et al (1987)	Girandurukotte, Sri Lanka (Malaria patients)	Rural n=80	2.50	21.30					
Mkawagile & Lihamia (1988)	Dar es Salaam, Tanzania (Adult malaria outpatients)	Urban n=126	33.33	21.43	80.95	64.29			
Sexton et al (1990)	Western Kenya (Household survey)	Rural n=105		9.00	59.00		40.00 (O)		
Coene et al (1989) (Referred to an unpublished observation of Coene(1988))	Kinshasa, Zaire (Household heads)	Urban n=200		11.00	46.50 9.50 (R)		16.50	3.50	
Ongore et al (1989)	Western Kenya (Household survey)	Rural n=187		10.20	23.20			17.10+	16.00
Butraporn et al (1986)	Eastern Thailand (Pair matched case control study)	Rural n=349		50.90 68.10 (R)					
Trape et al (1987)	Linzolo, Congo (School children)	Rural n=182		25.30					
Hlaing & Maung (1990)	Myanmar (Two villages and two timber extraction camps)	Rural n=165 (Villages)	Villages: 5.89 (R) 20.29 (O)	Villages: 10.00 (R) 50.00 (O)					
		n=72 (camps)	Camps: 84.28 (R) 8.17 (O)	Camps: 20.00 (R) 40.00 (O)					
Gamage-Mendis et al (1991)	Kataragama, Sri Lanka (Household survey)	Rural n=736		6.60					
Stein et al (1988)	Zimbabwe (Household survey)	Rural n=200	32.50						
		Urban n=200	19.00						
Bosman et al (1988)	Burkino Faso (Cross-sectional study on children)	Rural n=620	65.90						
		Urban n=1497	2/3 rd of them (R)						
Atkins et al (1993)	Farafenni, The Gamb (Househol	Rural n=607 (PHC villages)		Adults: 86 %					
		n=389 (Other villages)		Boys: 81 % Girls: 87 %					

The percentages are from the sample.
(R) = Regularly
(O) = Occasionally
* = both repellents coils and space spraying
+ = Burning leaves

and Malle (1985) mentioned this point emphatically.

Self preventive measures

Self preventive measures have not been subjected to detailed studies. Most of the authors examined self preventive measures either as a supplementary study of the main study or as a minor part of it. While undertaking a study on the changing pattern of clinical malaria, Edirisinghe et al (1987) examined the use of preventive measures among the patients who were subjected to the main study. In undertaking a study to find out the correlation between clinical diagnosis of malaria and parasitaemia, Mkawagile and Kihamia (1986) made an effort to examine whether malaria preventive measures protected against parasitaemia. Similarly, Sexton et al (1990) made a comparison of the use of self preventive measures before and after the implementation of a permethrin impregnated curtain and bed net programme. Findings of the studies which quantitatively measured percentages of the users of each self preventive measure are presented in Figure 2.1. The studies which made only observations, without making quantification, will be presented later. However, the numbers presented in Figure 2.1 should not be treated as a proper representation of the malarious areas in the developing world although most of them were undertaken in endemic areas. The figures only indicate the findings of the studies which were captured by the literature survey. Yet the presentation includes some African and Asian countries as well as rural and urban areas in those countries.

Among the self preventive measures, prophylaxis did not appear to be very popular, particularly in rural areas. The only exceptions were 32.5 % of users in the two rural areas of Chibi and Urungwa in Zimbabwe (Stein et al 1988) and 84.3 % of regular users in two timber extraction camps in Myanmar (Hlaing and Maung 1990). The authors did not explain the reasons underlying this behaviour pattern in either study, but the former study found many people were using an incorrect dosage and emphasised the presence of unsupervised drug users in both rural and urban areas. Gardiner et al (1984) were, however, of the view that the greater use of antimalarial drugs for prophylaxis and personal antimalarial measures could be attributed to widespread knowledge about prevention among better educated people in urban areas. On the other hand, only 3.5 % of household heads interviewed by Abyan and Osman (1993), in Afgoi district in Somalia, approved of chloroquine for pregnant women. The authors found this as a cultural barrier and recommended public education/ information with examples to show that this belief had no medical basis.

Among all self preventive measures, mosquito coils appeared to be the

most popular one. However, they also appeared to be much popular in urban than rural areas. Mkawagile and Kihamia (1988) found that 81 % of their study population in the city of Dar es Salaam in Tanzania used mosquito coils. In another study, in the same city, Stephens et al (1991) found that although 80 % of the respondents openly stated that they did not use any domestic mosquito control measures, many respondents preferred mosquito coils because they were cheap and affordable. In that study, insecticide space spraying, bed nets as well as window gauze were not much appreciated by the respondents due to high prices, need for a high quality house (especially for window gauze) etc. Abyan and Osman (1993) mentioned that mosquito coils were used largely by well-off households in rural Somalia. In a study in The Gambia, although Aikins et al (1993) did not mention the percentage of households using mosquito coils, they estimated that the non-users of bed nets spent 43 % more on mosquito coils and a repellent called "churai" than others.

Bed nets appeared to be used in rural as well as urban areas in both continents (i.e., Africa and Asia). But from the community point of view their importance among the currently used mosquito deterrents seemed to be low. In any study the percentage of regular bed net users did not go beyond 26 except in Aikins et al (1993) and Butraporn et al (1986). Moreover Aikins et al's (1994) presentation of the bed net usage percentages in five countries in West Africa indicated both Guinea-Bissau (69 % in 1986) and Senegal (36 % in 1990) had relatively large number of users in addition to The Gambia. But due to the lack of details of the methods used to make those figures only the Gambian study was taken for the comparison in this review.

In explaining poor usage of mosquito nets, Stephens et al (1991) referred to unaffordability, and Abyan and Osman (1993) mentioned their confinement to well-off households. One of the most interesting findings of Wang'ombe (1993) in irrigation schemes in Kenya was the rise in the household's usage of mosquito nets and prophylaxis with the increase in the price of malaria treatment. They further pointed out that those households who had accumulated reserves for meeting costs of malaria treatment appeared more likely to use mosquito nets to avoid malaria. However, Gamage-Mendis et al (1991) found that bed nets were not restricted to any particular group of individuals in a rural village in Sri Lanka. On the other hand, Fungladda and Sornmani (1986) showed a significant association between regular use of mosquito nets and sex, and marital status. In western Thailand, the highest probability for the regular use of bed nets was reported for married females, followed by married males and single females with the

lowest probability with single males. Through direct observations, Aikins et al (1993) found that rural Gambian young and adolescent boys often slept without bed nets outside the rooms. Butraporn et al (1986) raised the possible effect of overcrowded housing conditions on lower use of mosquito nets and sleeping out-of-doors. Singhanetra-Renard (1986) related lower use of mosquito nets to cultural habits; although some people in northern Thailand had moved into better built houses from bamboo huts, they maintained the habit of sleeping on the open balcony without a mosquito net. Lipowsky et al (1992) found a high rate of the use of bed nets in a rural area in Colombia. But they were used mainly as a protection against vampire bats.

Even though the use of bed nets was reported at a high rate in Sabah in Malaysia, Leake and Hii (1989) found that they were not used properly: only 52.5 % and 31.4 % of subjects were using bed nets at the time of observation; while some of them were sleeping outside the bed nets, others were engaged in some activities including watching TV. Snow et al (1988), too, found improper use of bed nets in The Gambia: 35.8 % of individuals got up in the night allowing mosquitos to enter their bed nets; there was at least one mosquito in 27 % of children's bed nets.

It was difficult to make generalizations from the literature reviewed on bed net use. But, there appeared to be a substantial demand for bed nets as a self preventive measure of malaria and/or as a means of avoiding nuisance from mosquitos among the people in endemic areas, though their felt need seemed to be not fully realized due to less affordability. Sexton et al (1990) found that almost 50 % of the respondents who used impregnated curtains under a trial preferred to have bed nets. However, cultural habits (e.g., privacy in The Gambia) and improper use should also be taken into consideration in analysing the demand and use of bed nets.

Other self preventive measures including house screening, repellents, insecticide space spraying, burning husks and leaves etc. were examined by a few authors. As mentioned earlier, Stephens et al (1991) examined the use of window gauze and insecticide space spraying in Dar es Salaam and found low affordability for the urban poor. Effectiveness of those measures were investigated by some authors such as Chiang et al (1990) (repellent/ insecticide bars in Peninsula Malaysia) and Ansari et al (1990) (mosquito repellents marketed in India) and the others observed the use of them in communities.

Use of small fires of dried leaves and woods in the evenings as repellents in rural Indonesia was observed by Pribadi et al (1986). Silva (1991) made similar

observations in a rural district in Sri Lanka. He referred to some practices such as burning a variety of leaves and cashew nut husks along with coconut or paddy husks. He emphasised further the growing of some plants around the house, which were believed to give a smell repulsive to mosquitos. Burning leaves as repellents was reported by 17.1 % of respondents in a study in western Kenya (Ongore et al 1989). Burning an aromatic wood called "churai" was observed by Greenwood (1989) in The Gambia; as mentioned, Aikins et al (1993) estimated the household level cost of churai along with mosquito coils. Aikins et al (1993) further reported the spreading of some leaves including lime and *Azadirachta Indica* around in rooms and sitting places in rural Gambia to repel mosquitos. Aikins et al (1994) presented a list of plants used in Ghana, Sierra Leone and The Gambia as repellents.

MacCormack (1984) made an observation in Kenya that weeds of sisal fibres inserted between the top of the wall and the roof functioned as a screen that let air through but kept mosquitos out. The author further reported that along the swampy cost of Sierra Leone, especially, children completely enveloped themselves in thick cloths made from locally spun and woven cotton as a protective measure. Ekeh and Adeniyi (1986) found farmers in rural Nigeria were rubbing kerosene oil and lime on their arms and legs as a protective measure. Rubbing cow-dung ash and cow's urine on the body and burning cow-dung were also treated as mosquito deterrents in some rural African locations (MacCormack 1984 and Ongore et al 1989). Abyan and Osman (1993) found that while middle income families used a plant called "Qori Qudde" to fumigate houses, low income families used maize ear for the same purpose.

This review has not focused on aetiology, knowledge and attitudes. But most of the studies reviewed looked at those aspects as well to a certain extent. The knowledge about the disease and preventive measures were, however, found to be substantially poor in many study populations. Thus in the comparison of bed net usage along with other control measures in five African countries Aikins et al (1994) concluded that health education programmes should have to play an important role in the control mechanism. Aikins et al (1993) found a close relationship between the level of education and knowledge about the cause of malaria. Wang'ombe (1993) found a positive correlation between educational background and use of mosquito nets as well as prophylactic drugs in rural Kenya. However, self preventive measures were still practised in many rural communities just for the purpose of avoiding nuisance from mosquitos and insects. Apart from that, the level of education, especially health education, and exposure

to control measures seemed to be important factors in determining acceptance of and compliance with preventive services. Although it can be reasonably presumed that affordability would play an important role in determining the type, level and pattern of demand for preventive care, the studies reviewed in this section, except one, did not pay much emphasis to it. Thus the exploration of economic factors underlying the demand for preventive services should certainly make a contribution to fill the gap of knowledge on control measures.

b.Curative care: acceptance and compliance

Several studies attempted to identify health seeking behaviour of patients with symptoms of malaria. Figure 2.2 illustrates the findings of fourteen such studies. Findings of some other studies are not included in this figure due to the differences in their formats in presenting results. But those studies will also be reviewed in this section along with the fourteen studies. However, the studies reviewed here should not be treated as a proper representation of all the countries or at least of the countries in which those studies were undertaken as in the case of Figure 2.1. These were the only studies, which could be found through the literature survey, focusing on the subject covered in this section. Notwithstanding of this fact, these studies could reasonably be used to identify some determinants of health seeking behaviour of malaria and malaria-like patients under different circumstances and, hence, factors affecting demand for curative services.

Most of the studies looked at the treatment behaviour pattern of patients in the areas where a control programme was operating. It seemed that the majority of patients in such areas sought treatment from public sources. In this context, public sources meant not only the control programme but also the other public health outlets and public sponsored treatment agents such as village health workers and volunteers. In Saradidi in Kenya Kaseje et al(1987b) and Mburu et al (1987) found that after the intervention 63.4 % and 85.2 % of patients sought treatment from public sources (mainly village health workers), respectively. Similar results were found by Moir et al (1985) in Madang in Papua New Guinea that 33.98 % of patients in the intervention area sought treatment from voluntary village aids. Trape et al (1987) found that 53.42 % of school children in their study sample in Lingolo in Congo were treated at health centres and school.

Sharma et al (1990) examined the treatment behaviour of an experimental village in the bio-environmental project in Kheda district in India along with a control village in the same district. More than 50 % of patients in both areas sought multiple

Figure 2.2: Use of curative care by study area and type of treatment*

Author/s	Country and area, and the nature of study or focus group	Sample size	SOURCE OF TREATMENT										
			PUBLIC				OTHER SOURCES						
			Malaria clinics+	Village health workers	Other govt. facilities	Total govt.	Drug stores	Self/Home treatment	Traditional healers	Private	Missala-neous	Other	No treatment
Fungladda & Sommani (1986)	Western Thailand (Patients attended malaria clinics)	Cases n=200	24.00	0.50	8.00	32.50	36.00	27.00	4.50				
		Control n=200	53.00	1.00	1.50	55.50	22.50	19.50	2.00	0.50			
Procacci et al (1991)	Zagthouli, Burkina Faso	n=112 (I) n=44 (C)				n.a n.a		56.10 60.20					
Sharma et al (1990)	Kheda district, India	n=766 (I) n=174 (C)	99.35 67.24		11.62 16.67	n.a n.a		0.65 1.15		48.96 83.91			
Mendis et al (1990)	Ketaragama, Sri Lanka	n=3735	75.00<						0.12	2.50			
Mwabu (1986)	Eastern Kenya	n=479			37.70	37.70		7.10			50.00	7.10	
Trape et al (1987)	Linzolo, Congo	n=161			53.42	53.42		40.37				6.25	
Kaseje et al (1987)	Saradidi, Kenya	n=82		51.20	12.20	63.40	28.00	4.90					3.70
Dabis et al (1989)	Conakry, Guinea ?	n=482			4.36	4.36		79.00				16.18	
Mburu et al (1987)	Saradidi, Kenya	Before Intervention n=34 (I) n=11 (C)		0.00 0.00		0.00 0.00	52.90 45.50					47.10 54.50	
		After Intervention n=61 (I) n=31 (C)		85.20 0.00		85.20 0.00	1.60 61.30					13.10 38.70	
Ongore et al (1989)	Western Kenya	n=174			18.70	18.70		74.90					6.40
Moir et al (1985)	Madang, Papua New guinea	n=206 (I) n=266 (C)		33.98 0.00		33.98 0.00					34.46 40.20	31.55 59.80	
Deming et al (1989)	Plateaux Region, Togo	n=507			20.00	20.00		72.00				8.00	
Yeneneh et al (1993)	Women in six rural communities, Ethiopia	n=300			34.00	34.00	45.10		0.70		7.80	12.40	
Jayawardana (1993)	Resettlement area, Sri Lanka	n=142 patients (first source of formal treatment)	6.50	7.00	55.00	68.50			25.00			6.50	

* The percentages are from the sample.

(I) = Intervention area:the area where an intervention was undertaken

(C) = Control area:the area where the intervention was not undertaken but used to make comparisons with the intervention area. For the study of Fungladda & Sommani (1986), however, the control patients were those who had not infected malaria during the past twelve months.

n.a. = not available

Notes:
1. The percentages are presented as they were shown in the respective studies. Totals of the columns are not equal to 100 in some studies.
2. The percentages of Sharma et al (1990) include multiple treatment as well. Thus each percentage indicates the proportion of patients sought treatment from the source at least in one time.
3. Jayawardana (1993) provided information on home treatment and completely ignored cases as well. But sufficient information was not provided in a consistent manner to compute % for each source for all episodes.

treatment. But 99.35 % of patients in the experimental area and 67.24 % in the control area sought treatment from public sources - mainly from malaria workers - as one source of treatment. The authors, by looking only at the figures related to patients who took a single treatment, attempted to show that the effectiveness of the health education component of the control programme in the experimental area could be the reason for the relatively high figure of seeking care from malaria workers in that area (i.e., 98.8 % compared to 30 % in control area). However, when looking at the figures of multiple treatment, it was difficult to make such a conclusion as both areas were having relatively high figures of public treatment. Moreover, the authors did not attempt to correlate the behaviour pattern of patients with their socio-economic status although they had collected ample information on it.

Among the other studies presented in Figure 2.2 only Fungladda and Sornmani (1986) attempted to show the impact of the presence of a control programme on treatment behaviour. They found that in western Thailand while only 32.5 % of control patients sought treatment from public sources (with only 24 % from malaria clinics) this figure was 55.5 % for other patients (with 53 % from malaria clinics). However, it was not clear why the control group of this study consisted of patients who did not suffer from malaria during the past twelve months (called non-malaria cases). Yeneneh et al (1993), found in a village in Ethiopia, that cost of treatment, distance and transportation seemed to have influenced seeking treatment from government clinics in addition to severity of illness of the child; thus although 48.3 % and 34.0 % of mothers preferred to take treatment for the child from a government clinic and a drug shop, respectively, 46.3 % and 56.7 % of such visits were made to those places, respectively. According to the findings of the study the notable difference between the percentages of preference and actual visits for drug shops (i.e., 56.7 - 34.0) could not be attributed to their ineffective treatment; for 83.3 % of respondents, effectiveness of treatment was the reason for preferring a particular source. Moreover, the authors surmised that mothers' awareness of unavailability of drugs in government health centres and a culture barrier (i.e., the rural population felt that they might not get sufficient respect at government institutions) might have affected them to move towards drug shops though in theory they preferred public clinics.

One specific feature of the other studies was the relatively small percentage of patients who sought treatment from public sources except in two cases; both of those studies were undertaken in Sri Lanka (Mendis et al 1990 and Jayawardana 1993). Mendis

et al (1990) made only a rough estimate of the attendance at public malaria clinics in a rural village in Sri Lanka as just over 75 % of all patients. Jayawardana (1993) went further and found that 68.5 % of episodes were treated at public sources as the first formal source of treatment in a new settlement area; this included government western clinics, malaria unit and public field/clinic workers. However, if one makes an attempt to generalize these findings, special emphasis should be given to the representativeness of the study area. Being a new settlement area with provision of health and other facilities still at the initial stage, the study area does not seem to be a representation of the malarious zone or general socio-economic atmosphere in Sri Lanka. Making 25 % of the first visits of patients to Ayurvedic doctors could be due to misspecification of malaria patients or to lower availability of western treatment in the near vicinity of the new settlement at the survey time.

In the other studies, low attendance rates at public sources were reported: 4.36% in Conakry in Guinea (Dabis et al 1989), 18.7 % in western Kenya (Ongore et al 1989) and 20 % in Plateaux Region in Togo (Deming et al 1989). A substantially high percentages of self treatment also were reported in these studies as 79, 74.9 and 72, respectively. However, the latter study found that altogether 44.67 % of patients who visited health centres (both public and private) did not take antimalarials at home indicating that they did not purchase the prescribed drugs. In addition to them, Mwabu (1986) without providing any further explanations just mentioned that 37.7 % of malaria patients in eastern Kenya took treatment from public sources.

Based on the findings of these studies it could be reasonable to conclude that patients preferred to obtain treatment from control programmes, if they had access to them. However, the presence of control programmes did not appear to have had a substantial impact on patients to move towards them in seeking care. For instance, it was revealed from the study of Sharma et al (1990) that although 99.35 % of patients in the experimental area took treatment from malaria workers, almost 48.96 % of them sought treatment from private sources as well. Whether they moved to private doctors after or before seeking treatment from malaria workers was not examined in the study. Another interesting finding was that even after the introduction of the control programme, the percentage of patients who sought treatment from other sources had not gone down notably in some control areas. For instance, Moir et al (1985) found that this percentage was still 31.55 for their intervention area in Papua New Guinea.

As explained in the above paragraphs although some authors identified the

relative importance of various sources of treatment under different circumstances, little attempt was made to identify factors underlying these behaviour patterns. Some authors, however, attempted to identify characteristics of patients who attended different sources of treatment. Ettling et al (1989a) found an under representation of women of all ages and children, in all clinics, except an adequate representation of children at mobile clinics. Reasons for the under representation was, however, not examined by the authors. Similarly, coverage - a reflection of acceptance - slowly declined among children with the increase in age up to 12-14 years in the mass drug distribution campaign in Nicaragua (Garfield and Vermund 1986). They further emphasised geographical variations in participation: coverage rates varied between 49 % in the urban areas to virtually 100 % in many rural areas. Mobility was cited as one reason for low acceptance in urban areas. However, the authors attempted to correlate the acceptance of control measures with literacy rates, and a significant correlation was found with the success of literacy campaigns. This could, however, be a special characteristic of the country in which the study was undertaken.

A reference to the age and sex structure of acceptors was made by Spencer et al (1987) in a study in Saradidi in Kenya. An unexpected consumption pattern was observed by the authors that persons on or above 30 years old and specifically females of 15-59 years old had higher treatment rates than young children. Inclusion of mothers as receivers into treatment lists by VHHs when they brought their children to see them was raised as a probable reason for the over representation of females. But reasons for excess use of treatment by other adults were not clear for the authors.

An interesting study on this line was reported by Glik et al (1989) in Guinea. In examining the behaviour of mothers in seeking treatment for their children by using chloroquine, authors found that socio cultural and structural factors were more important than individual factors in predicting utilization behaviour among mothers. They ruled out knowledge as an explanatory variable in behaviour. Urban-rural differentials coupled with access to health services and pharmacies were found as important determinants. In general, young mothers who had seen a health worker for the last episode of fever, were able to purchase drugs and had gone to obtain drugs from a health professional, would use chloroquine for their febrile children with a probability of .94. In spite of these interesting findings, the authors did not focus on the sources of treatment rather than examining the characteristics of users in a sociological perspective.

The only exceptional study found in the review as an attempt to explain

the treatment behaviour from an economic point of view was Wang'ombe and Mwabu (1993). Although their demand functions for treatment and preventive care had very low explanatory power, probably due to their misspecifications as the authors also accepted in one instance, the exercise as a whole produced at least some useful and interesting clues to explore this so far little exploited area. Firstly, they found a relatively high income elasticity (0.94) for malaria treatment. They also found that a rise in the price of malaria did not cause a fall in the demand for malaria treatment, but, indeed, an increase. This led the authors to make a provocative hypothesis and to justify it to a certain extent: demand for malaria treatment falls into the category of a Giffen Good. In their examination of cross-price effects, seemingly rational behaviour was found in that there was a greater likelihood of using more preventive measures with an increase in income, to avoid the direct cost of treatment.

In addition to the identification of individual characteristics and some socio-cultural characteristics of acceptors, the reviewed studies have not attempted to correlate broad socio-economic aspects of users with acceptance and compliance. Some studies, however, attempted to identify the sources of alternative treatment and the characteristics of non users of control programmes. Reasons for the non use of curative care provided by the control programme were also identified by some authors. This indeed covered a wide range because non acceptors included the patients who sought treatment from other sources and those who did not treat the illness as well. Further, self treatment and ritual/spiritual treatments also came under this category.

Based on the findings of a study in a rural area in the Philippines, Lariosa (1986) made a broad explanation for non use that, in some instances, there was a gap between knowledge and behaviour due to social, cultural and economic constraints. He pointed out that almost 70.6 % of respondents preferred to go to a private doctor and more than 50 % of them did not believe that the personnel of the rural health centre were friendly. (This finding was somewhat similar to the previously brought up cultural barrier in Ethiopia (Yeneneh et al 1993)). But self diagnosis and self treatment were rampant in the study area. In the case of severe illness, they preferred to go to a private practitioner only if it could be afforded. The nearest health centre was seldom open. Similarly, Spencer et al (1987) found that in Saradidi in Kenya, non availability of VHHs at home, non availability of drugs with the VHH and the patient too sick to take treatment from VHH were reasons for not taking treatment from the VHH. Kaseje et al (1987b), too, found that "VHHs were not home" and no drugs with them were the main reasons for

the non use of treatment facilities given by VHHs in Saradidi for 30.0 % and 18.67 % of patients of all ages. Among other reasons they found "patient too sick" and "treated with drug already available at home" were important. Incidentally, Ruebush II et al (1990) found that in Guatemala, that the literacy of voluntary health workers was not an important factor for the use or non use of their services. Waddington and Enyimayew's (1989) findings that in addition to cost, quality, accessibility and acceptability were also important in determining demand for health care seemed to be equally valid for malaria cases as well. Although their findings were based on a study on the impact of user charges, almost 40 % of patients at one of the health centres were malaria cases. One of the most interesting findings was that the elasticity of demand for government health services was greater in the rural areas than the towns. This reiterates the importance of cost and accessibility in seeking care for malaria.

Acceptance of the services of the control programme has, however, been observed by some authors as the second or third stage of treatment. Fungladda and Sornmani (1986) found that 34 % and 24.5 % of malaria patients first sought treatment from drug stores and self medication, respectively. Another 11 % took treatment from traditional healers, health stations and community hospitals before seeking treatment from malaria clinics. 6.5 % patients took treatment from other sources for two times and then attended the malaria clinic. A similar behaviour pattern was observed for the patients of the control group and of them 44.5 % and 2.5 % attended the malaria clinic as second and third source of treatment, respectively. Again in Thailand, Ettling et al (1989b) found 32 %, 18 % and 8 % of positive cases in three clinics sought treatment from other sources prior to the attendance at malaria clinic. The main source of prior treatment was drug stores followed by health posts, private clinic/hospital etc. Fungladda and Sornmani (1986) pointed out that seeking prior treatment from drug stores or self medication was due to the convenience for the patients to buy drugs in their village rather than going to malaria clinics. Ineffectiveness of those sources led them to seek treatment from malaria clinics. However, not many studies attempted to look at the stages of treatment leading people to seek the services provided by the control programme as the final source of treatment. Moir et al (1985) found that 25 % of patients took treatment from two or more sources. But this issue was not explained in detail. As mentioned earlier, Sharma et al (1990), too, found seeking treatment from multiple sources but the behaviour pattern of patients was not examined in detail in that study. In this context, Jayawardana (1993) made an interesting point that the patients in the new settlement area in Sri Lanka,

with increasing experience with malaria, the proportion of cases being dealt with the public clinics increased; i.e., while 51 % of the first formal visits for the first episode were made to government clinics, this percentage was 88 % for the fourth episode.

The above paragraphs, especially the first few of this section, examined the sources of treatment other than the control programme to a certain extent. The way the patients sought treatment from those sources and possible reasons for choosing them will be examined below with more emphasis on informal care: self medication, treatment received from officially not recognized sources, and ritual and spiritual treatment. Ettling et al (1989b) provided a description of sources of treatment of the non-attenders of two malaria clinics. These sources included all those explained in the above paragraph and injectionists. Referring to one clinic, 49 % of patients expressed their inability as the reason for non attendance: e.g., lack of money, time, too ill, no accompanying person etc. In fact, 60 % of these patients did not take treatment at all. In the other clinic, preference was the prime reason for seeking treatment from other sources. Yeneneh et al (1993) pointed to effectiveness as a prime reason for taking treatment from drug shops. Trape et al (1987) found that while 46.58 % of episodes of children were not medically examined, 74.7 % of them were treated by their parents with chloroquine; 12.5 % with other drugs and the remaining 13.3 % was not treated. Procacci et al (1991) just mentioned that 56.1 % of fever cases in an experimental area, where impregnated curtains were distributed, and 60.2 % of cases in the control area were self treated with chloroquine. Deming et al (1989) found that 72 % of cases in a village in Togo were treated at home with chloroquine. Although the authors mentioned that treatment of febrile children at home for malaria had been recommended in local health education projects in Togo, no attempt was made to explain the reasons for the high level of home medication except elaborating advantages and disadvantages of it. Similarly, Gardiner et al (1984) mentioned that 87 % and 94 % of febrile episodes in an urban area and a rural area in Ghana, respectively, were treated at home most commonly with chloroquine. Dabis et al's (1989) findings were somewhat different in that although 79 % of cases were treated at home about 80 % of them were treated at the health facility as well. Jayawardana (1993) found that 56 % of the episodes were first treated at home with analgesics, Aspirin, Disprin or Panadol; children and adults received the same treatment.

Referring to Thailand, Harinasuta (1986) mentioned that availability of drugs in small packets containing small doses of anti-pyretic, anti-inflammatory, analgesic, anti-biotic and anti-malaria was one reason for self medication before visiting

a health facility. Mburu et al (1987) found that most people preferred to go to health facilities for illness of unknown aetiology rather than buying medicine from shops or obtaining treatment from VHHs. It appeared in the literature that, except in very remote areas with very low literacy levels, people in most of the malaria endemic areas were familiar with the symptoms of the disease. This could be the main reason for self treatment. Jayawardana (1993) found that the familiarity with the disease tended to create a confidence among her study population to have their own ability to use malaria tablets which were freely available in the village at health volunteers and family health workers. This review has not attempted to look at symptomatological and etiological aspects related to community behaviour. Yet it is worth mentioning that Jackson (1985) found a close correlation between self diagnosis of malaria (among mothers and children) and clinical diagnosis. Singer and Sawyer (1992) also found some correlation between self diagnosis and the results of serological tests.

Some portion of outward moving patients from publicly provided curative services appeared to have sought treatment from "informal" sources as well. Jackson (1985) found that the mothers in Liberia who did not have access to other treatment sources finally took treatment from "country doctors" to determine the spiritual basis of the situation and to obtain more powerful preparations and ritualistic directives. Many authors attempted to explore patient behaviour in relation to herbal medicine and spiritual/ritual treatment.

In referring to the rural village in the Philippines, Loriosa (1986) pointed out that 81.8 % of respondents used herbal medicines such as "an darayan", "diat" and "talt allikod". Bichmann et al (1991) found in Benin, a slightly higher degree of the use of traditional treatment for malaria; traditional healers were less costly than modern health services. Acceptance of credit was also an incentive to seek treatment from traditional healers. Silva (1991) in his study in a traditional village in Sri Lanka found some persistent folk remedies for malaria. He mentioned even the components of some herbal medicine which were readily available and indigenous to the local area. However, the author stressed the gradual disuse of these preparations and they had been largely replaced by western antimalarials even in the most remote villages. He further found that ritual practices were not normally conducted as part of the healing of malaria. Jayawardana's (1993) study also seemed to have confirmed this finding by saying that only those who believed that illness was due to visitation by a bad spirit resorted to exorcism. Lipowsky et al (1992), however, found a high persistence of using both herbal

medicine and ritual treatment in a rural area in Colombia. They also found a large set of plants, which were easily available in the forest around houses or in the gardens, used for the preparation of herbal medicine. Chloroquine was always combined with a plant remedy as a long tradition of plant treatment. The authors also referred to some ritual treatments related to spleen enlargement that persisted some time ago.

Aikins et al (1993 and 1994) explained in detail the traditional practices of malaria treatment in The Gambia, in particular, and in Ghana, Guinea-Bissau, Senegal and Sierra Leone. They found that nearly half of their study population in The Gambia used some form of traditional treatment. An extreme case of ritual treatment was reported from a polynesian outlier in Papua New Guinea (Feinberg 1990). Although the people were willing to accept medical treatment, they considered it as imbuement of God. The author explained in detail the observed spiritual etiologies. This case should be considered as an extraordinary one as it did not appear to be representative of malarious areas in the developing world. However, as mentioned above, Jackson (1985) in referring to Liberian mothers pointed out that inaccessibility to formal treatment for their children led them to ritual treatment. Yet no special charms or amulets were worn exclusively for the disease. The treatment pattern explained by the author seemed to be a combination of ritual treatment and herbal medicine. But such a combination did not seem to exist in the practices of The Gambia (Aikins et al 1993).

In concluding on treatment practices, it may be interesting to mention the case reported by Dhillon and Kar (1961) in a tribal population in India. Although rituals and ceremonies were considered as a general protection against diseases and calamities, no treatment was taken for fever and malaria was considered as a self-limiting disease. Malaria and fever were believed to have resulted from climatic factors.

Concluding remarks

The literature reviewed in this part focused on various aspects of the control of malaria particularly from a community point of view. They ranged from parasitological studies to studies focused on knowledge, attitudes and perceptions of the users. Thus a wide variety of methods were used by the authors. None of the studies had its prime objective as examining community behaviour in preventive and curative care for malaria, and identifying factors underlying community behaviour. While some studies focused much on these issues, others made an attempt to look at them just as a minor objective of the study or as a supplementary study. Therefore little attempt was made to review the methods adopted in those studies, but rather to generalize their findings on

community behaviour in preventive and curative care.

In general, data on community behaviour were collected through household surveys for most of the studies. Few studies adopted qualitative methods such as focus group discussions and in depth interviews in collecting data. General observations on the habits of the study population were common in many studies. In the analysis, simple frequency distributions and cross-tabulations were the most commonly used tools. Few studies used logistic models and odds ratios, and χ^2 and P values were used by many studies to indicate the statistical significance of observed relationships. Only one study used a regression model but with some specification errors. This indicated that the methods used to examine community behaviour from the economics point of view are still at its infant stage; and, a researcher should have to devise a method for a new study primarily on the basis of the presumed characteristics of the study population and on the experience of the other researchers.

In this review community behaviour was examined from three angles: transmission, prevention and treatment. Not much emphasis was, however, put on transmission; an attempt was made to find out whether there were any socio-economic factors which were associated with transmission, and directly or indirectly related to community behaviour and, hence, with demand for preventive and curative care. Among those factors, occupation and population movements were found important in determining transmission and, hence, health effects of control measures. But these factors have to be treated with caution as their relevance was dependent on the circumstances under which a study was undertaken. Housing conditions were also found to be an important determinant of transmission. Since this variable could be considered as a proxy for living conditions, and have some effect on behaviour (and, hence, on demand for services), further investigations on it may be worthwhile. Poor living conditions, on the one hand, forced people for more exposure to the disease and, on the other hand, constrained them from obtaining benefits from some preventive measures such as spraying, and using some preventive tools. This was largely due to unsuitability of poor housing conditions for some preventive measures and unaffordability of the people who lived in those houses. Moreover, in the absence of any other suitable variable to measure socio-economic status of the target population, housing conditions may be considered as a proxy for it.

Preventive measures provided by control programmes were examined with respect to acceptance, compliance and maintenance. Residual spraying was found to be refused by community members for several reasons including cultural and religious

habits. It seemed that the poor understanding about the causes of the disease and objectives of spraying was not the main reason for refusals and poor compliance was indicated by replastering or washing off walls just after spraying. Cultural and religious factors were important in determining the behaviour only in some countries or locations. However, the findings of the studies reviewed were not sufficient to come to any general conclusion about the reasons underlying refusals indicating that this would be an area for further research.

Among other preventive measures, impregnated bed nets and curtains appeared to have received an appreciable acceptance from target populations. Many of those studies were, however, focused on field trials. Yet poor compliance and irregular maintenance were found by some authors as factors which constrained the achievement of desired health effects from those interventions. Willingness to pay for them was not examined in almost all those studies. This could also be considered as an area for further research. The other preventive measure examined in the review was prophylaxis. This control tool appeared to be facing a problem of poor compliance rather than poor acceptance. Poor knowledge among the users and incapabilities of the providers to make the drug available in time were found to be the most important reasons for poor compliance which sometimes led the users to hoard the drug in some rural areas.

It was attempted to find out whether the community had its own preventive measures to compensate for their poor acceptance of and compliance with preventive measures provided by the control programmes. Self preventive measures varied from self administered prophylaxis, through mosquito coils/nets, to various types of domestic control measures such as burning leaves, and rubbing cow-dung ash and cow's urine on the body. Among those devices, mosquito coils were found to be the most popular, particularly, in urban areas. It appeared that self preventive measures were undertaken in many communities as a protection from mosquito nuisance rather than a malaria control measure. In general, undertaking of self preventive measures was common in almost all endemic areas for either purpose. The reviewed studies, however, had not attempted much to examine the purposes of using these measures. Further research is needed to clarify this issue: to find out whether there exists any relationship between refusals, poor acceptance of and compliance with preventive measures, and self preventive measures. Further, it is necessary to make an attempt to identify socio-economic characteristics of those who use self preventive measures and to link them with their behaviour patterns in prevention. This would certainly make a contribution to fill

the gap of knowledge about the demand for preventive services.

With respect to curative care, intervention of a control programme through the provision of curative care appeared to have made a little impact on the behaviour of patients; dependence on informal treatment including self treatment was still important in many endemic areas where control programmes were operating. Reasons underlying health seeking behaviour, and, hence, demand for curative care from control programmes have not yet been sufficiently examined in the literature. Yet poor access to health facilities or health workers and acquaintance with the disease through exposure to it appeared to have made patients depend on self medication. Although some authors found a movement towards private practitioners in certain areas, this issue was not analyzed sufficiently by any author. As in the case of preventive care, many authors just examined the sources of treatment rather than examining factors underlying behaviour patterns. However, multiple treatment from several sources including private and self treatment, and inconvenience in taking treatment from public sources, were revealed by some studies as some reasons for the seeming dependence on self treatment. Among other sources of treatment ritual/spiritual treatment appeared to have less importance in many endemic areas.

In general, health seeking behaviour of malaria and malaria-like patients has not yet been investigated sufficiently in relation to identifying its socio-economic determinants. More specifically, how socio-economic factors such as income, education, age, sex, occupation etc. influence patients in making a choice among available sources of treatment (in seeking care) still appears to be an unanswered question, and an area for future research.

CHAPTER 3.METHODOLOGY

This chapter presents the methods used in achieving the aims and specific objectives of the study. It begins with restating the aims followed by the specific objectives. With a brief explanation of the link between aims and specific objectives the analytical framework of the study will be presented. This will be followed by the three main sections of the methodology: selection of the study area, sources of data and analysis of data.

3.1 Aims and specific objectives

The aims of this research study (Chapter 1) are as follows:

a. to undertake a cost-effectiveness analysis (CEA) of the AMC in Sri Lanka, through means of a case study in a selected district, with respect to its control strategies and measures, and the programme as a whole;
b. to examine socio-economic factors underlying community behaviour in relation to acceptance of and compliance with preventive and curative care for malaria with a view to enrich the economic evaluation methodology of communicable disease control programmes in developing countries;
c. to explore policy implications from the application of cost-effectiveness analysis along with a community behaviour analysis relevant to the malaria control programme in Sri Lanka.

The study was basically a non-experimental and analytical one. In order to reach the aims, it was undertaken under several steps as specific objectives as follows:

a. To measure the cost and output of provision of services of the AMC by activity level;
b. To measure the cost borne by the community for both preventive and curative care for malaria;
c. To identify the factors underlying community behaviour in relation to preventive and curative care for malaria with special emphasis on socio-economic factors;
d. To measure cost-effectiveness of control of malaria with special emphasis on intermediate outcomes from a societal point of view;
e. To estimate cost implications and efficacy of a set of policy options with a view to enhancing the economic viability of the control of malaria.

The first, second and fourth specific objectives were related to the attainment of the first aim of the study. Under the first specific objective the cost scenario

of the provision of AMAs were analyzed from the provider's point of view. The second specific objective was the examination of cost of AMAs from the receivers' point of view. Findings of the these two exercises were conjoined from a societal point of view under the fourth specific objective to reach the first aim of the study. The third specific objective was directly linked with the second aim of the study. Similarly, the third aim of the study was met through the achievement of the fifth specific objective. However, the achievement of the fifth specific objective was entirely dependent on the success of reaching the first two aims of the study; the findings of the main study and data collected from other sources were used in estimating cost implications of the identified policy options under the fifth specific objective.

3.2 Analytical framework

This study was based on the analytical framework of CEA proposed by Drummond et al (1987) and later developed and adapted by Mills (1992) with respect to malaria control programmes. Guidelines of Phillips et al (1993) were also followed in the analysis. However, the study focused primarily on intermediate health outcomes rather than final health effects. This departure from the conventional CEA and the standard CEAs such as Mills (1989, 1992 and 1993a) and Picard et al (1993) clearly moved the study away from undertaking a Level I analysis proposed by Mills; i.e., choice of malaria control versus other health programmes. Thus this study largely focused on the other three levels of CEA (Mills 1992):

1. Level II: Choice of vector control verses case-detection and treatment as means of malaria control;
2. Level III: Choice of means of case-detection and control; and choice of means of vector control;
3. Level IV: Choice of ways of organizing each activity.

This analytical framework was, however, not sufficient to achieve, particularly, the third and fourth specific objectives of the study. With respect to the fourth specific objective, the literature review clearly showed that in assessing the cost-effectiveness from a societal point view, special emphasis should be put on acceptance and compliance as major determinants of community effectiveness of control tools, which seemed to have not been explicitly handled in the Drummond et al (1987) framework. Thus the analytical framework had to be broadened towards community effectiveness by considering the analytical framework elucidated by Vlassoff and Tanner (1992) and Tanner et al (1993). In this way community perceptions and practices were brought into

the analytical framework. The CEA looked at community effectiveness and assessed effectiveness of control measures incorporating both acceptance and compliance into the CEA. To assess the community effectiveness of a control tool, a new indicator was developed - household level illness rate of malaria (HLIR). For the analysis, HLIR was compared with the acceptance of and compliance with various control measures.

The analytical frameworks of standard CEA or community effectiveness did not suffice to capture socio-economic factors underlying community behaviour in response to the disease. More specifically, although the findings of a community behaviour analysis could be used to enhance the cost-effectiveness of a control programme, the analytical frameworks stated above do not go beyond the realized or observed practices of the community. For instance, they are not capable to provide answers for questions like why didn't some respondents display a full acceptance of or compliance with control measures: was it due to the poor understanding of the benefits of them; was it due to the unaffordability of the service centre, etc. Therefore an analytical framework of community behaviour had to be brought into the study to fill this gap. However, no such a standard analytical framework was found in the literature reviewed except in Hongvivatana (1986). This analytical framework also had some drawbacks as was highlighted in the preceding chapter. Thus a revised version of this framework, which was elucidated in that chapter, was taken as the broad analytical framework for community behaviour.

The policy analysis relating to the fifth specific objective took the form of a sensitivity analysis. To make the analysis simple, under a set of assumptions of the acceptance, compliance and community effectiveness of the control measures concerned, policy analysis was largely confined to the provider's cost.

The following sections provide a description of the methods used to achieve specific objectives of the study. This contains three sections: selection of the study area; sources of data; and analysis of data. The methods adopted in achieving the fifth specific objective are explained in detail in Appendix 2 as this exercise was primarily based on the findings of the main study.

3.3 Study area

Reflection of the malarious zone in the island was the prime criterion used in selecting the study area. The most reliable and feasible indicator to express the endemicity across districts was the API prepared by the AMC. Although the selection of two or more districts could have provided a better basis to undertake comparisons, it

was not feasible primarily due to time and resource constraints. Since the researcher had to take part in data collection, discussions, interviews, observations as well as in co-ordinating field activities, it was extremely difficult to carry out the field work in more than one district at the same time. Even if the field work in another district had been designed to take place after the completion of work in one district, time and resource constraints would have hindered the materialization of such a task. Therefore only one district was selected for the study. By examining API across districts, Matale district was selected for the study in the following manner.

a.Incidence rate

In 1990 and 1991, Matale was the district with the highest API of 67.10 and 89.54, respectively, although it was only ranked fourth in 1989 (Table 3A.1). The HA with the highest API was also in Matale district in 1990 and 1991 (Table 3A.2). The API of this HA (Dambulla) had moved up from 94.50 in 1989 (with the rank of four) to 165.02 and 235.16 in 1990 and 1991, respectively.

It should be noted that although certain districts in Table 3A.1, had relatively high incidence rates and high ranks, some of those districts had to be ruled out due to security reasons; this basically applied to Puttalam and Polonnaruwa districts and to a certain extent to Anuradhapura district. APIs of all other districts in Table 3A.1, except Kurunegala, declined in 1990. But the general trend in 1991 was the increase in API in almost all districts. Although the API in Kurunegala district was relatively high, it does not represent different climatic conditions and, hence, variations in the incidence rate among HAs - a prominent feature in Matale district (please see other considerations). As Table 3A.3 indicates, while the majority of HAs (i.e., eight) in this district had relatively low APIs during the three years concerned, relatively high APIs were reported in only four out of the 13 HAs. In practical terms, however, it is difficult to undertake a field study in this district covering the whole district given the resource and time constraints; it covers nearly 10 percent of the population and land area of the island. The latter aspect was equally valid for Anuradhapura, Polonnaruwa and Moneragala districts as well (Figure 3.1).

b.Other considerations

Even though endemicity was the prime criterion in selecting the district, given the scope of the study, certain other aspects, which will be explained below, were also taken into account in providing a further justification for the selection. For instance, if the selected district was the poorest one in the island, a generalization of the findings

of the study for the whole malarious zone would have less validity. Such an attempt in Sri Lanka was highlighted in the literature review (Jayawardana 1993). Thus the variables considered for further justification of the selection of Matale district were climatic conditions, types of vectors, proportion of species (P. vivax and P.falciparum), control activities of the AMC and availability of sources of treatment other than the public MCs. Each of these will be explained below in order to provide a brief introduction to the district as well.

Climatic conditions

Matale district is located in the Central Province bordering to Kandy district, and the provinces of North Western, North Central, Uva and Eastern. One specific characteristic of Matale district is that it covers all three climatic zones, namely, dry, intermediate and wet (Figure 3.1) and incidence rates of malaria in those zones are normally high, moderate and low, respectively. This is the existing malaria prevalence pattern in the island as well. The general presumption that the incidence is relatively high in the new settlements in the dry zone (Jayawardana 1993) could also be observed in Matale district; the district consisted of old settlements as well as new ones.

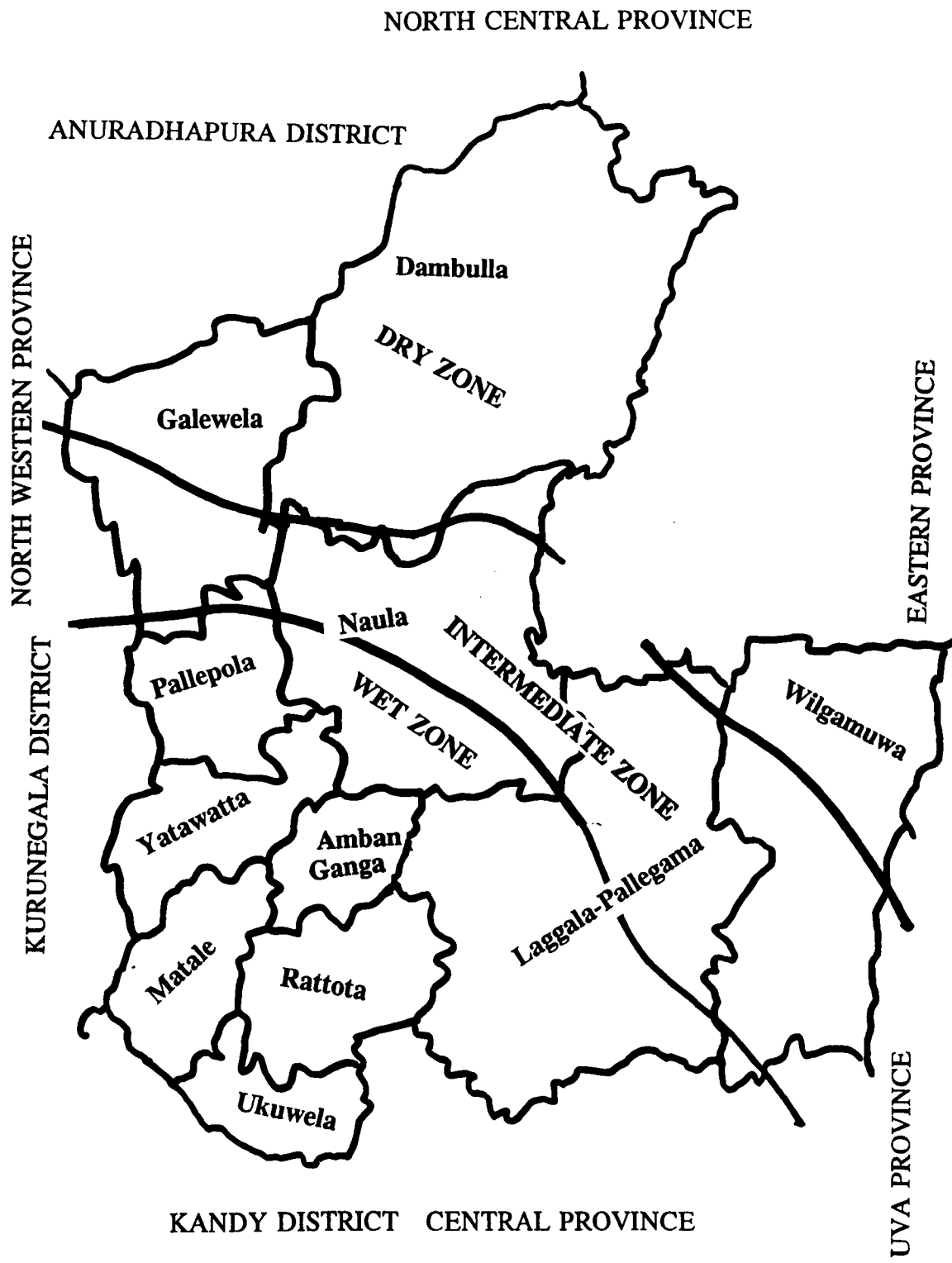
Vectors and species

Although it was not possible to provide accurate data on the types of vectors (mainly A.culicifacies) in the selected study area, AMC reports indicated that the proportions of the species (i.e., P.vivax and P.falciparum) in Matale district were almost equal to national figures in 1990; while national figures stood at 79.44 and 20.22 for the two species, respectively, they were 75.70 and 23.98 for the selected district (AMC 1990). In 1991, however, P.falciparum (p.f) proportion in Matale district had risen to 27.31, while the national figure was 18.83 (Table 3A.4). A comparison across districts, however, shows a wide variation of p.f proportions in almost all districts. Among the highly malarious districts this proportion varied between 20 and 30 except in four districts (i.e., Polonnaruwa, Moneragala, Hambantota and Trincomalee).

Control activities

In general, the AMC undertakes its conventional control methods such as residual spraying, case detection and treatment, fogging, larvicide spraying etc. at almost the same rate in all malarious areas. Measures such as impregnation of mosquito nets were, however, carried out in only few districts. Among other activities, source reduction is carried out with a focus on breeding places such as abandoned gem pits which are common in certain parts of Matale district.

FIGURE 3.1: MAP OF MATALE DISTRICT WITH CLIMATIC ZONES AND HEALTH AREAS



Health care services

As in any other district, health care services in Matale district are provided by the public sector as well as by private practitioners; this includes both western and ayurvedic treatments (Table 3A.5). In 1991, 31 fixed public MCs were functioning in the district; one Base Hospital (BH), 4 district hospitals (DH), 4 Peripheral units (PU), 4 Rural hospitals (RH) and 18 Central dispensaries/ Central dispensary and maternity homes (CDs). There were 36 private western doctors, 19 public ayurvedic doctors and 44 private ayurvedic doctors in the district in 1991 (Table 3A.5). Matale district does not have a Provincial Hospital. This is a feature of many endemic districts such as Puttalam and Polonnaruwa. But Moneragala district does not have even a BH. In the malarious zone, Provincial Hospitals exist only in Anuradhapura and Kurunegala districts. Thus, public health facilities in Matale district are at the average level compared to other malarious districts. Although no evidence is available, it is reasonable to presume that the existing practices, in rural areas, on various types of non-formal treatment practices such as ceremonial treatment (i.e., religious practices) and self treatment could be equally observed in Matale district.

Socio-economic and cultural background

In 1991, 82.53 % of its population were Sinhalese, 9.59 % were Tamils, 7.74 % were Moors and the remaining.14 % belonged to other ethnic groups (Statistical Branch, Matale, 1991). While the majority of Sinhalese and Tamils were Buddhists and Hindus, respectively, Moors were Muslims. The rest of the population were normally Christians; thus, it was a mixture of all the major religions in the island. Matale district consists of old villages and new settlements, as well as relatively developed townships with good infrastructure facilities. All the townships are well connected by a good road network, and a public and private transport system but there are many villages with extremely poor road facilities. However, public schools are functioning even in the most remote areas of the district. Although most of the commercial banks are centred in the main townships such as Matale, Dambulla and Galewela, branches of the two main public commercial banks are spread throughout the district along with rural banks. With this background, among the districts in the malarious zone, Matale district is clearly in between the most remote and less developed rural districts such as Moneragala, and districts such as Kurunegala with relatively better socio-economic status and infrastructure facilities.

3.4 Sources of data

Both quantitative and qualitative data were collected for the study and the main sources of quantitative data were a) Official records and reports, b) the Time allocation study and c) the Household survey. Discussions, observations and interviews were the sources of qualitative data. Each of them is explained below.

a.Official records and reports

Year of reference for the data collected through this source was 1992. Records and reports of the following institutions were used to collect relevant data:

I. Regional Malaria Office, Matale (RMOM)
II. Office of the DPDHS, Matale
III. Other (i.e., Offices of DDHSs, MCs, DAMC, MoH etc.,)

The data collected from these three institutions were largely related to the achievement of the first, fourth and fifth specific objectives. Thus cost of the provision of AMAs and outputs of those activities were collected from these institutions.

RMOM

Three types of data were collected from the RMOM: a) payments made for certain inputs, b) quantities used of certain inputs and c) information on control activities. The first type of data were on fuel, repairs and maintenance, postal and telephone charges, water supply, electricity, rent of malathion stores at HA level, and payments made using petty cash given by the DPDHS. However, the records on fuel were not directly related to the year 1992. They were the payments made during the year irrespective of the time at which fuel was used. Suppliers had a practice of submitting vouchers for a set of purchases made during a long period (i.e., normally one month or two). Similarly, payments on repair and maintenance (for buildings and vehicles) also referred to the time at which those payments were made[1]. Records on payments for postal, telephone, water supply, electricity etc., also suffered from the same weakness. However, the payments made by petty cash ledger related to the year concerned. This included payments on caustic soda (sodium hydroxide), kerosine oil, polythene bags, torch batteries and bulbs, mantels, small repairs of vehicles such as changing a tube etc.

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[1] Vouchers of all these payments were at the DPDHS office. But at the time of data collection they were with the auditors for the annual audit enquiry. However, by scanning them it was found that even if they were available for full screening, it would be a highly time consuming task to separate out the vouchers for the year concerned. Methods adopted to resolve this problems will be presented in the following sections.

The second type of data referred primarily to the inputs provided by the DAMC and DPDHS. Thus a) issue of malathion to each HA, b) distribution of drugs to MCs, DDHS etc., c) distribution of spraying spare parts to DDHSs and spraying units, provision of uniforms to AMC workers, and d) use of Permethrin, Abate, stationery, office equipment etc., were collected as quantities. Running charts of the vehicles belonged to the RMOM were also collected.

The RMOM was the focal point for collecting data on control activities. Monthly data on collection of blood films and case detection at all the MCs and Special Programmes (SPs) were available at the RMOM; Laboratory Form 3 provided a summary of those data. For AMC employees, any intervention apart from their routine duties was a SP. This included mobile clinics (MBCs), police mobile clinics (PMCs), other mobile clinics (MBCOs), special spraying programmes (SSPs), fever surveys (FSs), mass blood surveys (MBSs) and mosquito net impregnation (MNI)[2]. However, some information of SPs such as duration of intervention, people involved, and use of vehicles, fuel and drugs were not complete. This deficiency was common for the SPs organized and conducted by DDHSs. Finally, details of the perennial residual spraying programme (PRSP) such as number of houses fully/ partially sprayed, number of refusals, closed houses, use of malathion and population of the coverage area, were collected from the monthly progress reports prepared by the RMOM at HA level.

DPDHS Office

The most important set of data collected from the DPDHS office was personnel emoluments. They were collected on five types of employees: a) Permanent employees attached to the RMOM, b) Permanent employees attached to DDHS offices and engaged only in AMAs (e.g., PHIs, FAs and SMOs), c) Permanent employees attached to DDHSs with some involvement in AMAs (e.g., PHWs), d) Permanent employees attached to MCs with some involvement in AMAs (e.g., doctors, nurses, attendants) and e) All the temporary workers paid by the district malaria budget, and the employees attached to DPDHS office with some engagement in AMAs (e.g.,DPDHS, Accountant, clerical staff).

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[2] A PMC is mobile clinic run as one of the services provided at a mobile service centre organized by a police station in its service area in order to develop close relationship with the community in collaboration with temples and schools in that area. A MBCO is a mobile clinic run by a medical officer for general patients in the catchment area of his/her MC by his/her own initiative.

For the first two categories, data were collected on their monthly salaries, and travelling and subsistence payments. Salary figures were taken from the Personnel Emolument Register. There was a separate register for travelling and subsistence; they were paid for a) all the permanent AMC employees for their engagement in duties after working hours and/or SPs and b) for the permanent employees attached to perennial residual spraying (PRS) units for travelling. For all other categories, only monthly salary or wage figures were collected from the personnel emolument register as they were not entitled to receive any other payments for their AMAs.

In addition to the personnel emolument figures, detailed monthly financial statements of each health project and programme under the DPDHS were also collected; data on payments for inpatient food were included in those statements. Only the summary statements of hospital food supplies were collected but they were prepared for three hospital categories making both PUs and RHs one category. Collection of hospital food records for each hospital was not undertaken due to two reasons. First, with the limited access to screen their original vouchers (due to the audit enquiry) it was not possible to do it during the given time period. Secondly, a scanning of payment vouchers showed that it would be a highly time consuming task. Thus the collection of data on hospital food supplies was confined to the available aggregate monthly figures for the three categories of hospitals.

Other sources

Other sources were used either to fill the data gaps or to resolve problems encountered in collecting data from the above sources. With respect to prices, DAMC was the source to obtain prices of malathion, spraying spare parts etc. Prices of supplies such as stationary were taken from the Government Supplies Department. Drug stores of the MoH was the source to obtain prices of drugs and chemicals. Records of the Sri Lanka Customs Department were screened to get the replacement cost of capital inputs such as vehicles and microscopes.

For other types of data, firstly, running charts of the vehicles used by the DDHSs for AMAs were collected from those offices. Through the DPDHS a request was made to all MC to provide a report of the use of anti-malaria drugs during 1992 and visits were made to the MCs which did not respond in time. Data on patient attendance at MCs were collected from the returns sent by the MCs to the Medical Statistics Division of MoH. To measure replacement cost of hospital buildings and the rental value of RMOM, required information was collected from three real estate businessmen in the

district; e.g., average replacement cost per square foot.

b. Time allocation study

The prime purpose of the time allocation study (TAS) was to generate a data base to facilitate the undertaking of a cost apportionment exercise (of personnel emoluments) at activity level. This information was essential as many employees of the AMC and the other health outlets of the district had multi functions. Thus the TAS served the first specific objective and indirectly the fourth and fifth specific objectives of the study.

A general time allocation questionnaire (TAQ) was designed for all employees (Appendix 3). The TAQ was not, however, possible to administer among some employees who were primarily engaged in administration and /or management of AMAs because they were not in a position to apportion their time contribution among AMAs. Their contribution can, however, be regarded as a type of overhead cost of the control programme (Drummond et al 1987). For instance, the DPDHS emphasised that, on average, he spent one full working day of a week on AMAs without specifying the time proportions for each activity. Similar responses were given by the accountant and clerical staff. Thus it was not attempted go beyond the interview with them. However, DDHSs and the RMO attempted to fill the TAQ as they had a basis to do so with their direct involvement in AMAs (although their duties were related to administrative and managerial matters). The TAQ was administered to all other employees under DPDHS in section 3.4a; the exception was the temporary workers who were not involved in AMAs but paid by the district malaria budget.

The TAQ was administered to the employees of the RMOM at that office. With the help of DDHSs, meetings of the employees under their supervision (i.e., PHIs, FAs, SMOs and PHWs) were held at their offices and the TAQ was administered to them at those meetings. At Galewela HA such a meeting was held for the AMC workers on their salary day and at Naula HA it was the review meeting of all AMC workers after the completion of one spraying cycle. At some HAs such as Laggala-Pallegama, Rattota, Dambulla and Yatawatta at the end of the monthly meetings of all PHWs (including AMC PHIs and FAs) with the DDHS, the TAQ was administered to all the participants. Thus there was no uniformity in administering the TAQ as it was not possible to collect all the employees of each HA for those meetings. Therefore, after developing contacts with PHIs and FAs at the meetings held at DDHS offices, field visits were made to meet spraying teams and other employees such as PHWs.

Each MC of the malarious zone was visited and after a discussion with the medical officer in-charge of the MC, the TAQ was administered to relevant employees; i.e., at hospitals, employees of the wards allocated for non-malaria patients were not interviewed.

c. Household survey

Objectives

The main objective of the household survey (HHS) was to identify how the community behaved in relation to curative and preventive care for malaria at the household (HH) level. In general, this involved the community response to the disease and specifically, the identification of socio-economic factors underlying community behaviour and the cost borne by the community due to the disease. Thus it served primarily for the achievement of second, third and fourth specific objectives of the study.

One month was taken as the recall period for curative care and identification of cases was done on the basis of the responses of patients. The reasons underlying the belief of having had malaria during the recall period were examined in detail; for instance, patients were asked how was it confirmed that they had malaria: e.g., was it due to taking a blood test at a public/private MC, was it due to the statement of the public/private doctor at the MC with no blood testing facilities (BTF) etc[3]. With respect to residual spraying, firstly, the general attitude towards spraying was examined followed by a detailed examination of the community response for the last visit of the spraying team. It was assumed that the detailed information on the last spraying round was sufficient for the estimation of cost borne by the community in accepting residual spraying. For self preventive measures, however, due to the seasonality of the disease and the presence of mosquito nuisance, and the undertaking of the HHS covering one of the peak seasons of the disease, confinement of the reference period to a fixed period preceding the HHS would have generated biased results. Therefore, for all those measures such as mosquito nets, prophylactic treatment and burning coils and leaves, the previous year (i.e., 1992) was taken as the reference period. The main aspects of the study population covered by the HHS were:

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[3] From the economics point of view it is quite reasonable to include all the costs borne by a patient, who believes he/she has malaria, into the cost analysis (and then in the CEA) unless otherwise it has been proved as a non-malarious case by a proper diagnostic procedure.

a) socio-economic characteristics
b) incidence of malaria
c) behaviour pattern of malaria patients in seeking care from various sources and types of treatment
d) time lost to the patient and how it was recovered
e) time lost to the other HH members and how it was recovered
f) cost borne by patients and their HH members on treatment due to the illness of malaria
g) community behaviour in response to malaria with respect to preventive care; time, materials and cost involved in self preventive measures for malaria and in acceptance of and compliance for the preventive measures of AMC
h) perceptions on illness, treatment and preventive care for malaria, and control strategies of the AMC

(see Appendix 4 for the HHS questionnaire)

Sampling method

A random sample was selected from the HHs in an area of the study district which was demarcated as the malarious zone by the AMC for operational purposes. The reason for the adoption of this method was to obtain a representation of the total population of the malarious zone rather than merely the patients to generate a data base to achieve the objectives of the study. Thus it provided a basis to identify the community behaviour in response to the disease; patients were a sub set of the sample. The cluster sampling method suggested by Bennett et al (1991) was used to determine the sample size and the number of clusters (i.e.,GNDs[4]) (See Appendix 5 for details of the sampling method).

The resulting number of clusters was 54 which made the sample size equal to 1080 HH units and about 5500 respondents. The 54 clusters were distributed among the GNDs in the malarious zone by using the *probability proportional to size (PPS)* method (Bennett et al 1991). HHs from each selected GND for the sample were randomly selected from the "Registry of household heads" of each GND, which were available at the District Secretariat, Matale.

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[4] Literally Grama Niladhari Division (GND) means the division of village officer. This is the lowest public administration unit in the island. It comprises one or a few villages, depending on the population size of each village.

Undertaking the household survey

Before the HHS, a pilot survey was undertaken in the malarious zone covering 20 randomly selected HHs; 9 from Dambulla HA, and 6, 4 and 2 from Naula, Matale and Rattota HAs, respectively, according to population proportions. They were out of the selected villages for the HHS and two questionnaires were administered in each village. Based on the findings of the piloting, the questionnaire was revised. However, only a few structural changes were made in the questionnaire. One such major change was the shifting of the question on the confirmation of the disease from the beginning of Form 2 to a place just after the explaining of all treatment sources. It was found from the pilot survey that asking this question first may mislead the field interviewers and leave out the patients who believed they had malaria but that was not confirmed through a blood test. Most of the revisions were, largely, additions made to the expected responses. For instance, for the questions on the reasons for accepting or using different preventive measures, many respondents referred to the need to get rid of mosquitos rather than malaria. Although this indirectly meant the need to avoid malaria, as a convention many respondents used to refer to mosquitos. Therefore answers such as "to get rid of mosquito nuisance", "to reduce mosquitos" and "as it was the mosquito season" were added to the responses. Expected responses for some questions also were reformulated to make them more clearer to the respondent. For instance, the term prophylaxis was replaced by its colloquial term, *sathi peththa,* which literally means the tablet to be taken weekly.

Two graduates, who were residents of Matale district and had experience in field research, were selected as Field Supervisors. Initially ten Field Investigators were selected from different parts of the district through interviews. They were school leavers after appearing for the G.C.E.(A/L) Examination.

A two week training programme was held for all the field workers in December 1992 at the research co-ordinating office in Naula town. The RMO, Matale also took part in the training programme by explaining all necessary particulars of the AMC control programme and the disease itself to the trainees. As part of the training, trainees were taken to some selected villages, which were not covered by the survey, and asked to administer a sample questionnaire at randomly selected HHs. Throughout the training programme, five questionnaires were administered by each trainee. The Investigator helped them to undertake that exercise. A group discussion followed after each field exercise. After evaluating the performance of 10 Field Investigators, only 8 were selected for the HHS.

Before the survey, heads of selected HHs were informed (by mail) the selection of his/her HH for the survey and the date of the survey; a request was made to assist the Field Investigator to carry out the survey. The HHS was initiated on January 4, 1994 and ended on 10 March 1994.

d. Discussions, interviews and observations

Discussions, interviews and observations (DIOs) were conducted at different stages of the study with five main objectives:

a) to resolve problems encountered in collecting data from official sources;
b) to test the validity and consistency of the responses for the TAS and to obtain some understanding about the time allocation pattern of the employees to whom the TAQ could not be administered;
c) to test the validity and consistency of the HH questionnaire and to identify the limitations of it with the view of modifying it;
d) to develop a close relationship with the community members with a view of receiving their co-operation to carry out the HHS successfully;
e) to obtain an in depth understanding of community behaviour in relation to the aspects covered by the HHS;

Collection of qualitative data with these objectives was related to all the five specific objectives of the study. The first two objectives of DIOs were primarily related to the first and fourth specific objectives. The last three objectives of the DIOs had a close link with the second, third and fourth specific objectives as those DIOs were based on the HH questionnaire or linked with the administering of it. The details of the DIOs undertaken under each objective are presented below.

For the first objective, discussions were initially held with the DPDHS, RMO and the Accountant of the DPDHS office to get an understanding about the district level malaria control programme, operational problems encountered at implementation level and financial procedures (especially the changes that took place after decentralization). Discussions were held with DDHSs and medical officers in-charge of MCs as part of the TAS but those discussions went beyond the TAQ and focused on operational problems of the control programme. Throughout the data collection period a series of informal discussions were held with different level of employees to get a through understanding about AMAs and related costing and effectiveness issues. Finally the director of the DAMC was interviewed on the new control strategies and measures introduced with a view of identifying a set of policy options to achieve the fifth specific

objective of the study.

For the second objective, firstly, some employees who responded to the TAQ were interviewed to get an idea of the time allocation patterns of their fellow workers who were absent for the interviews. Secondly, immediate supervisors of respondents were asked to explain their time allocation pattern; and, on the basis of those interviews, entries of the questionnaires of some employees were revised to maintain consistency. Finally, a further consistency test was undertaken by asking DDHSs and the RMO to provide information on the time allocation pattern of the supervisory level employees who were under their immediate control.

For the third objective, about thirty randomly selected people were informally interviewed from different parts of the district (while undertaking the pilot survey) with a view to ascertain the validity of questions included in the questionnaire. For instance, the pilot survey confirmed that the study population was well aware of the name of the disease (i.e., malaria) and no local names were used for it[5].

For the fourth objective, whenever time permitted, prior visits were made to the selected GNDs to meet the respective GNs[6]. On the directions of the GN, brief discussions were held with some village leaders. When the GN was not available, visits were made to village boutiques[7] to have brief discussions with the people gathered at those places. All these visits and discussions along with the pre posted letter to the selected HHs produced fruitful results with a 96 % response rate for the HHS.

For the fifth objective, a large number of DIOs were made while the HHS was being undertaken. Completed questionnaires were screened in the field itself on the same day and a second visit was made to some HHs by the Investigator or a Field Supervisor when the responses were found to be examined in detail; e.g., a second visit was made to HHs which were refused by sprayers; five cases were reported from one HH but all of them had not taken treatment from the same source - a second visit and a

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[5] This was primarily due to the continuous operations of AMAs even in the most remote areas in the island for over a half century.

[6] GN (Grama Niladhari) literally means village officer. GN is the officer who handles all public administrative matters within the GND.

[7] This is a small tea shop (with some groceries) at a central point of the village. It is a common practice of rural folks to make visits to it to read the news paper available at that place and/or have a cup of tea and to have a chat with fellow villages on any interesting issue.

discussion led to a better understanding of the behaviour pattern of that HH. As a usual practice, whenever time permitted, the Investigator met the villagers either at the village boutique or at homes in the GND covered for the day and had informal discussions with them on the disease and control measures. Through the informal discussions at village boutiques when it was possible to select a good respondent, the Investigator made a visit to his/her house (normally on his/her invitation) and had a detailed discussion. Since these DIOs were undertaken in an informal manner, no attempt was made to count them. Instead, notes were taken down when the responses seemed to be important for the analysis.

In addition to discussions and interviews, field investigators were asked to make a detailed inspection of some selected houses and ascertain whether the respondents had given correct answers on residual spraying. These observations were made in 20 randomly selected GNDs[8]. Field investigators were asked to check in and around the dwelling of the first HH (of the survey day) which stated full acceptance of spraying and to write a brief report on the spot.

Two discussions were held with the VHWs of Galewela and Dambulla HAs. The first one was organized by the DDHS at his office and twelve VHWs attended. The second one was conducted after a training programme for them at Dambulla DDHS office and ten VHWs participated[9]. Three more VHWs were met during field visits; two in Dambulla and one in Laggala-Pallegama HA. These discussions focused on their activities and socio-economic backgrounds, and problems encountered in undertaking AMAs.

Finally, without any prior arrangement the HHS and residual spraying were carried out in the same GND on two occasions. This provided an opportunity to observe the behaviour of sprayers as well as the community response for sprayers.

3.5 Analysis

DBASE IV was used for the data entry and both QUATTRO PRO and SPSSPC+ were used for the analysis. The analysis of the main study was undertaken under four headings: cost of provision of services, community cost, community response

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[8] This procedure was introduced only a few weeks after the commencement of the survey with a view to test the validity of responses on spraying.

[9] The VHWs of Dambulla HA were, however, not engaged in AMAs in 1992. Disposal of drugs to VHWs in Dambulla HA was suspended in 1992 (See footnote 10).

to the disease and cost-effectiveness.

a. Measurement of the cost of provision of services

The following guidelines were used to measure the cost of provision of services. This included the resources provided by the DAMC and the MoH through the allocations for the Central Province. No donations were made directly to the district AMAs in 1992.

I. Classification of activities

Defined the number and type of AMAs undertaken by the public health system of the district in 1992.

II. Identification of resources

Identified and listed out the types of resources used to undertake each activity both at field level and at the stations (i.e., RMOM and public MCs).

III. Determination of recurrent cost at current prices

Used actual expenditure records, vote ledgers and other financial reports of RMOM, DDHS offices, DPDHS office, MoH, Government Supplies Department and the DAMC where appropriate to estimate the actual expenditure incurred on each resource during the year.

IV. Determination of capital cost at current prices

Replacement cost was measured for buildings, vehicles and equipment (i.e., microscopes and spray machines) using the "high side" World Bank discount rate of 10 % (Creese and Parker 1991) to produce equal annual economic costs.

V. Measurement of the cost of inputs supplied by sources other than the government in assisting the provision of services by the AMC

Only the contribution of the VHWs came under this category. However, distribution of anti-malaria drugs among the VHWs in Dambulla HA was suspended in 1992[10]. Only the VHWs in Galewela, Naula and Laggala-Pallegama HAs took part in AMAs in 1992. But the discussions and interviews with them revealed that they spent only a marginal amount of time on AMAs. Most of them were unemployed and had spare time to engage in AMAs. Their main contribution was to treat the suspected patients who sought treatment from them. Only a few VHWs visited the houses of fever patients. Thus

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[10] One VHW committed suicide by taking an overdose of anti-malaria drugs.

no attempt was made to value their time contribution[11].

VI. Determination of total cost at district level at current prices

The sum of all cost items in above (III) and (IV) was the provider's cost on AMAs at the district level. This total, however, did not include the contributions of the personnel at the DAMC, the MoH head office and the Provincial Health Administration Office to the district level AMAs; contributions from the personnel at the DAMC and the MoH came up only with respect to policy formulation, providing guidelines for action and research. Similarly, the contribution from the provincial authorities was also involved in supervision and provision of guidelines for action. The only way to include their contribution was to administer the TAQ among them and add a proportion of their emoluments to the provider's cost. But a discussion with the PDHS revealed that he was not in a position to provide any indication of his involvement in AMAs in Matale district. Similar result would have been found if the DAMC employees were interviewed. By screening the expenditure reports of those institutions, it was found that even if the time proportions of those employees were included, their total value would not make any notable difference in the cost estimates. Therefore only the cost of their involvement in purchasing and distributing inputs to the district was added to the prices of those inputs under above (III).

The Economic Research Department of the Central Bank of Sri Lanka was consulted on shadow pricing. It was found that since Sri Lanka was an open economy with a liberalized foreign trade regime, it did not use a standard conversion factor in project appraisals; for this purpose, the bank only looked at the future variations in the exchange rates. Thus on a possibly unrealistic assumption that market prices reflected economic prices of all inputs, no adjustments were made to the financial cost of inputs.

VII. Allocation of cost among activities

The provider's cost was apportioned into 16 activities and they are presented in Table 4.8 in Chapter 4. Findings of the TAS were used to apportion personnel emoluments among activities. For other resources, observations, discussions and screening of service charts (e.g., running charts of vehicles) were used to determine allocation proportions for each activity.

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[11] Even if it was valued, it would have been a small amount with no significant effect on total cost.

VIII. Testing consistency of cost estimates and further adjustments

Proportions used for the cost apportionment exercise were repeatedly checked by a series of discussions held with the employees concerned. They were found to have some weaknesses. Respondents were not in a position to allocate their time correctly, especially among the activities for which they spent only a small proportion of their time. Employees of the RMOM were unable to provide the proportions of their time spent in each HA for each activity[12]. Therefore a small portion of the total cost of AMAs was not apportioned at HA level and left as unspecified. Given the time constraint, no attempt was made to check the consistency of cost estimates based on the cost apportionment approach by re-estimating them through the direct cost measurement approach. Since the possibility of having such discrepancies was high for the activities which consumed small proportions of inputs, direct cost measurements were made only for those activities (i.e., mobile clinics, special spraying, fever surveys, mass blood surveys and mosquito net impregnation).

b. Estimation of community cost

Estimation of community cost was based on the HHS. Following Drummond et al (1987) community cost was classified into two categories as direct and indirect cost for curative and preventive care separately (Figure 3.2). Two new features which appear in Figure 3.2 are cost of ritual treatment and self treatment. Ritual treatment refers to the performance of any religious activity by the patient, HH members, relatives, friends etc., with a view to get some relief for the patient. Any cost involved in organizing ritual acts comes under direct costs and the time cost of those involved in them comes under indirect costs. Self treatment refers to any type of treatment (other than ritual treatment) taken by patients on their own initiative before or after taking treatment from a formal source of treatment; thus, the term "formal source of treatment" refers to all the sources of treatment except self and ritual. Specifically, this includes all public and private treatment centres including ayurvedic clinics, field workers of AMC, PHWs under DDHSs and VHWs.

Community costs were measured within the periphery of the HH. But the concept of "household" was defined very broadly; a HH consists of a set of people who treat one particular dwelling as their permanent residence. This definition, indeed, goes beyond the boundaries of the conventional definitions of HH and moves closer to the

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[12] Most of the SPs were conducted with the involvement of employees of the RMOM.

Figure 3.2: Identification of community cost of curative and preventive care for malaria

Type of cost / Type of care	Curative	Preventive
Direct	1. Cost of treatment 1.1 From public MCs a. Treatment cost b. Prescribed drugs c. Special food 1.2 From other formal sources of treatment a. Treatment cost b. Prescribed drugs c. Medical tests d. Special food 1.3 Self treatment 1.4 Ritual treatment 2. Travel cost Travel cost of the patient and the person/s accompanied the patient for treatment	1. Cost of prophylactic treatment 2. Cost of repellents 3. Cost of mosquito nets 4. Cost of replastering or repainting after spraying 5. Cost of any measurable side effect of spraying, prophylaxis or MNs impregnation 6. Contributions for the preventive activities organized by community organizations 7. Cost of any other preventive measure
Indirect	1. Loss of time of the patient due to illness including travel time and waiting time for treatment 2. Loss of time of the HH member/s accompanied the patient for treatment 3. Loss of time of the HH member/s attended the patient during the period of illness	1. Time lost for the preparation of house before and after spraying 2. Time spent for the impregnation of mosquito nets 3. Time contribution for the preventive activities organized by the community

concept of family. No attempt was made to explore this definition along with the ongoing debate (Bernstein et al 1992, and Mackintosh 1989). With this definition, people who lived outside their permanent residence for purposes such as employment and studies were also considered as HH members of their permanent residence. Given this framework, costs borne by the people outside the HH either in monetary terms or in time were not included in the analysis. For instance, some patients were accompanied by a friend or relative to the treatment centre. But information on their socio-economic status was not available to make any cost measurement of their loss of time.

Direct cost

Measurement of direct cost of curative care not only involved direct payments for treatment but also certain items for which patients had not made any payment but had used; e.g., using king coconuts or young coconuts plucked from the home garden as a special drink/food. Similarly, available home stock of coriander, dried herbal mixtures or disprin/ aspirin/ panadol were used by some patients as self treatment. Market prices of those items collected through discussions were used to value them.

Direct cost on curative care was decomposed into two categories: cost of receiving treatment (RC) and cost of compliance (CC). RC refers to the cost borne by the patient to receive treatment from a formal source; thus, it includes travel cost of patient and accompanied person/s, treatment cost, cost of any prescribed drugs and payments for medical tests for a private clinic. The term compliance is used for the second cost category in a broad sense, in that it encompasses all types of direct cost borne by the patient as part of treatment but in addition to RC. Thus it includes cost of vitamins, nutritional food, special foods and drinks, and any self treatment taken while taking drugs received from a formal source[13].

For the analysis, RC and CC were measured for a set of regrouped sources of treatment with respect to perceivably fully recovered patients (PFRPs) and other patients separately. Perceived full recovery was decided on the basis of patients' responses to Form 2 of the HHS[14]. Regrouping was done on the basis of utilization of a single or a combination of sources of treatment for the recovery. Standard deviations and intervals were measured for RC and CC for each regrouped sources of treatment to elucidate their dispersion ranges.

Measurement of the cost of preventive care was based on the responses for Form 3 of the HHS. For repellents and prophylaxis, respondents gave the total cost incurred during the previous year. For mosquito nets, first, the life period of each net was measured by adding the number of years used up to the time of the HHS and the expected life years of use. The purchase price of each net was then divided by its life period just to obtain an indicator of the average cost attributed for the year concerned. This simple

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[13] Some patients had a practice of taking either boiled coriander water or tablets such as panadol along with anti-malaria drugs.

[14] Malaria infected HH members were asked whether they were fully recovered by taking treatment from the mentioned source/s of treatment (See questions no. 2.13, 2.30, 2.45, 2.62, 2.63 and 2.64 of the Form 2 of the HHS - Appendix 4).

method was used on the assumption that even if the highly complicated and time consuming replacement costing method was used for each net with an appropriate discount rate, the results would not be substantially different. Further, it was not clear how to make an allowance for the quality of nets as many observed nets were found damaged.

Indirect cost

Estimation of indirect cost was primarily based on the output-related approach (Goldschmidt-Clermont 1987). Priority was given to the responses for the questions on recovery of work lost due to illness[15]. Responses with similarities were categorized into separate groups and due modifications were made to them on this approach as explained below. Interviews and discussions with respondents were also used to resolve some issues such as division of labour within the HH.

Following the output-related approach no attempt was made to value the time lost of school children, children below school going age, job seekers, economically inactive adults who were physically and/or mentally incapable to do any productive work and those who were engaged only in housework. For them only the time lost of the HH members who attended them during the illness period were valued. In valuing time loss emphasis was first drawn to the occupation which was affected by illness irrespective of whether it was the main or secondary occupation. For instance, if the secondary occupation of a patient or other HH member (whose main occupation was household work) was affected by illness only the secondary occupation was considered for the valuation exercise. Secondly, value of time lost was estimated only for fully disabled days as there was no pattern among the patients in spending their partially disabled days; for instance, while some were partly engaged in productive activities, some others just attended to some household work; another set of patients stated they started their economic activities just after the end of fully disabled days. Thirdly, the same approach was adopted in valuing the time spent for arranging the house for residual spraying as well.

As farming was the main occupation of most of the adults who lost time, their own valuations on output and/ or income losses were initially taken for the valuation exercise. These output losses occurred due to damage by wild animals or absence of proper care for cultivation during the illness period; income losses were normally related to the inability to harvest the crop in proper time (e.g.,tobacco leaves). When respondents expressed their output/income losses only in quantities, the findings of the discussions

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[15] See questions 2.63 to 2.74 of Form 2 of the HHS (Appendix 4).

were used to get their approximate net values.

For the valuation exercise only realized losses were considered; i.e., farmers' expectations on future harvest losses were avoided (Ref. question 2.74 of Form 2 in Appendix 4). Some farmers were unable to provide even an approximate value for their future harvest losses although they strongly believed in such losses. An attempt was made to make extrapolations for them using available information for similar cases but was failed. This was due to extremely poor correlation between the level of farming income and projected harvest losses of those who valued their future harvest losses.

In the case of hiring labour to recover the loss of time, their actual wages paid were used for the time valuation exercise. In addition to that "incentives" such as food provided to hired labour, and neighbours and relatives who helped to recover foregone work were also added to the cost of time. One example for incentives was the provision of food and, on certain occasions, a small amount of money to a person to protect the *chena*[16] from wild animals when the HH head accompanied the patient to the MC.

In the case of sharing foregone economic activities among family members, irrespective of the persons who attended to that work, the average wage rate of the respective HA was used to value the time spent by them assuming the number of fully disabled days of the patient was equal to the total time spent by HH members for work recovery[17].

For daily wage earners, depending on their responses, loss of wage income was directly applied for time valuation. For monthly salary/wage earning employees, this method was not appropriate because the absence of employment would lead only to loss of their entitled annual paid leave. This, of course, was a loss to the employee but its

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[16] Slash and burn farming in the adjoining jungle to the village with the beginning of the rainy season. The term "chena" comes from the Sinhala word "hena" and is widely used in geographical studies on land use patterns.

[17] This estimation method may be somewhat upward biased as the loss of one day's work (for instance, of a farmer) was not necessarily equal to the wage rate of a casual labourer. Except in peak seasons (e.g., cultivation and harvesting seasons) a farmer does not necessarily have to spend his/her total time of a day to look after the field. Based on the discussions and responses to the questionnaire, all possible attempts were made to avoid such marginal cases to bring down the upward bias of estimates. For instance, during the HH head's illness period, if a HH member made visits to the paddy field just for the purpose of checking its water level, as an approximation each visit was valued as half of the one day's casual wage rate.

conversion into monetary terms is a controversial issue. But losing a number of annual paid leave days would reduce the available leisure time of the employee and his/her family members. Therefore, as an approximation, half of the daily salary/wage was used to value one working day of those employees.

Although the same approach and procedures were adopted, there were some exceptions in valuing the time lost for accepting residual spraying. Since the time spent for accepting residual spraying was always small, a very pragmatic approach was adopted in valuing that time. For instance, for a farmer, the probability of getting his farming work adversely affected by just losing one hour on the spraying day was extremely low. But interviews and observations[18] revealed that HH members were normally waiting for some time to confirm (in the case of pre announced programmes) whether sprayers had reached the village. Once they received the news of sprayers' arrival, they first arranged the house and again waited for their visit. This practice was more common among full acceptors. In this way the time spent for arranging the house was most probably more than their response for the question 3.15 of Form 3 of the HHS. Thus it was assumed that if the time spent by a HH member for preparatory work exceeded two hours, he/she lost one day's work of his/her occupation in which he/she was supposed to be engaged in if spraying was not undertaken on that day[19]. Otherwise it was treated as a half day's loss of work related to the affected occupation.

c. Community response to the disease

The statistical tools used to analyze community behaviour included frequency tables, contingency tables, χ^2 test and ANOVA (Hirsch and Riegelman 1992). In analysing community behaviour in curative care, underlying factors were classified into three groups as conditional factors, socio-economic factors and perceptions. This classification method was a less sophisticated version of the method used by Schwartz et al (1993) in their demand models for heath. Thus conditional variables refer to choice-specific or provider specific variables such as location of MCs and waiting time. Both socio-economic factors and perceptions come under chooser-specific variables; e.g., income, age, sex, literacy level, knowledge and attitudes. Since the literature lacks

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[18] Observations made on the days residual spraying and the HHS were undertaken together in the same village without any pre arrangement.

[19] This refers to the question 3.16 of Form 3 of the HHS: what would have been done by you if the sprayers did not come on that day?.

sufficient evidence on the relationships between most of these variables and community behaviour in response to malaria (and this was, of course, found as a gap of knowledge), for the present analysis, it was assumed that all these variables had an impact on community behaviour in curative care. With a speedily emerging private sector, analysis was extended to the choice between public and private care.

For the analysis of preventive care, much emphasis was placed on socio-economic factors and community perceptions. The effect of provider specific variables on acceptance and compliance were examined through the analysis of community perceptions. Discussions and interviews with respondents were also used to elucidate some important issues.

d. Measurement of cost-effectiveness

Measurement of cost-effectiveness of AMAs was based on data collected from official sources as well as the HHS. As mentioned earlier, analysis was focused primarily on process and intermediate level cost-effectiveness indicators (CEIs) but an approximate measure of final health outcome was also measured and expressed in monetary terms; the following guidelines were followed.

Step I: Performance, productivity and cost implications

I. Performance and productivity

Using data collected through official sources, the following indicators related to the utilization and/or coverage of services were measured for AMAs.

Surveillance and treatment

Three indictors, namely, number of blood films examined, number of cases detected and SPR were measured for each source of surveillance and categorised under the three means of case detection; APCD, ACD and PCD[20]. These three indicators were then measured for the HAs.

Analysis was moved further with a set of simple productivity indicators such as number of blood films examined per day and number of cases detected per day for each MC with a MIC and the laboratory at RMOM. SPR of each of those surveillance

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[20] N.B.: According to the record keeping system of RMOM, APCD refers to cases detected at MCs with at least BFF (Ref. Laboratory Form No.3). For this analysis, MBCs, PMCs and SPs except FSs were also categorized under APCD. Only FSs and MBSs were under ACD. PCD refers to blood films collected by AMC employees while they were engaged in a field activity of which the prime purpose was not case detection; e.g., collection of BFs by FAs during residual spraying or by a PHI of the AMC when inspecting spraying units.

centres were also measured.

Residual spraying

Five indicators, namely, number of fully sprayed houses (FSHs), number of partially sprayed houses (PSHs), number of refusals, number of closed houses and population covered by full and partial spraying were measured for each HA. Each coverage number was expressed as a percentage of the total number of targeted houses in each HA which is the sum of the first four indicators. In measuring productivity, each of the first four indicators were expressed as per day figures for HAs; e.g., number of FSHs per day.

II. Cost implications

Using the above indicators a set of cost indicators was measured as follows and comparisons were made across means of surveillance and treatment, and HAs wherever possible:

Surveillance and treatment:

For inpatient care cost per case treated (CPIT), incremental cost per case treated (ICIT) were estimated for each type of MC with respect to the level of the availability of BTF.

For outpatient care average cost per case detected (CPCD), average cost per case treated (CPCT), incremental cost per case detected (ICCD) and incremental cost per case treated (ICCT) were estimated with components of cost for each type of MC with respect to the level of availability of BTF.

Residual spraying at each HA (perennial and special):

Two indictors, namely, cost per house fully sprayed (CFSH) and cost per house partially sprayed (CPSH) were estimated for each HA with components of costs[21].

Mosquito net impregnation:

The cost per mosquito net impregnated (CPNI) was estimated for each impregnation programme.

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[21] All not fully sprayed houses (except refusals) are reported as half sprayed houses in AMC records. But field observations revealed that half spraying normally takes the form of spraying the outside of the house, for which the usage of time and other inputs could most probably be less than a half of a fully sprayed house. Therefore, just as an approximation, inputs and cost per partially sprayed house was taken as one third of a fully sprayed house.

Step II: Community effectiveness: final health outcomes and cost implications

An attempt was made to extend the analysis towards final health outcomes as much as possible with the available information on community effectiveness. But there was a limited scope to undertake such an analysis. First, it was not possible to measure a final outcome indicator with the changes in API. API was measured with AMC records which covered only the patients examined at public MCs; and the sharp annual fluctuations in API (observed in AMC reports) prevented obtaining a sensible measurement of even its annual changes which could be attributed to the control programme. Secondly, due to the poor data base and, of course, the apparent tendency towards private sources of treatment, there was no scope to measure even a pool of infection model and a case prevention model (Kaewsonthi 1988). Thirdly, cases prevented were also impossible to measure (using conventional methods) due to the absence of a control area and the impossibility to undertake a randomized control trial for the present study.

As one of the probable candidates for final outcome, therefore, cost per PFRP was measured for different means of treatment and compared across them. For this purpose, probability of perceived recovery from illness (PRFI) was measured for all public means of treatment. The CPCT at each means of treatment was then multiplied by the inverse of its PRFI to obtain a measure for cost per PFRP. Probabilities were measured using the following method[22]:

$$P_j^i = \sum C_j^i / T_j^i$$

j= Type of the MC with respect to the level of the availability of blood testing facilities[23] (=1,2,3,..)

i= MC to which patients attended (=1,2,3,....)

T= number of patients took treatment

C= number of patients perceivably fully recovered

P_j^i = Probability of getting recovered by taking treatment from the ith MC of jth type

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[22] Due to the one month recall period of the HHS, however, relapsed and recrudesced cases were not captured by this method.

[23] Means of treatment was defined on the basis of the level of availability of BTF. Therefore each type of MC in the formula indicates a particular means of treatment.

For the PRSP, the cost per house/person protected was measured and comparisons made across HAs. The findings of the HHS were used to make comparisons across HHs with contingency tables and χ^2 tests to assess the community effectiveness of residual spraying (RS); acceptance and compliance for RS, infection of the disease as well as the practices of using self preventive measures were taken into account in these comparisons. In these analyses, HLIR was compared with acceptance and compliance to assess the community effectiveness. Similarly, CPPP was measured for MNI, on the basis of information provided by the AMC, just as an approximate measure[24].

In measuring the cost of each CEI, provider's cost and community cost were added together for each delivery point, means of treatment and HA as applicable. An important problem encountered in this exercise was the incompatibility of the two time dimensions of provider's cost and community cost on treatment and residual spraying: the former referred to the year 1992; community cost on treatment was measured normally for one episode of illness (except few cases of recrudescence); cost of RS was for the last occasion of the sprayers' visit. Thus an attempt was made to extrapolate the latter two types of cost for the whole year by considering seasonal variations in a) the incidence of malaria and b) productive work (which in turn affects the cost of time), both in each HA. The viability of undertaking such an analysis was examined by comparing the monthly rank orders of the incidence rate of malaria across HAs using Spearman's rank correlation coefficient. Geographical and land use patterns across HAs were also taken for the comparison as they seemed to have a direct relationship, particularly, with the seasonality of the outputs of agricultural production. This exercise did not produce any fruitful results and therefore a direct comparison between community and provider's costs was hindered. The details of this exercise and the seemingly second best methods used for the analysis will be presented at the beginning of chapter 7 with the presumption that it would be the most appropriate place for that purpose.

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[24] The HHS was not able to capture HHs which accepted MNI as it was introduced at a very small scale only in December 1992.

CHAPTER 4. PROVIDER'S COST OF CURATIVE AND PREVENTIVE CARE FOR MALARIA

This chapter primarily looks at the cost borne by the provider in the provision of AMAs in Matale district (hereafter district) in 1992. It serves the first specific objective of this study and provides part of the data with which to undertake the CEA in Chapter 7. The chapter first looks at the sources which financed AMAs, composition of resources provided by each financing source and distribution of resources across HAs. This provides a basis to compare cost implications of AMAs across HAs in relation to their endemicity. Analysis will then be focused on some process and intermediate output indicators of AMAs followed by a brief productivity analysis. With that background, analysis will focus on total and average costs (ACs) of AMAs by activity level with respect to intermediate level outputs. This follows an analysis of IC. In each sub-section the indicators used for the analysis will be compared across delivery points and HAs for curative and preventive care respectively[1], primarily to elucidate the efficiency of various means and ways in the provision of AMAs.

It's worth mentioning that the ICs will be examined only for curative care. For an IC analysis of preventive care, only RS seemed to have a sufficient data base because it was the only preventive measure which covered the whole malarious zone with a set of delivery points (or more specifically HAs) for comparison. But it was doubtful whether such an analysis would provide meaningful results due to the ambiguity in taking HA as the reference point for the scale of output of RS.

4.1 Financing of resources for AMAs in the district

a. Sources of financing and their destinations

In 1992, AMAs in the district were financed by three sources:

a) District malaria budget (DMB) - from the PDHS of Central Province through the DPDHS of Matale district to the RMO, Matale.

b) District health budget (DHB) - from the PDHS of Central Province through the DPDHS of Matale district to MCs and DDHSs in the district.

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[1] The analysis of this chapter was largely based on the findings of the TAS. Among the employees subjected to the TAS, almost all under the RMOM filled the TAQ. The response rates of the other AMC employees and the PHWs under DDHSs were 85 % and 70 %, respectively. From the employees who were involved in AMAs at MCs, almost 90 % filled the TAQ.

c) Provisions from the DAMC (PDAMC) - from the DAMC to the RMO, Matale.

During 1992 a sum of Rs.39.77 millions came through these sources and the DAMC was the main contributor with Rs.24.11 millions (60.6 %) followed by DMB and DHB with Rs.11.38 millions (28.6 %) and Rs.4.28 million (10.8 %), respectively (Table 4.1). According to the financial statements of the DPDHS, however, Rs.12.36

Table 4.1: Public expenditure on AMAs in Matale district in 1992 by source of finance (Rs.)

Source of finance	Amount	% from sub total	% from total
1. From DMB			
a. To DDHSs	8,506,728	74.7	21.4
b. To RMO	1,951,891	17.1	4.9
c. To MCs	925,339	8.1	2.3
Sub total	11,383,958	100.0	28.6
2. From DHB			
a. To DDHSs	1,046,250	24.4	2.6
b. To MCs	3,234,355	75.6	8.1
Sub total	4,280,605	100.0	10.8
3. From PDAMC			
a. To RMO	125,405	0.5	0.3
b. Through RMO to DDHSs	23,923,919	99.2	60.2
c. Through RMO to MCs	56,762	0.2	0.1
Sub total	24,106,086	100.0	60.6
TOTAL	**39,770,649**	---	**100.0**
FROM ALL SOURCES			
To RMOM	2,077,296	---	5.2
To DDHSs	33,476,896	---	84.2
To MCs	4,216,456	---	10.6

Sources: RMOM, DDHS Offices and DPDHS Office, Matale, DAMC, Government Supplies Department, Sri Lanka Customs Department and Drug Stores, Ministry of Health

millions were spent under the project[2] called "Malaria Control" which was termed as DMB for this study (Tables 4A.1 and 4A.2). The difference between this amount and the amount under DMB (in Table 4.1) was due to the measurement of the latter on the activity basis excluding the usage of DMB funds for non-AMAs[3]. Thus the contribution for AMAs through DMB was 13.4 % and 52.9 % of the district total expenditures on health care services and community health services, respectively. If contributions from these sources were added together, total expenditure on AMAs was 36.4 % of the total health expenditure of the district in 1992[4].

Almost 99.2 % and 74.7 % of funds came from the DAMC and DMB, respectively, reached DDHSs through RMOM; 24.4 % of funds provided by the DHB also took the same destination. But the rest 75.6 % of DHB funds went to MCs. Thus almost 84.2 % of funds for AMAs reached DDHSs; 10.6 % and 5.2 % went to MCs and the RMOM, respectively.

It is worth mentioning that for the RMO, DMB was the closest funding source (with immediate access). For almost all routine payments of the RMOM (e.g., wages and salaries, travelling and subsistence, and provisions of many supplies), the RMO was heavily dependent on the DPDHS and, hence, on DMB[5]e.

b.Composition of expenditure

The recurrent cost accounted for 97 % of the total cost on AMAs (Table

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[2] In the financial statements of DPDHS, recurrent expenditure was first categorized under three programmes called a.) Central and regional administration, b.) Patient care services and c.) Community health services. Each programme, except the first one, was then classified into several projects and malaria control was one such project under Community health services.

[3] For instance, malaria control project funds were used to hire temporary labourers for non-AMAs because health authorities were not eligible to use funds of other projects to hire temporary staff. Similarly, according to running charts of DDHS offices, a portion of fuel provided by the malaria control project was used for non-AMAs (Table 4A.2).

[4] This comparison was somewhat upwardly biased. Although financial statements on AMAs were adjusted to obtain their economic cost, no such adjustments were made to expenditure on other health services. For instance, capital cost was not measured for them as it was out of the scope of this study. But the capital cost of AMAs was only 3 % of their total cost (see Table 4.2). To a certain extent this indicates the level of the upward bias of this comparison.

[5] For all payments, the RMO has to take approval of the DPDHS and accounts of the RMOM are handled by the DPDHS office.

4.2). Among capital cost items, buildings had the highest share of 1.4 % followed by equipment (1.0 %). While the former refers to hospital buildings, RMOM building and malathion stores in the field, latter consists of microscopes and spray machines.

Among recurrent costs, the larger proportions of funds came from DHB and DMB were used for personnel emoluments with 74.6 % and 93.5 %, respectively. The balance 6.5 % of the DMB was spent on a variety of inputs including stationary, consumables[6], laboratory supplies, uniforms for field workers, fuel, maintenance of vehicles and buildings, and permethrin. It is important to note that permethrin, which accounted for only 0.1 % of the DMB, was not provided by the DAMC but the MoH through its provincial allocations. The DAMC, in addition to the funding of malathion

Table 4.2: Composition of the total cost on AMAs by source of finance and type of input

Type of input	District Malaria Budget		District Health Budget		Anti-Malaria Campaign		Total cost	
	Amount	%	Amount	%	Amount	%	Amount	%
RECURRENT COST								
1.Wages and Salaries	7,982,078	70.1	3,194,426	74.6	0	0.0	11,176,505	28.1
2.Travelling and subsistence	2,666,229	23.4	0	0.0	0	0.0	2,666,229	6.7
SUB TOTAL - Personnel emoluments	10,648,307	93.5	3,194,426	74.6	0	0.0	13,842,734	34.8
3.Repair and maintenance:								
- vehicles	267,907	2.4	0	0.0	0	0.0	267,907	0.7
- buildings	17,869	0.2	0	0.0	0	0.0	17,869	0.0
4.Supplies (General)								
- Stationary	18,452	0.2	0	0.0	0	0.0	18,452	0.0
- Consumable	10,170	0.1	0	0.0	0	0.0	10,170	0.0
- Fuel	184,561	1.6	0	0.0	0	0.0	184,561	0.5
5.Supplies (Spraying)								
- Uniforms	99,873	0.9	0	0.0	0	0.0	99,873	0.3
- Spare parts	0	0.0	0	0.0	182,706	0.8	182,706	0.5
- Malathion	0	0.0	0	0.0	23,112,881	95.9	23,112,881	58.1
6.Supplies (Curative care)								
- Drugs	5,932	0.1	277,492	8.5	111,120	0.5	394,544	1.0
- Laboratory	1,324	0.0	0	0.0	26,445	0.1	27,770	0.1
- Food	0	0.0	337,271	7.9	0	0.0	337,271	0.8
7.Supplies (Other)								
- Abate	0	0.0	0	0.0	30,479	0.1	30,479	0.1
- Permethrin	6,998	0.1	0	0.0	0	0.0	6,998	0.0
8.Utilities								
- Communications	22,232	0.2	0	0.0	0	0.0	22,232	0.1
- Electricity and water supply	25,335	0.2	0	0.0	0	0.0	25,335	0.1
RECURRENT TOTAL	21,957,266	192.9	7,003,616	163.6	23,463,632	97.3	52,424,513	131.8
CAPITAL COST								
Vehicles	0	0.0	0	0.0	238,438	1.0	238,438	0.6
Buildings	75,000	0.7	471,415	11.0	0	0.0	546,415	1.4
equipment	0	0.0	0	0.0	404,016	1.7	404,016	1.0
CAPITAL TOTAL	75,000	0.7	471,415	11.0	642,454	2.7	1,188,869	3.0
TOTAL	22,032,266	193.5	7,475,031	174.6	24,106,086	100.0	53,613,383	134.8

Sources: RMOM, DDHS offices and DPDHS office, Matale, DAMC,Government Supplies Department
Sri Lanka Customs Department and Drug Stores, Ministry of Health

[6] Consumables included items such as soap, kerosine oil for entomological team for field work, torch batteries and torch lights.

which was almost 97.3 % of its provisions, provided Abate for larval control activities which, however, stood only at 0.1 % of its total provisions.

While laboratory supplies for curative care, especially for BT, were provided primarily by the DAMC, a small proportion of such items (i.e., surgical spirits) were provided by the DPDHS as well. Both the DAMC and the DPDHS were responsible for the provision of drugs but more than 2/3 of them were provided by the DPDHS. These provisions largely consisted of the distribution of drugs by the Regional Drug Stores in Matale directly to MCs. The DPDHS spent another 7.9 % of its expenditure to provide food for inpatients.

It is noteworthy that the extremely high value of malathion provided by the DAMC brought down the relative importance of personnel emoluments in the total cost to 34.8 % as the share of malathion in total cost was almost 58.1 %. With the exception of drugs (1.0 %), none of the other recurrent input items attained a full figure in relative terms. For instance, shares of permethrin, abate, spraying spare parts and laboratory supplies were < 0.1 %, 0.1 %, 0.5 % and 0.1 % of the total cost of AMAs.

c. Distribution of expenditure among Health Areas

Although the district was classified into 11 HAs for administrative purposes, six HAs began to operate only in the later part of 1992. However, the implementation of this new administration set up was still in its transitory process by the end of 1992. Two HAs (Wilgamuwa and Ambanganga Korale) were still administered by the DDHSs of their adjoining HAs as no DDHSs had been appointed for them. Thus no separate expenditure records were available for the 11 HAs for the whole year. Decomposition of total cost was, therefore, made for five HAs.

Table 4.3 shows the largest proportion total expenditure was spent in Galewela HA (28.2 %) followed by Naula and Dambulla HAs with 25.6 % and 25.4 %, respectively. Both Matale and Rattota HAs reported low proportions as a larger part of each of these HAs were not covered by control measures as they belonged to "non malarious" zone. This distribution pattern of resources had the same rank order as case detection through public means. In 1992, 35.7 % of cases were reported from Galewela HA followed by Naula and Dambulla HAs with 29.3 % and 21.1 %, respectively. API was also had a similar distributional pattern across HAs.

The distribution pattern of resources among HAs should, however, be treated with caution as the proportion of resources used by the RMOM (5.2 %) could not be distributed among HAs (Section 3.5.a VIII). First, employees of the RMOM were

unable to quantify their time allocation patterns across HAs with respect to activities because they had to work in all HAs depending on field requirements. Secondly, available

Table 4.3: Distribution of total expenditure on AMAs across Health Areas (Rs.)

Health Area	Amount	Percentage
1. Galewela	11,228,130	28.2
2. Dambulla	10,094,115	25.4
3. Naula	10,190,519	25.6
4. Rattota	2,018,546	5.1
5. Matale	4,162,043	10.5
6. Unspecified - RMOM	2,077,296	5.2
TOTAL	39,770,649	100.0

Sources: As same as Table 4.1

information on resources used by the RMOM in field activities such as PMCs, health education and, training and supervision of volunteers was not complete to assess their distribution pattern across HAs. Thirdly, no attempt was made to collect information on entomological investigations and their distribution pattern across HAs as no output indicators could be measured for them. However, a preliminary analysis on available data indicated that the distribution patterns of those activities were similar to Table 4.2. Some exceptions were abate and permethrin; while the former was used in only four HAs, the latter was used in only two HAs.

4.2 Process and intermediate outputs and productivity of AMAs

In 1992 no significant changes took place in AMAs in the district. The only addition was the introduction of MNI. Based on the available official data, this section examines the measurable results of those activities in terms of utilization of resources, coverage and productivity. The first sub section describes surveillance and treatment, and the second will be on the PRSP. The few SSPs undertaken during the year could not be taken up separately due to insufficient information on those programmes, and similarly, with health education, volunteers' work and administration of prophylaxis[7].

[7] Level of the availability of information on such activities varied across HAs. For instance, for health education activities, some detailed information was available for the Galewela HA. For Dambulla HA, however, available documents were only on proposed programmes; the purpose of preparing them was to get prior approval for the proposed programmes from district authorities.

a. Surveillance and treatment

Outputs

During 1992, 87,107 BFs were examined with a SPR of 25.5 (Table 4.4) and 93.8 % of them were collected through APCD means where the patient takes the initiative to attend a clinic. ACD and PCD covered much smaller proportions of BFs with only 4.9 % and 1.3 %, respectively. Almost 96.4 % of all detected cases attributed to APCD. This was simply due to the low SPRs of both ACD and PCD (Table 4.4).

PCD ceased in June 1992 as a precautionary measure for HIV with the suspicion that field workers may not get an opportunity to sterilise their needles/lancets properly with their busy work schedules. Spraying teams played the most important role in PCD accounting for almost 79.6 % of cases detected. Their SPR was much higher than PMCs, SPs with no BTF, VUs and PHSs[8], and slightly lower than MBCs (Table 4A.3).

Case detection always corresponded with radical treatment at MCs with BTF and, in that way, 19,762 confirmed cases were treated during 1992 as confirmed cases (Table 4.4). With respect to ACD and PCD, the number of suspected cases treated can only be approximated to the total number of BFs collected. The only exception is the refusal of treatment by some patients.

Table 4.4: Distribution of case detection in Matale district in 1992 by means of surveillance

Means of surveillance	Blood films examined		Positive cases		Slide Positivity Rate
	No.	%	No.	%	
A.APCD					
I.SCs with BTF	75,123	86.2	19,762	89.0	26.3
II.SCs with only BFF	6,329	7.3	1,632	7.4	26.2
SUB TOTAL	81,725	93.8	21,394	96.4	26.2
B.ACD	4,224	4.9	624	2.8	14.8
C.PCD	1,158	1.3	184	0.8	15.9
TOTAL	87,107	100.0	22,202	100.0	25.5

Note: Details across SCs and HAs are in Tables 4A.3 and 4A.4.
Source:RMOM, Laboratory Form 3

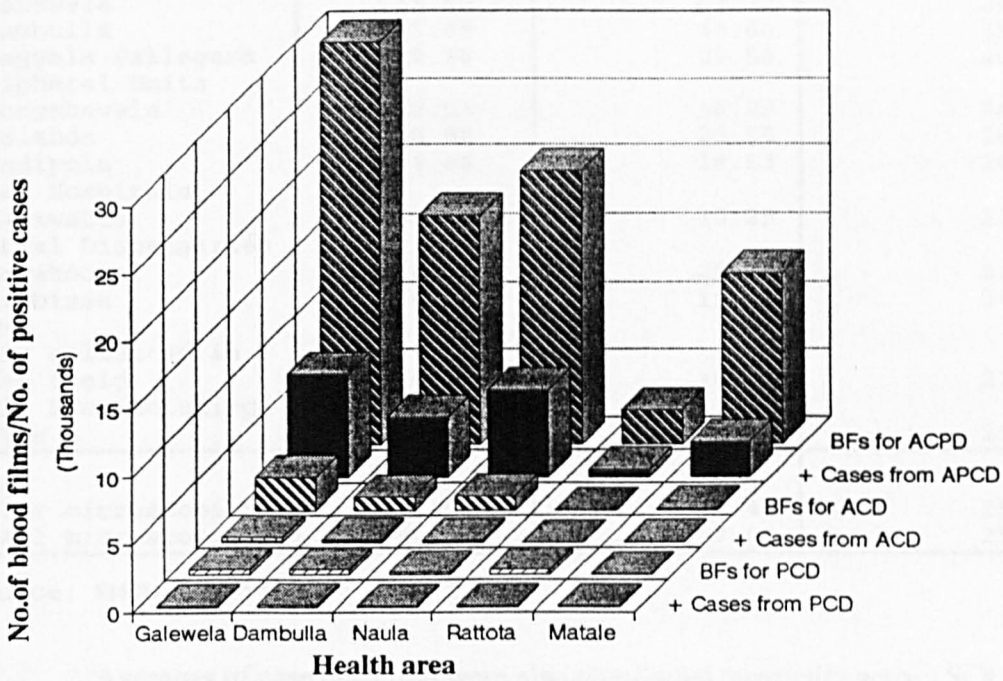
Thus around 5,382 (4,224 + 1,158) patients were given radical treatment as suspected cases but only 808 (15.1 %) of them were found to be positive at the RMOM laboratory

[8] VU stands for the vigilance unit run by the PHI (AMC) of the HA and the BFs taken by him during his field (or vigilance) visits come under VUs. BFs taken by DDHSs come under PHS (Public Health Supervisors).

tests later.

The highest number of cases were detected from Galewela HA (7925); the highest SPR was reported from Naula with 30.66 % (Table 4A.4 and Figure 4.1). Both Galewela and Dambulla HAs had SPRs around 25 %. Although the almost similar SPRs of both Matale and Rattota HAs (around 20 %) were slightly lower than Galewela and Dambulla HAs, the number of BFs examined as well as the number of case detections in

Figure 4.1: Case detection across HAs by means of surveillance, 1992



those HAs were substantially less than other HAs. On the other hand, almost half of the case detections of Matale HA were made at the Yatawatta RH which is at present under Yatawatta HA.

Productivity

This analysis is confined to the MCs with BTF. Since case detection always correspondent with radical treatment, the productivity indicators examined below are equally valid for treatment as well.

On average, a MIC examined 27.5 BFs per day and in total all MICs examined 375 BFs a day (Table 4.5) with an SPR of 25.5. These averages were, indeed, far lower than the existing norm of AMC that a MIC should examine at least 65 BFs a

day[9]. Across MCs, however, the former average varied substantially; only Galewela DH came closer to the required average (63.8); the lowest average was reported from Yatawatta RH (15.3). Except Dambulla DH and Kongahawela PU, this average was almost less than half of the required rate for all other surveillance centres (SCs) including the laboratory at RMOM.

Table 4.5: Productivity of case detection by type of surveillance centre

Type of surveillance centre	No. of cases detected per day	No. of blood films examined per day	Slide positivity rate
1.Base Hospital			
a.Matale	2.97	24.67	12.04
2.District Hospital			
a.Galewela	15.50	63.77	24.30
b.Dambulla	11.05	43.64	25.33
c.Laggala-Pallegama	10.26	25.58	40.10
3.Peripheral Units			
a.Kongahawela	12.55	36.28	34.59
b.Nalanda	6.88	25.95	26.50
c.Madipola	4.86	18.53	26.23
4.Rural Hospitals			
a.Yatawatta	5.12	15.29	33.48
5.Central Dispensaries			
a.Dewahoowa	8.75	28.18	31.05
b.Kimbissa	4.81	19.85	24.22
6.RMOM			
a.BFs collected in the field	4.13	18.86	21.92
b.All BFs including MBCs	5.30	30.09	21.39
TOTAL			
a.Per microscopist	7.00	27.46	25.49
b.All microscopists	91.00	357.00	25.49

Source: RMOM, Laboratory Form 3

Averages of case detection were also distributed unequally across SCs. The most noteworthy average was reported for the Matale BH where it was only 3 per day. Even though this BH is not located in an endemic area, it is expected to serve the whole district as the leading medical institution. Thus Matale BH seemed to have maintained a practice of examining BFs of all the suspected fever cases (i.e, 6020 BFs with only 725 positive cases). Among the other SCs the lowest average was reported from the laboratory at RMOM for the BFs collected a) at MCs with no MICs and b) in the field by VUs, FAs and PHSs[10]. On the other hand, Galewela DH reported the highest rate of 15.5 per day

[9] Personal communication with the RMO, Matale (June 1993).

[10] This figure should, however, be treated with caution as the latter practice was stopped in June 1992.

followed by Kongahawela PU and Dambulla DH with 12.6 and 11.1, respectively. Among other SCs, irrespective of the high endemicity in their catchment areas, relatively low case detection averages were reported for MCs such as Kimbissa CD, Nalanda PU and Dewahoowa CD (Table 4.5).

With respect to SPR a different pattern was observed, in that all the SCs, except Matale BH (as expected), reported figures above 20. Laggala-Pallegama DH[11] had the highest figure of 40.10 followed by Kongahawela PU and Yatawatta RH. The high SPRs of the SCs with low case detection rates and BT rates indicated the practice of using available BTF selectively at those MCs by prescribing BT only for the most suspected cases (unlike the case at Matale BH).

Limitations of morbidity figures

It is necessary to question the accuracy of morbidity data on which the above presentation was based. First, most of the small MCs, which received malaria drugs from the Regional Drug Stores and, indeed, treated suspected cases, did not have even BFF[12]. Insufficiency of MICs and FAs was cited by health managers as a reason for not conducting at least blood filming at those MCs; and, it was argued that stationing of even an FA at most of those MCs was not worthwhile as few cases were reported from them. Thus the RMO had a practice to station an FA or both FA and a MIC to a MC only when the signs of an epidemic or outbreak appeared in its catchment area[13].

Secondly, although a considerable number of chloroquine and primaquine tablets were distributed among VHWs and they had treated a large number of suspected cases, no records were available on their treatment performances[14]. For the volunteers in Galewela and Naula HAs 7,800 and 8,900 chloroquine tablets, and 7,980 and 8,900 primaquine tablets, respectively, were delivered during the year. At the interviews,

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[11] It may be important to note that a MIC was attached to the Laggala-Pallegama DH only in October 1992 and its surveillance rates are applicable to that short period.

[12] The time allocation study also provided information about the time spent by the employees of those MCs on treating suspected malaria patients.

[13] In that way, in 1992, FAs were stationed to Lenadora CD in Dambulla HA and Wahakotte CD in Galewela HA for short periods.

[14] Most of the interviewed VHWs were maintaining a small note book which contained information of the patients treated and drugs delivered. But these records had not been reported back to the respective DDHS offices. Only the FA or PHI, who delivered drugs to VHWs at their homes, used to examine those records.

however, one complaint made by almost all VHWs was the lack of a proper drug distribution system; they faced drug shortages very frequently. This was also an indication of the VHWs' treatment of a considerable number of suspected cases.

Thirdly, no information was available on the treatment practices of PHWs like Family Health Workers (FHWs). They were engaged in treatment as well as administration of prophylaxis, especially for pregnant mothers.

These data deficiencies, however, did not have any adverse effect on the validity of output and productivity indicators examined above as they referred to sources with BTF. The most important issue is the insufficiency of the morbidity data base of the AMC to draw up a complete picture of the output of its own activities. Without any further information, it is still premature to make any assessment about the magnitude of the incompleteness of the AMC morbidity data base.

b. Residual spraying

Outputs

During 1992 62.0 % of targeted houses[15] were fully sprayed by the perennial spraying teams (PSTs) by covering a population of about 0.66 million (Table 4.6). Another 16.4 % of houses were partially sprayed making the refusal rate equal

Table 4.6: Output of perennial residual spraying by health area

Health area	Fully sprayed	Partially sprayed	Refused*	Targeted houses#	Population covered*	Use of Malathion (kgs)
1.Galewela						
a.No.of houses	44,905	10,584	13,598	69,447	249,701	43,483
b.Percentage	64.7	15.2	20.1	(29.5)	(30.0)	(31.9)
2.Dambulla						
a.No.of houses	40,902	7,898	15,937	64,737	219,600	37,248
b.Percentage	63.2	12.2	24.6	(27.5)	(26.4)	(27.3)
3.Naula						
a.No.of houses	35,757	13,083	15,961	64,801	219,780	37,676
b.Percentage	55.2	20.2	24.6	(27.5)	(26.4)	(27.6)
4.Rattota						
a.No.of houses	8,986	2,290	1,392	12,668	50,742	6,762
b.Percentage	70.9	18.1	11.0	(5.4)	(6.1)	(5.0)
5.Matale						
a.No.of houses	15,681	4,787	3,729	24,197	92,106	11,303
b.Percentage	64.8	19.8	15.4	(10.3)	(11.1)	(8.3)
TOTAL						
a.No.of houses	146,231	38,642	50,977	235,850	831,929	136,472
b.Percentage	62.0	16.4	21.6	(100.0)	(100.0)	(100.0)

*Sum of direct refusals (i.e.,asked sprayers not to spray) and closed houses.
#Sum of the population of fully and partially sprayed houses (provisional figures).
Note: Within parentheses are the percentage of targeted houses/ population covered/ use of malathion in each HA.
Source: RMOM, Monthly Progress Reports of Residual Spraying

[15] Indicates the total number of houses in the malarious zone (to be covered by perennial spraying teams).

to 21.6 %. This includes direct refusals as well as closed houses because each of them, in practice, indicates a refusal. In total, 136,471.9 kgs of malathion were used for spraying.

Across HAs, the highest number of fully sprayed houses (FSHs) was reported in Galewela (44,905) followed by Dambulla (40,902). Galewela HA also had the highest number of targeted houses (69,447). In this regard, Naula HA had the second largest number of 64,801 followed by Dambulla HA with 64,737. Although Galewela and Dambulla HAs had substantially high FSH rates of 64.7 % and 63.2 %, respectively, it was only 55.2 % in Naula HA. However, the highest FSH rate was reported from Rattota HA which is located in the intermediate /wet zones with fewer reported cases and the smallest number of targeted houses. The less endemic Matale HA had the second highest FSH rate. In this context, it may be important to remember that, during the period concerned, the highest number of confirmed cases was reported from Galewela HA (followed by Naula and Dambulla HAs) and Rattota reported only 11.35 % of the total confirmed cases[16].

On the other hand, the less endemic HAs, reported lower rates for partial acceptance and refusals. Although Naula HA had the highest partial spraying rate (20.2 %), Matale and Rattota HAs reported the next highest rates of 19.8 % and 18.1 %, respectively. With respect to refusals, Rattota HA had the lowest rate of only 11.0 %, followed by Matale with 15.4 %. This figure was at 20.1 for Galewela HA followed by Dambulla and Naula HAs with 24.6 % each.

Productivity

A PST, on average, visited 27.6 dwellings and carried out spraying at 21.6 of them per day (Table 4.7). According to the standard norm of AMC a PST should spray 25 houses per day[17]. Thus from the provider's point of view, the above average figure stood within an acceptable range as a PST had to spend a substantial time to visit even closed houses especially in remote and hill areas. On average, a PST visited about 6 (i.e., 4.0+2.0) refusals, and 17.1 and 4.5 FSHs and PSHs, respectively.

Across HAs, Naula had the highest visiting rate of 29.5 followed by Galewela and Dambulla with 28.5 and 26.5, respectively. However, the highest average

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[16] Even the APIs of the malarious zones of Rattota and Matale HAs were much more lower than other HAs.

[17] Personal communication with the RMO, Matale (June 1993).

Table 4.7: Average number of houses visited per day by a spraying unit by Health Area

Health Area	Fully sprayed	Partially sprayed	Directly Refused	Closed	Coverage Rate	Total visits
1.Galewela	18.4	4.3	3.7	2.1	22.7	28.5
2.Dambulla	16.8	3.2	3.6	2.9	20.0	26.5
3.Naula	16.3	6.0	5.7	1.6	22.3	29.5
4.Rattota	18.4	5.7	2.5	0.4	23.1	26.0
5.Matale	16.1	4.9	3.0	0.8	21.0	24.8
District	17.1	4.5	4.0	2.0	21.6	27.6

Source: RMOM, Monthly Progress Reports of Residual Spraying

figure of FSHs was reported in Rattota and Galewela HAs with 18.4 each. All other HAs had this figure below 17. On the other hand, Naula HA had the highest average of 6.0 for partial spraying; and, Dambulla had the lowest figure of 3.2. Naula reported the highest refusal rate of 7.3 as well (i.e., 5.7 +1.6). But among refusals, the highest average number of closed houses were visited by the PSTs of Dambulla HA (2.9 houses). PSTs of both Rattota and Matale HAs visited the lowest average number of closed houses of 0.4 and 0.8, respectively.

c. Mosquito net impregnation.

MNI was the only other activity for which sufficient information was available on output. With the initiation of this activity in December 1992, five impregnation programmes were conducted in two HAs during that month: three in Galewela and two in Naula.

In total, 232 MNs were impregnated at five places by using 8.3 litres of permethrin (Table 4A.5). According to information provided by the receivers of Galewela HA (to those who conducted impregnation) 273 people including 40 children below 5 years were regularly using the MNs which were taken for impregnation. It was indicated in the feed back reports that for almost all programmes, receivers gave an encouraging response (i.e., being a new control measure they were very keen on getting their nets impregnated). Feedback report of the last programme conducted in Naula HA indicated the turning back of a number of potential receivers due to the lack of insecticide (without mentioning the number).

4.4 Cost implications of the AMAs

This section first presents a decomposition of total cost of AMAs into activity level. Cost of each possible activity will then be presented at the average level

with respect to its outputs. For patient care at fixed MCs, average cost figures will be presented for all delivery points except the MCs with no BFF. Similarly, average cost of the PRSP will be presented at HA level. Then a set of case studies on MBCs, FSs, MNIs, MBSs, SPs and SSPs will be presented; they are based on direct cost measurements as those estimates seemed to be more reliable than the cost apportionment exercise (Section 3.5.a VIII). Since these small scale activities were frequently undertaken together (e.g., an FS with an SSP) under the title of SP, some of the case studies will cover more than one activity. Prophylactic treatment was also administered in some SPs.

Table 4.8: Total cost of anti-malaria activities in 1992 by activity (Rs.)

Activity	Total cost	% from sub total	% from grand total
1.PREVENTIVE CARE			
1.1.Residual spraying			
a.Perennial spraying	31,572,560	97.4	79.4
b.Special spraying	266,598	0.8	0.7
Sub total	31,839,158	98.2	80.1
1.2.Other activities			
a.Prophylactic treatment	320,699	1.0	0.8
b.Larvicide spraying	205,662	0.6	0.5
c. impregnation	58,978	0.2	0.2
Sub total	585,339	1.8	1.5
SUB TOTAL - Preventive care	32,424,496	100.0	81.5
2.DETECTION AND TREATMENT			
2.1.At fixed MCs			
a.Outpatient care at MCs	2,152,373	38.5	5.4
b.Inpatient care at MCs	1,785,443	31.9	4.5
c.Outpatient care at RMOMC	49,742	0.9	0.1
Sub total	3,987,559	71.3	10.0
2.2.In the field			
a.MBCs	362,227	6.5	0.9
b.FSs	254,349	4.5	0.6
c.PMCs	123,505	2.2	0.3
d.MBSs	87,169	1.6	0.2
e.Other	776,592	13.9	1.9
Sub total	1,603,842	28.7	4.0
SUB TOTAL - Detection and treatment	5,591,401	100.0	14.1
3.SUPPORTIVE ACTIVITIES			
3.1.Health education	917,509	52.3	2.3
3.2.Entomological investigations	588,869	33.6	1.5
3.3.Training & supervising VHWs	248,374	14.2	0.6
SUB TOTAL - Supportive activities	1,754,751	100.0	4.4
GRAND TOTAL	39,770,649	-----	100.0

Sources: RMOM, DPDHS Office, DAMC, Government Supplies Department, Sri Lanka Customs Department and Drug Stores,Ministry of Health

The distribution of total cost among sixteen AMAs is given in Table 4.9. A huge proportion of expenditure was invested in preventive care (81.5 %), with 80.1 % for RS. Among curative care the largest proportion was spent for outpatient care at MCs (5.4 %) followed by 4.5 % for inpatient care; detection and treatment in the field had a share of 4.0 %. The category called "other" refers to the involvement of PHIs and FAs of AMC, PHWs, PHSs etc., in detection and treatment in the field in their routine activities. Three activities were categorised as "supportive" simply because theyseemed to have effects on both curative and preventive activities; they are health education, entomological investigations, and training and supervision of VHWs, and accounted for 4.4 % of total expenditure.

a. Inpatient care

For this analysis, only cost per inpatient treated (CPIT) was taken for two reasons: first, case detection was largely undertaken at the outpatient clinics; secondly, although an FA normally spent one hour from 1-2 pm to get BFs from inpatients, case detection records at the RMOM do not make any differentiation between inpatients and outpatients. Discussions with FAs revealed that the highest proportion of BFs were attributable to outpatient clinics. Therefore, although the TAS provided information on time allocation of health personnel between detection and treatment in inpatient care, analysis had to be done in the form of CPIT without decomposing it into detection and treatment.

Average cost

On average, Rs.295.45 was spent to detect and treat one inpatient with Rs.160.79 for manpower, Rs.68.15 for supplies including drugs and food, and Rs.66.51 for building and equipment (Table 4.10). One drawback in these estimates was the impossibility to get any valid figure for the drugs used at Handungamuwa RH[18]. But this may not have any substantial effect on the averages for all MCs as this MC treated only 81 suspected patients out of the total of 6,041 inpatients in the district.

MCs with BTF reported the highest CPIT of Rs.315.06 followed by MCs with no BFF with Rs.285.45. MCs with BFF had the lowest CPIT of Rs.246.41 (Table 4.9). The high CPIT of the only MC with no BFF was largely due to the cost of

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[18] Due to non availability of BTF, no records were available on outpatient malaria cases of this MC and therefore it was not possible to get any estimate of the drugs used for inpatient treatment from the total usage of drugs.

buildings and equipment. The small number of (total) inpatients at this MC increased the capital cost component of buildings each inpatient. On the other hand, relatively high values of all cost components of CPIT moved up average figures of MCs with BTF compared to the MCs with only BFF. When examining the drug distribution among MCs, MCs with MICs appeared to have priority in receiving drugs; this could be due to the fact that the availability of a MIC at a MC normally indicates high endemicity in its catchment area. For instance, chloroquine and/or quinine injections were supplied only to Matale BH, Dambulla DH, Madipola, Nalanda and Kongahawela PUs and Handungamuwa RH[19].

Table 4.9: Cost per inpatient treated by the level of availability of BTF and the type of MC (Rs.)

Item	Level of BT facilities			Type of MC				Total (ALL HOSPITALS)
	BTF	BFF	NO BFF	BHs	DHs	PUs	RHs	
a. NO OF HOSPITALS	7	3	1	1	4	4	2	11
Total inpatients	66,585	13,866	708	38,024	27,632	13,756	1,74[illegible]	81,159
Bed occupancy rate	n.a.	n.a.	n.a.	100	71	58	33	80
No. of patients treated	4,271	1,691	81	621	3,592	1,461	369	6,043
a. TOTAL COST	1,345,649	416,672	23,122	2[illegible]8,882	879,147	476,786	130,628	1,785,443
b. CPIT	315.06	246.41	285.45	481.29	244.75	326.34	354.01	295.45
BREAKDOWN:								
Manpower	176.39	125.12	83.05	291.81	137.80	171.97	119.83	160.79
Buildings & equipment	67.73	60.60	125.71	77.26	54.84	69.18	151.50	66.51
Supplies	70.95	60.69	76.69	112.22	52.12	85.19	82.68	68.15
(drugs)	13.65	5.52	0	24.19	11.2	7.02	5.76	11.19
(food)	57	51.81	76.69	87.73	39.66	76.69	76.69	55.81

CPIT = cost per inpatient treated

Cost of manpower, however, made the largest contribution in increasing the CPIT of MCs with MICs. The salary of the MIC itself contributed to a larger proportion of the cost of detection. With respect to the low manpower cost components of MCs with only BFF, it is important to note that two of them were in interior locations of the district with extremely poor living and infrastructure facilities, and this seemed to have led to deployment of insufficient manpower into those MCs and low CPITs. For instance, it was only in June and October 1992, that Laggala-Pallegama DH received the service of an FA and a MIC, respectively.

Across type of MCs, CPIT demonstrated an apparent tendency, in that, irrespective of the level of the availability of BTF, CPIT moved down from RH (Rs.354.01) to PUs (Rs.326.34) and went further down to Rs.244.75 at DHs. But CPIT

[19] Matale BH was the only exception because it seemed to have gained priority in drug distribution being the leading hospital in the district.

jumped twice at the only BH to Rs.481.29. It is noteworthy that almost 36.34 % of the district's total expenditure on health services in 1992 was spent for this hospital.

Within this apparent tendency, however, cost components of CPIT demonstrated different patterns. For instance, from RHs to BHs component of drug cost showed a steady upward movement from Rs.5.76 to Rs.24.19. This, however, does not invalidate the above observation on MCs with MICs receiving priority in drug distribution because most of the higher level MCs had a MIC. With respect to the cost component for buildings and equipment as was explained above it was substantially higher at RHs simply due to their relatively small inpatient case loads.

Manpower component of CPIT, however, increased from RHs to PUs, decreased at DHs and then became nearly twice at the BH. One simple reason for these two increases was the involvement of a relatively large number of health personnel in inpatient care, in general, at higher level of MCs. TAS showed that only one medical officer, two attendants and one labourer attended malaria inpatients at Handungamuwa RH. These figures were one, three and two at Yatawatta RH[20], respectively . But three medical officers, three nurses, two attendants and two labourers attended malaria inpatients at Nalanda PU. The food cost component also had a similar pattern across type of MCs, but it should be treated with caution as it was not possible to measure it separately for PUs and RHs[21].

It was the large inpatient number which reduced the CPIT of DHs, although manpower involvement, drug usage etc., of those MCs were relatively larger than PUs. Dambulla DH itself treated over one quarter (i.e., 1675) of the total inpatients in the district. This number was 798 and 781 for Laggala-Pallegama and Galewela DHs, respectively. Thus irrespective of high personnel inputs, high patient load brought down the average manpower cost component of CPIT of those MCs. In this regard it should be noted that while the four DHs reported a bed occupancy rate of 71 % for all inpatients, it was 58 % and 33 % for PUs and RHs, respectively (MoH, 1992). This was, indeed, one reason for the lower food cost component of the CPIT at DHs; wastage of food allocations at these MCs seemed to be much less than PUs and RHs due to their

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[20] Yatawatta RH's close proximity to Matale town could be one reason for having more staff than Handungamuwa.

[21] N.B.: As was explained in Chapter 3 estimation of the cost of food for each hospital was a highly time consuming task. Given some practical difficulties (explained in Chapter 3) and time constraints no such exercise was undertaken.

large inpatient cases. On the other hand, high drug cost of the two DHs with MICs was offset by the low values of the same of the other two DHs with no MICs.

Incremental cost

ICIT at MC with BFF, compared to a MC with no BFF was Rs.57.08 (table 4.10). This figure was Rs.65.96 for MC with BTF; a similar MC incurred an ICIT of Rs.71.50 compared to a MC with BFF. These ICIT values were difficult to interpret on the basis of the comparisons made in measuring them (i.e., level of the availability of BTF). The above sub section showed that the cost component of providing BTF or BFF did not really affect the CPIT. But the level of available BTF could have determined the output figures and, hence, the values of ICIT.

Table 4.10: Incremental cost per inpatient treated by level of the availability of BTF at MC and the type of MC

Method of comparison	Additional patients	Incremental cost (Rs.)
By level of BTF		
1.At a MC with BTF compared to:		
1.1 a MC with BFF	2,580	71.50
1.2 a MC with no BFF	4,190	65.96
2.At a MC with BFF compared to:		
2.1 a MC with no BFF	1,610	57.08
By type of MC		
1.At Base Hospital compared to:		
1.1 Rural Hospitals	333	574.70
1.2 Peripheral Units	134	571.91
1.3 District Hospitals	n.ap.	n.ap.
2.At District Hospitals compared to:		
2.1 Peripheral Units	2,131	195.12
2.2 Rural Hospitals	3,223	236.00
2.3 Base Hospital	2,971	193.16
3.At Peripheral Units compared to:	1,092	391.30
3.1 Rural Hospitals		

n.ap = not applicable

Thus in a comparison with MCs without BFF, the attendance of a large number of inpatients at MCs with BTF made their ICITs (Rs.57.08) lower than the MCs with BFF (Rs.65.96).

The ICIT figures related to BTF levels were not, in general, plausible to

be interpreted with respect to the scale of output; the only exception was the comparison of MCs with no BFF along with MCs with BFF. This was, of course, a movement from only one lower level RH to three middle level MCs (i.e., two DHs and one PU). This movement brought down average cost (see above sub-section) with a corresponding ICIT having a lower value.

The ICIT figures related to the type of MCs did not show any indication of the cost implications of scale. The BH had the highest ICITs but, due to its low case load, it was not possible to compare it with DHs. On the other hand, although PUs had a lower CPIT than RHs, their ICIT was much higher than their CPIT. DHs reported the lowest ICITs; their highest ICIT was for the comparison with RHs (Rs.236.00). Considering the high case load at DHs, ICIT was measured with respect to the BH as well (Rs.193.16). The ICIT values seemed to be more dependent on the number of inpatients treated than on the scale of the respective MC.

b. outpatient care

This sub section examines outpatient care at all public MCs including the clinic at RMOM (RMOMC). Four average cost measurements will be examined: cost per BF (CBF[22]), cost per positive case (CPC), average cost per case detected (CPCD) and cost per case treated (CPCT). Composition of the last two indicators will be examined across MCs with respect to their types and levels of the availability of BTF. Incremental costs per case detected (ICCD) and per case treated (ICCT) will also be compared across MCs.

Average cost

On average, Rs.13.92 was spent per smear and Rs.96.47 per positive case at a MC with BTF or BFF; CPCD stood at Rs.52.61 and a confirmed case was treated with a cost of Rs.52.84 (Table 4.11.). Except CBF, noticeable differences we re observed between MCs with BTF and BFF. CBF ofMCs with BTF was Rs.14.18 and Rs.11.49 for the others. For CPC, MCs with BTF and BFF spent Rs.86.36 and Rs.183.82, respectively. Although the CPCD value was not so different between the two types of MCs (Rs.53.96 and Rs.40.90, respectively), CPCT at MCs with BFF was four times larger than the others (Table 4.12)[23]. Manpower input accounted for a higher proportion

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[22] N.B.: This indicates the cost per suspected patient examined by testing a smear.

[23] Due to the absence of morbidity figures these indicators were not measured for MCs with no BFF at this stage. In total, Rs.403,604 (or 18.75 % of total outpatient care

of both CPCD and CPCT (i.e.,90.7 % and 75.57 %, respectively). The smaller proportion of manpower in CPCT was due to the 22.2 % of the drug component. For the MCs with BFF, however, the drug component was only 10.4 % of their CPCT.

Several reasons underlay the differences in costs and specially the relatively high figures at MCs with only BFF. First, case detection cost of the RMOM laboratory for the cases attributed to those MCs was much higher than the MCs with MICs at around Rs.50.00 per case. Secondly, these averages were heavily weighted by one CD with BFF (Aluthwewa CD) as only 75 cases were detected during the year from 360

Table 4.11: Average cost indicators of outpatient care for malaria patients by level of availability of BT facilities at MCs (Rs.)

Item	Level of BTF availability			Total*
	BTF	BFF	NO BFF	
No.of MCs	9	5	17	31
No.of smears	61,817	6,692	542	69,051
No.of cases detected	16,248	1,880	192	18,320
No.of cases treated	13,415	1,632	192	15,239
Total cost	1,403,176	345,573	403,624	2,152,373
AC per smear	14.18	11.49	N.A.	13.92
AC per positive case	86.36	183.82	N.A.	96.47
CPCD	53.96	40.90	N.A.	52.61
Breakdown:				
Manpower	48.71	39.20	N.A.	47.72
Buildings & equipment	4.11	0.72	N.A.	3.76
Supplies	1.14	0.97	N.A.	1.12
CPCT	39.24	164.65	N.A.	52.84
Breakdown:				
Manpower	27.24	144.28	N.A.	39.93
Drugs	11.06	17.20	N.A.	11.73
Other	0.94	3.17	N.A.	1.18

N.A. = not available
* Includes cost of MCs with no BFF and BFs collected/cases detected/ treated at two CDs for a short period and at one CD on an ad hoc basis; they were not considered for the measurement of averages.

smears. Thirdly, there was scepticism about the case detection data of Hettipola and Rattota MCs; in the former, although 290 cases were detected according to RMOM records, 553 were treated as malaria patients according to its statistical returns to the Medical Statistics Division; in the latter, these figures stood at 390 and 338. The case of Hettipola PU was, however, not contradictory because the statistical returns to Medical

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at fixed MCs) was spent on malaria patients at these MCs (Tables 4.12 and 13). Based on the findings of the household survey, approximate average cost was measured for them in Chapter 7.

Statistics Division were largely based on diagnosis reports made by the doctors who treated inpatients[24]. The case of Rattota DH stays outside the apparent patient attendance trend of all other MCs. Therefore, only a proportion of confirmed cases were taken for outpatient care by considering the general patient attendance of all other MCs. Finally, as pointed out by some AMC employees, BF at those MCs were undertaken in an ad hoc manner because it was not normally related to the treatment procedure (due to the time lap between BF and receiving its report from RMOM). Thus the average cost figures of MCs with BFF should be treated with caution as the denominator is questionable.

Table 4.12: Average cost indicators of outpatient care for malaria patients by type of medical centre (Rs.)

Item	Public Medical Centre						RMOMC
	BH	DHs	PUs	RHs	CDs	TOTAL	
No.of MCs	1	4	4	4	18	31	1
No.of MCs with BFF	1	4	4	1	4	14	1
No.of smears	5,418	27,315	18,756	3,358	14,202*	69,051	2,091
No.of cases detected	653	7,171	5,594	1,124	3,778*	18,320	586
No. of cases treated	104	5,183	5,213	961	3,778*	15,239	586
TOTAL COST	169,859	672,769	490,100	126,167	693,441	2,152,373	49,471
TC OF MCs WITH BFF	169,895	618,661	490,100	86,853	383,239	1,748,749	49,471
AC per smear	17.87	12.68	13.72	19.40	13.77	13.92	17.41
AC per positive case	260.38	86.27	87.61	77.26	106.87	96.47	84.88
CPCD	148.41	48.29	45.99	57.46	52.46	52.61	62.12
Breakdown:							
Manpower	138.57	44.46	41.47	51.66	46.24	47.72	51.72
Buildings & equipment	7.42	2.72	3.49	5.38	5.10	3.76	5.09
Supplies	2.42	1.10	1.03	0.90	1.11	1.12	5.32
CPCT	702.48	52.56	44.66	22.61	54.41	52.84	22.76
Breakdown:							
Manpower	675.56	38.99	35.51	14.40	36.11	39.93	10.02
Drugs	24.19	12.29	8.35	7.38	16.64	11.73	7.20
Other	2.73	1.27	0.79	0.83	1.68	1.18	5.54

* Includes BFs collected/cases detected/treated at Lenadora and Wahakotte CDs for a short period and at Ukuwela CD on an ad hoc basis; these cases were not considered for the measurement of averages.

Across the types of MCs, the BH reported the highest values for all averages except CBF for which the RH had the highest figure (Table 4.12). Compared

[24] In preparing these returns, no reference seemed to have made to the diagnosis reports of the RMOM laboratory, which takes a few weeks to reach the MCs and normally by that time the patient has already been discharged.

to the public MCs, RMOMC had relatively high figures for CBF and CPCD[25]. But CPC and CPCT were only higher than the RH. Once again the manpower input was the largest component for all MCs for CPCD and CPCT (with relatively lower proportions).

For CBF, the lowest value was reported for DHs (Rs.12.68) with their large number of smears compared to other types of MCs followed by PUs (Rs.13.72) and CDs (Rs.13.77). CPC was lowest for the RH with Rs.77.26 followed by RMOMC (Rs.84.88) and DHs (Rs.86.27). The lowest CPCD was for the PUs (Rs.45.99) and DHshad the next highest figure of Rs.48.29. As was noted the lowest CPCT of the RH (Rs.22.61) was followed by RMOMC (Rs.22.76) and PUs (Rs.44.66).

In general, endemicity in the catchment areas of MCs and, hence, patients' attendance (i.e.,BFs collected) and case load (i.e.,SPR) seemed to have determined most of the average cost figures. With respect to the cost components, manpower might have been an important determinant of CPCD and CPCT, even if its proportion did not vary much across MCs (except the BH); Their absolute figures vary substantially across MCs[26]. The capital cost component of CPCD and particularly drug cost component of CPCT appeared to have contributed much to the cost differences across types of MCs. But the effect of the former was, in turn, determined by the number of smears and positive cases. Differences in drug usage and seemingly irregular distribution pattern of drugs across MCs were examined and will be addressed in Chapter 9.

Incremental cost

ICCD and ICCT at a MC with BTF compared to a MC with BFF were Rs.55.67 and Rs.21.87, respectively (Table 4.13). While the former was above its CPCD the latter was smaller than its CPCT. Due to the different scales of MCs with BTF, however, no proper understanding can be obtained on scale of operation from these IC figures. But it indicates that excessive efforts in detecting more cases by collecting more smears could move up the ICCD. Treating more cases normally increases the cost of drugs but not necessarily at an average level; if manpower was not utilized closer to full

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[25] The former was only lower than the BH and RH, and the latter was only lower than the BH.

[26] In examining efficiency, a direct comparison of public MCs with RMOMC is not very meaningful as the latter was functioning under a different set up. On average about 10 suspected malaria patients sought treatment from RMOMC per day. Whenever a patient came, an FA of the RMOM used to attend the patient. It seemed to be an additional activity of the RMOM rather than a separately organized clinic unlike an outpatient clinic at a public MC.

capacity, more cases would bring down the cost share of the manpower component per case; similarly capital cost such as building cost would also be shared among more cases. This could be the reason for the lower value of ICCT than ICCD.

In the case of DHs, however, ICCDs were smaller than their CPCTs with the exception for the comparison with PUs[27]. PUs reported the lowest ICCDs against all other types of MCs taken for the comparison. Thus it could be surmised that DHs compared with other MCs and specially with PUs were still at so low a level of resource utilization with respect to both case detection and treatment to move down their ICs with increases in their case loads.

Table 4.13: Incremental cost per outpatient detected and treated by type of the MC and the level of availability of BTF at MC (Rs.)

Method of comparison	Additional cases detected	Additional cases treated	IC per case detected	IC per case treated
By type of MC				
1.At BH compared to:	n.ap.	n.ap.	n.ap.	n.ap.
1.1 DHs	n.ap.	n.ap.	n.ap.	n.ap.
1.2 PUs	n.ap.	n.ap.	n.ap.	n.ap.
1.3 RH	n.ap.	n.ap.	n.ap.	n.ap.
1.4 CDs				
2.At DHs compared to:				
2.1 BH	1,577	n.ap.	56.45	n.ap.
2.2 PUs	6,047	4,222	46.50	59.37
2.3 RH	6,519	5,079	38.27	39.25
2.4 CDs	3,393	1,405	46.62	55.00
3.At PUs compared to:				
3.1 BH	4,942	5,109	32.47	31.27
3.2 RH	4,470	4,252	42.98	49.64
3.3 CDs	1,816	1,435	38.08	26.26
4.At RH compared to				
4.1 CDs	180	n.ap.	100.77	n.ap.
By level of BT facilities				
At a MC with BTF compared to a MC with BFF	14,368	11,783	55.67	21.87

n.ap = not applicable

The ICCTs showed a different pattern, in that, for DHs they were higher than their all CPCD figures. But for PUs, they were smaller than their CPCDs except forthe comparison with RHs. At this stage it is difficult to provide any precise reasons

[27] The large ICCD for the comparison with PUs was due to their relatively large number of cases detected; the number of patients treated was larger than the DHs and this made the measurement of IC inappropriate.

underlying these differences but they raise possibilities about underutilization of resources at those MCs. The scope for improving efficiency of outpatient care at MCs will be examined further in Chapter 9.

c. Perennial residual spraying

Table 4.14 shows cost per fully sprayed house (CFSH) was Rs.198.43 and approximately one third of this amount was for a PSH (Section 3.5.d II). In decomposing these averages among input items, malathion accounted for almost 73.21 % followed by wages and salaries with 23.21 %. The balance of 3.54 % was for spray machines and their spare parts, supplies, rent, vehicles and fuel.

Across HAs, CFSH and some of its components showed wide variations. Naula recorded the highest value of CFSH (Rs.209.66) followed by Galewela and Dambulla with Rs.203.38 and Rs.200.27 , respectively. The other two HAs, Matale and Rattota, had relatively low CFSHs of Rs.172.60 and Rs.165.21, respectively. The cost component of malathion also varied substantially,

Table 4.14: Cost per house fully/partially sprayed by health area (Rs.)

Item	Health area					District
	Galewela	Dambulla	Naula	Rattota	Matale	
Cost per fully sprayed house	203.38	200.27	209.66	165.21	172.60	198.43
Breakdown in Rupees:						
Malathion*	152.05	144.90	159.05	117.47	110.80	145.26
	(.898)	(.856)	(.939)	(.694)	(.654)	(.858)
Manpower	46.08	49.68	44.74	44.06	55.43	47.62
Equipment	1.63	1.45	3.02	2.71	3.05	2.16
Buildings	0.23	0.59	0.18	0.23	0.28	0.32
Supplies	1.37	1.34	0.73	0.41	2.01	1.21
Transport	2.02	2.30	1.94	0.33	1.02	1.86
Breakdown in percentages:						
Malathion	74.76	72.35	75.86	71.10	64.20	73.21
Manpower	22.66	24.81	21.34	26.67	32.12	24.00
Equipment	0.80	0.73	1.44	1.64	1.77	1.09
Buildings	0.11	0.29	0.09	0.14	0.16	0.16
Supplies	0.67	0.67	0.35	0.25	1.16	0.61
Transport	0.99	1.15	0.92	0.20	0.59	0.94
Cost per partially sprayed house	67.79	66.76	69.89	55.07	57.53	66.14

* Within parentheses are the average quantity of malathion used per house in kgs.

from Rs.110.80 to Rs.159.05. However, the proportions of malathion was around 73 %

for all HAs except Matale where it was only 64.2 %. The variations in malathion component can be elaborated by examining quantities used in each HA, in that malathion per FSH in Matale HA (0.654 kgs.) was nearly one third less than that of Naula HA (0.939 kgs.). Rattota also had a small quantity of 0.694 kgs. Values and proportions of other cost components did not very substantially; for instance, manpower input was around Rs.45.00 (22 %), for all four HAs except Matale (Rs.55.43 and 32.12 %).

These observations demonstrated that the HAs with high coverage rates (i.e., Matale and Rattota) had low CFSH costs and visa versa. To examine these observations with respect to efficiency, however, some attention should be drawn to the quality of spraying as well; i.e., variations in the quantity of malathion used in high coverage HAs. This issue will be taken up along with community perceptions in Chapter 9.

d. Other curative and preventive activities

This sub section presents the findings of seven case studies; two MBCs run by RMOM, one FS/ MBS, one SSP, two MNIPs and one SP[28]. The prime source of data for these case studies was the feed back reports of the SPs concerned. Total cost was measured by considering both capital (e.g., vehicles and microscopists) and recurrent cost.

Case studies 1 & 2: Mobile clinics

1.Millawana estate[29]

Millawana estate was under Galewela HA. Fifteen MBCs were held in consecutive weeks at a centre in the estate. A PHI or the RMO (for only two occasions), an FA, a MIC and a temporary worker (SSMO) took part in the clinics along with a driver of the RMOM. 450 litres of diesel were used for the vehicle. The total amount of wages and salaries, and subsistence paid for the MBC team amounted to be Rs.20,743.03. Six varieties of drugs were used: Chloroquine, Primaquine, Phenergen, Fansidar, Camoquine and Paracetamol. The cost of drugs was Rs.1509.76. In total,

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[28] NB: From the AMC employees point of view all these were SPs. All these SPs except the two MBCs and the SSP, covered more than one activity. But they were titled by the apparent main activity of each SP. One SP which covered several activities was titled just as an SP for illustrative purposes.

[29] Millawana estate is largely a rubber and cocoa plantation where the workers live in the quarters in the estate. Medical facilities are provided to the workers by the management at a small clinic in the estate.

Rs.29,877.49 was spent by the RMOM for the 15 clinics (Table 4.15).

Table 4.15: Cost and consequences of the MBCs at Millawana estate

1. Total cost	Rs.29,877
2. No. of BFs examined	1,494
3. No. of positive cases	206
4. SPR	13.79
5. No. of cases detected per MBC	13.73
6. Cost per BF examined (CBF)	Rs.12.98
7. Cost per case treated (CPCT)	Rs.50.94
8. Cost per case detected (CPCD)	Rs.94.10

2.Hattota Amuna village

Hattota Amuna village is located in Laggala-Pallegama HA. This is a highly endemic area specially due to the undertaking of gem mining; abandoned gem pits provided sites for mosquito breeding. Although a set of MBCs was held in this village, due to the unavailability of complete information on all clinics, the case study was confined to the first 3 MBCs. A PHI or the RMO (for two clinics), an FA, a MIC, an SSMO and a driver took part in conducting the clinic. 90 litres of diesel were used and a sum of Rs.4,094.92 was spent

Table 4.16: Cost and consequences of the MBCs at Hattota Amuna village

1. Total cost	Rs.6,068
2. No.of BFs examined	199
3. No.of positive cases	23
4. SPR	11.56
5. No.of cases detected per MBC	7.76
6. Cost per BF examined (CBF)	Rs.21.03
7. Cost per case treated (CPCT)	Rs.93.54
8. Cost per case detected (CPCD)	Rs.171.76

on wages and salaries, and subsistence. Chloroquine, Primaquine, Phenergen and Paracetamol were used for treatment with a value of Rs.226.12.

The average costs of MBCs were primarily dependent on patient attendance and the case load of the respective clinic. In a simple comparison, CBF was not

substantially different from fixed MCs (Table 4.16). This was due to the high attendance of suspected patients at the MBCs; they were held in close proximity to the patients' houses. But the CPCD and CPCT of both MBCs had seemingly higher values compared to fixed MCs. In the case of Millawana MBC, the prime reason for these high values was the drop of patient attendance for the last few clinics. The case of Hattota Amuna was different; patients could attend the nearby CD instead of waiting for the MBC. The difference at that CD was the lack of BFF. Further, patients had access to the medical officer of the CD even in off duty hours at his private clinic. This indicates that the selection of venues for MBCs should be made by giving more attention to the availability of medical facilities in the surrounding area. Patients' attitudes and preferences may also play an important role in attending MBCs (Chapter 6).

Case study 3: Special Programme in Kongahawela area

This SP was conducted in Kongahawela area in the Naula HA for three purposes: to spray all the dwellings in the target area, to treat suspected cases and collect BFs when required, and to administer prophylactic treatment for deserving people. This SP was designed after the finding of 20 p.f. cases from the target area. For this 10 day programme, a PHI, two FAs, a driver and three SSMOs participated and 200 litres of diesel were used. Only Chloroquine, Primaquine and Paracetamol were used with a value of Rs.821.64. For the spraying programme, 686.4 kgs of malathion were used (Rs.116,248.70).

Table 4.17: Cost and consequences of the SP in Kongahawela area

1. Total cost	Rs.140,629
2. No.of people examined	421
3. No.of blood films collected	11
4. No.of positive cases	2
5. No.of suspected patients treated	23
6. No.of people given prophylaxis	398
7. Cost per person examined	Rs.27.23
8. No.of houses fully sprayed	460
9. Cost per house fully sprayed (cost of malathion per house)	Rs.282.45 (Rs.246.81)

Although the purpose of this SP was to control the spreading of the disease in the target area, only two cases were found from a total of at least 460 people.

On the other hand, CFSH had a very high value of Rs.282.45, which was 35 % more than even the highest CFSH reported for an HA for the PRSP (Table 4.17). Although there was an extremely high coverage rate (92.56 %), use of malathion per FSH was much higher than the PRSP (1.457 kgs). Such a comparison may not, however, be very meaningful as one of the prime purposes of the SP was to cover all the houses in the target area in the most appropriate manner. On average Rs.27.23 was spent to examine per person for any purpose; it was not possible to measure the cost per person for prophylactic treatment as (according to the report of the SP) part of the drugs were given to two VHWs (with no record of the quantity) in the target area. The SP report indicted that, at most, 4 chloroquine tablets could be given per person as prophylaxis. If the average cost figures of spraying were compared with the case detection rate and other outputs of the SP, validity of the decision to undertake such an expensive SP in that area is questionable.

Case study 4: Special spraying at Millawana

This SSP was conducted in Millawana in Galewela HA, for the sole purpose of covering all dwellings of the target area. It was undertaken in parallel with the MBCs run at the Millawana estate. One PHI, two FAs, one driver, one SMO and seven SSMOs took part in the programme. 149.4 kgs. of malathion and 120 litres of diesel were used for the SSP which lasted for five days.

Table 4.18: Cost and consequences of SSP at Millawana estate

1. Total cost	Rs.39,897
2. No. of houses fully sprayed	161
3. No. of refusals	5
4. Cost of malathion per house	Rs.157.16
5. Cost per house fully sprayed	Rs.247.80

Although nearly full coverage was achieved, average cost figures seemed to be substantially higher than the PRSP; cost of malathion per FSH and CFSH were at Rs.157.16 and Rs.247.80, respectively (Table 4.18).

The relatively high CFSH of the SSP was primarily due two reasons: use of a separate vehicle (unlike the PRSP) and supervision of the SSP by a separate PHI. Thus manpower cost naturally went beyond the PRSP. But, as in the case of Kongahawela SP, if the selection of the site for an SSP was not properly made, incurring a relatively high expenditure for such a programme may be fruitless.

Case study 5: Fever survey/Mass blood survey in Galewela HA

The two terms of FS and MBS were used inter-changeably in the records of the district malaria control programme. This case study was on such a programme called FS but it seemed to be a MBS (or a combination of them !). Within a period of about one month it was carried out in five rounds covering over 20 villages. The MBS team was consisted of a PHI, three FAs, two drivers and one manual worker. For the whole programme 150 litres of diesel (provisional) were used and Chloroquine, Primaquine and Camoquine were used to treat suspected cases and administer prophylactic treatment. Cost and consequences of the MBS are given in Table 4.19.

CPCT and CPCD of this field activity also reported relatively high values compared to fixed MCs. The low SPR of just 15.16 was a good evidence for those large average costs. But the low average cost of prophylactic treatment, in a way, justified the

Table 4.19: Cost and consequences of the FS/MBS in Galewela HA

1. Total cost	Rs.63,340
2. No.of fever case examined	1,133
3. No.of blood films taken	1,926
4. No.of positive cases	292
5. No.of suspected patients treated	1,133
6. No.of people given prophylaxis	778
7. Cost per blood film examined (CBF)	Rs.21.30
8. Cost per case detected (CPCD)	Rs.140.50
9. Cost per case treated (CPCT)	Rs.63.00
10. Cost per prophylactic treatment	Rs.4.66

conducting of this MBS. Nevertheless, the records of this MBS did not show any evidence of providing more than four tablets per person as prophylactic treatment; in measuring its effectiveness, however, a weight should be given to the compliance of acceptors as well. It is worth mentioning that the high laboratory investigation cost of the RMOM for the BFs collected in the field was also responsible for the relatively high CPCDs of such MBSs.

Case studies 6 & 7: impregnation programme

6.Thalakiriyagama village

One of the first MNIPs was conducted in Thalakiriyagama village in

Galewela HA as part of a MBC. A PHI, an FA, a MIC, a driver and four SSMOs took part in the whole programme. 30 litres of diesel and 2.3 litres of permethrin were used for the programme. In addition to the supervision of clinical work, PHI was engaged in supervising MNI for which he had received some training. Cost and consequences of the whole programme are given Table 4.20.

7.Galewela town

The second MNI was also conducted in the same HA but in a different location. This is different from the previous one as it was conducted only for the purpose of MNI. One PHI, an SMO and a driver took part in the session. 30 litres of diesel and 1.54 litres of permethrin were used for it. Cost and consequences of the programme are given below in Table 4.21.

Table 4.20: Cost and consequences of MNI at Thalakiriyagama village

1. Total cost	Rs.3,902
2. No.of patients examined	35
3. No.of cases detected	5
4. Cost per BF examined (CBF)	Rs.25.96
5. Cost per case detected (CPCD)	Rs.181.72
6. No.of nets impregnated	57
7. Cost per net impregnated (CPNI)	Rs.49.04
8. No.of people protected	115
8. Cost per person protected (CPPP)	Rs.24.31

Table 4.21: Cost and consequences of MNI at Galewela town

1. Total cost	Rs.2,593
2. No. of s impregnated	42
3. No. of people protected	70
4. Cost per net impregnated	Rs.64.69
5. Cost per person protected	Rs.38.82

The CPNI and CPPP of the second case study were substantially higher than the former one. In the latter case, a separate vehicle, and therefore a driver was entirely used for impregnation; in the former programme, however, these inputs were shared between the MBC and the MNI. Similarly, a part of payments for the PHI of the

previous programme was ascribed to the supervision of the MBC. Due to these reasons, although the average use of permethrin per MN was almost the same for in both programmes, average cost per net impregnated of the latter moved up. Irrespective of these differences, both impregnation programmes reported seemingly low average costs per person protected. But it should be noted that these estimates are valid only if the receivers complied by using the nets regularly (assuming that impregnation does protect a person with full compliance).

Concluding remarks

This chapter looked at the sources of financing and costs for AMAs by activity from the provider's point of view. Even though the DAMC did not have direct access to supervise AMAs at HA level, it was still the main source of financing for control activities. There was a diversification of malaria control funds from DPDHS and RMOM to non-AMAs, especially at HA level; this seemed to be a result of the abolition of vertical control programme.

There was a severe dependence on traditional control methods such as RS and APCD with a substantially low capacity utilization especially in surveillance and treatment. Although the PRSP did not have such a problem, higher coverage rates and lowmalathion input proportions were reported from the less endemic HAs.

While average costs of surveillance and treatment were largely dependent on patients' attendance and SPRs, high proportions of malathion per dwelling moved up the average cost figures of RS. Even though the patient load played an important role in determining average and incremental cost figures, MBCs appeared to be less efficient than fixed MCs. Most of the special programmes also seemed to be less efficient with some queries about their effectiveness. Questions rose about the selection of targeting areas for SPs and specifically the value of providing prophylaxis for only two weeks through a SP. Although there appears to have a considerable scope of reallocating available resources in order to improve efficiency of AMAs, it is still immature to reach such conclusions without looking at the receivers of services and the next two chapters will be devoted for that purpose.

CHAPTER 5. COMMUNITY COT OF CURATIVE AND PREVENTIVE CARE FOR MALARIA

In a CEA of malaria control from a societal point of view it is essential to look at the cost borne by the community for both curative and preventive care. The community cost covers a wide range from self preventive measures to economic loss due to illness. This chapter presents results of the measurements of costs for curative and preventive care and thus serves the second specific objective of the study.

The chapter begins with an examination of curative care and therefore the starting point will be a brief outlook at patients' behaviour in seeking care. This will be followed by an examination of total and average costs borne by patients in seeking care; average costs will be presented for various sources of treatment per visit and per episode of illness. Analysis will then be focused on indirect cost incurred by the community due to illness. Valuing loss of time due to illness will be the prime concern of those sub sections. With respect to preventive care, emphasis will be first drawn to the community cost of receiving RS - the main preventive measure of AMC. Analysis will then be directed towards cost of self preventive measures, mainly, repellents and MNs.

Before moving onto the analysis it is worth mentioning that this chapter is based entirely on the HHS. The HHS was conducted in 54 randomly selected GNDs in the malarious zone in the district covering 1080 HHs with 20 from each. The response rate for the HHS was 96.1 %. While all the selected HHs in 32 GNDs responded to the HHS, the lowest response rate (14 HHs) was reported from a GND called Kiulwadiya in Laggala-Pallegama HA; most of these HHs had not received the letter sent by the Investigator as they were engaged in chena cultivation for a long time.

5.1 Health seeking behaviour of malaria patients - a brief outlook

Out of the 5,221 people interviewed for the HHS, 393 had been infected by malaria[1] during the recall period of one month. Eight of them had been infected by malaria twice making the total number of cases equal to 401 (Table 5.1). The highest number of patients (34.9 %) were reported in Dambulla HA followed by Galewela and Naula HAs with (20.0 %), and (13.0 %), respectively. 84.8 % of patients had undertaken

[1] For this analysis whether a person was infected by malaria during the recall period was decided only on the basis of responses for the household survey; see questions 1.13 and 1.4 of Form 1 and, Form 2 of household survey.

Table 5.1: Health seeking behaviour of patients by source of treatment and Health Area

A.	SOURCE OF TREATMENT	Health Area										Total	% from total Patients
		Galewela	Dambulla	Laggala-Pallegama	Naula	Wilgamuwa	Yatawatta	Ambangan Korale	Pallepola	Rattota	Matale		
	INFORMAL TREATMENT												
1.	Self Treatment												
	- Only self treatment	1.25	2.14	8.82	0.00	5.00	0.00	8.33	0.00	0.00	0.00	10	2.49
	- Before formal treatment	81.25	80.71	76.47	94.23	90.00	100.00	83.33	95.00	100.00	88.89	340	84.79
	- After formal treatment	17.50	10.71	2.94	3.85	5.00	0.00	8.33	0.00	0.00	11.11	36	8.98
2.	Ritual Treatment	8.75	10.71	0.00	5.77	10.00	14.29	25.00	10.00	0.00	33.33	38	9.48
	FORMAL TREATMENT												% from total visits
1.	Public inpatient care	11.11	3.95	5.13	9.46	1.75	12.50	5.56	13.33	20.00	8.33	38	7.13
2.	Public outpatient care	48.15	49.72	48.72	55.41	42.11	62.50	33.33	43.33	60.00	66.67	262	49.16
3.	Private Western	20.37	19.21	2.56	0.00	8.77	25.00	16.67	6.67	10.00	16.67	72	13.51
4.	Private Ayurvedic	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.19
5.	Private Western (Govt.)+	16.67	18.64	23.08	31.08	47.37	0.00	11.11	16.67	0.00	8.33	118	22.14
6.	Field Officer of the AMC	0.93	1.13	0.00	1.35	0.00	0.00	0.00	0.00	10.00	0.00	5	0.94
7.	Public Health Worker	0.00	1.13	2.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3	0.56
8.	Voluntary Health Workers	0.93	4.52	0.00	1.35	0.00	0.00	0.00	0.00	0.00	0.00	10	1.88
9.	Mobile Clinics (MBCs)	0.93	1.13	17.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10	1.88
10.	Clinic at RMOM (RMOMC)	0.00	0.00	0.00	1.35	0.00	0.00	33.33	3.33	0.00	0.00	8	1.50
11.	Mobile Clinic (Other)++	0.00	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1	0.19
12.	Employer's Clinic	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.67	0.00	0.00	5	0.94
	Total Visits: Number	108	177	39	74	57	8	18	30	10	12	533	100.00
	Percentage	20.26	33.21	7.32	13.88	10.69	1.50	3.38	5.63	1.88	2.25	100.00	
B.	OUTCOME OF TREATMENT												
1.	Fully recovered	86.25	84.29	91.18	94.23	85.00	57.14	75.00	80.00	100.00	77.78	85.79	
2.	Partly recovered/still taking treatment	8.75	12.14	2.94	5.77	10.00	28.57	16.67	15.00	0.00	11.11	40	
3.	Stopped/ignored/not yet decided	5.00	3.57	5.88	0.00	5.00	14.29	8.33	5.00	0.00	11.11	17	
4.	No.of patients.	80	140	34	52	40	7	12	20	7	9	401	
5.	No. of patients as a %	19.95	34.91	8.48	12.97	9.98	1.75	2.99	4.99	1.75	2.24	100.00	

+ Receiving treatment from a Government (Western) doctor in private capacity for payment
++ Mobile clinics run by a Medical Officer of the nearby MC for all patients (MBCO)

self treatment before and 9.0 % after treatment from a formal source. Ten patients were entirely dependent on self treatment and of them two had taken the proper dose of anti-malaria drugs and recovered. Among the patients who took self treatment before attending a formal source 96 % took either Panadol, Disprin or Aspirin. Boiled coriander water and boiled water of a herbal mixture called *paspanguwa*[2] were the other most frequently used items for self treatment (2.5 % each). As part of informal care, ritual treatment was sought by a low proportion of patients (9.5 %). Common ritual practices were tying a chanted thread around the patient's neck, applying chanted oil to the patient's head and keeping a coconut at a safe place in the house with a view to breaking it (in front of a shrine of the believed god) after a speedy recovery from the disease.

In seeking care from formal sources, patients made 533 visits with an average of 1.4 visits per patient. Almost 49.2 % of these visits were made to government western outdoor clinics and another 7.1 % for inpatient care from government hospitals (Table 5.1). Taking treatment from government doctors practising in a private capacity (GPDs) was the most popular private source of treatment with 22.1 % visits followed by private western doctors (PDs) with 13.5 %. It is important to note that only one visit was made to an Ayurvedic doctor. All other sources seemed to be less important with respect to the number and percentage of visits made to them. RMOMC and the MBCs conducted by RMOM attracted only 3.4 % of visits. Moreover only 0.9 % of patient visits were attributable to the field officers of AMC. PHWs received only 0.6 % of visits, but the percentage of visits made to VHWs was almost equal to mobile clinics run by the RMOM (1.9 %).

Across HAs, the largest proportions of visits to GPDs (27.97 %) and PDs (47.22 %) were made in Dambulla HA (Table 5.1). Galewela HA also had relatively large proportions. Patients could not visit private doctors in Naula HA as there were none (Table 3A.5). In Wilgamuwa HA nearly half of the visits were made to GPDs, although

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[2] Literally *paspanguwa* means the combination of five types of herbs. Silva (1991) explained in detail the ingredients of a similar herbal mixture prepared and used by the folks in an interior village in the dry zone of Sri Lanka. In the present context, however, as it was revealed through discussions with patients and traders, and by observations, ingredients of a packet of *paspanguwa* (purchased from shops) differed from one producer to another. Some producers include more than five types of dried herbs in their packets. A *paspanguwa* packet normally consisted of roots or cover of Lime and Pawatta plants (*Adhatoda vasica*), roots of Ginger, Coriander, and some dried herbs.

there were 2 PDs.

Almost 85.8 % of perceivably fully recovered (PFR) patients[3] after taking either formal or informal treatment; this included six out of the ten patients who took only self treatment. The reported recovery rate varied from the lowest in Yatawatta HA (57.1 %) to 100 % in Rattota HA. Laggala-Pallegama and Naula HAs had recovery rates of over 90 % and, for the other HAs, it was around 80 %.

In concluding this brief outlook at patients' behaviour it is important to note the highly diversified treatment pattern across the ten HAs. Although the public sources were popular among patients, availability of private sources seemed to have influenced the behaviour pattern of patients.

5.2 The direct cost of receiving curative care

a. Total direct cost and its composition

In total Rs.28,738.19 was spent by the patients as direct cost in receiving treatment for the disease from any of the fourteen sources shown in Table 5.2. The highest proportion of direct cost (37.1 %) was on special food, and treatment cost came second (31.3 %) followed by travel cost to the patient and person/s accompanying the patient with 11.5 % and 10.3 %, respectively.

In this context, special food, in general, consisted all supplementary foods and drinks consumed by the patient just because of illness. They were consumed first, due to the loss of appetite (for normally consumed foods) during the illness period; secondly, as a means of aiding an early recovery or to avoid side effects of anti-malaria drugs. Biscuits, a variety of home prepared soups including rice and sago soups, and even toasted bread (for those who normally took rice or some other grains) came under the first category. Although it was impossible to draw a clear dividing line between the two categories, basically, young coconut, king coconut, orange and soft drink bottles purchased from shops were under the second category. Interviews revealed that, although by practice patients were acquainted with these food items, on certain occasions some of them were prescribed by the doctor as well. Due to these reasons, cost of special food was treated as a separate cost item rather than including it under self treatment.

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[3] The term "full recovery" is used only on the basis of patients' responses. For instance, for patients who were infected by malaria only once during the recall period, whether he/she had fully recovered was decided only if the patient or the respondent for the patient (in the absence of patient, when the patient is a child etc.,) stated that he/she was able to engage in normal activities at the time of interview.

Table 5.2: Total direct cost of receiving treatment by type of treatment and type of cost (Rupees)

	Source of treatment	Type of Cost							TOTAL	As a % from Sub Total	As a % from Total Direct Cost
		Travel Cost		Treatment Cost	Payment for Blood Test	Cost of Vitamins Purchased	Cost of Nutritional Food	Cost of Special Food			
		Patient	Accompanyin person/s								
I.	FORMAL TREATMENT										
a.	Total Cost										
1.	Public inpatient care	386.83	241.16	0.00	0.00	0.00	260.00	1,133.15	2,021.14	7.47	7.03
2.	Public outpatient care	917.50	924.25	70.00	0.00	177.00	1,262.50	4,899.65	8,250.90	30.48	28.71
3.	Private Western	930.00	841.50	2,467.50	410.00	0.00	188.00	1,389.00	6,226.00	23.00	21.66
4.	Private Ayurvedic	0.00	0.00	30.00	0.00	0.00	0.00	14.00	44.00	0.16	0.15
5.	Private Western (Govt.)+	918.50	802.50	5,031.00	23.00	53.50	364.25	1,997.65	9,190.40	33.95	31.98
6.	Field Officer of AMC	0.00	0.00	0.00	0.00	0.00	0.00	107.00	107.00	0.40	0.37
7.	Public Health Worker	0.00	0.00	0.00	0.00	0.00	0.00	41.00	41.00	0.15	0.14
8.	Voluntary Health Workers	0.00	0.00	0.00	0.00	0.00	52.00	167.00	219.00	0.81	0.76
9.	Mobile Clinic (AMC)	16.00	20.00	0.00	0.00	0.00	3.50	170.40	209.90	0.78	0.73
10.	Clinic at RMOM	148.00	124.00	0.00	0.00	0.00	0.00	427.50	699.50	2.58	2.43
11.	Mobile Clinic (Other)++	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12.	Employer's Clinic	0.00	0.00	0.00	0.00	0.00	10.00	50.00	60.00	0.22	0.21
	SUB TOTAL	3,316.83	2,953.41	7,598.50	433.00	230.50	2,140.25	10,396.35	27,068.84	100.00	94.19
	Percentage	12.25	10.91	28.07	1.60	0.85	7.91	38.41	100.00		
II.	INFORMAL TREATMENT										
1.	Self Treatment **	0.00	0.00	1206.10	0.00	0.00	0.00	265.00	1,471.10	88.12	5.12
2.	Ritual Treatment	0.00	0.00	198.25	0.00	0.00	0.00	0.00	198.25	11.88	0.69
	SUB TOTAL	0.00	0.00	1404.35	0.00	0.00	0.00	265.00	1,669.35	100.00	5.81
III.	TOTAL DIRECT COST ON FOR AND INFORMAL TREATMENT #	3,316.83 11.54	2,953.41 10.28	9,002.85 31.33	433.00 1.51	230.50 0.80	2,140.25 7.45	10,661.35 37.10	28,738.19 100.00		100.00

+ Receiving treatment from a Government (Western) doctor in private capacity for payment

++ Mobile clinics run by a Medical Officer of the nearby MC for all patients

** Cost of special food of those who were solely dependent on self treatment is coming under the respective column

The bottom number indicates the percentage from total direct cost

Informal sources of treatment

The share of the cost of informal treatment was only 5.8 %, of which 11.9 % was ritual treatment (Table 5.2). Such a small amount for ritual treatment is clearly understood as only a few people practised relatively simple ritual practices (Section 5.1) during the illness period. The balance of the cost on informal care consisted of drugs (82 %) and special food (18 %) for those who were solely dependent on self treatment.

Formal sources of treatment

The largest proportion (34 %) of direct cost of formal treatment went to GPDs followed by outpatient care at fixed public MCs (30.5 %) (Table 5.2). With the exception of PDs (23.0 %), government inpatient care (7.5 %) and the RMOMC (2.4 %), cost proportions of the remaining sources fell below one percent. Among formal sources, except GPDs and PDs, the highest proportion of cost was reported for special food. For GPDs, treatment cost proportion was over 50 percent and special food component accounted for more than 20 percent. For PDs they stood around 40 % and 20 %, respectively.

The travel cost component (i.e., sum of patient's and accompanying person/s), however, varied significantly across fixed public MCs, GPDs and PDs varied depending on the location of treatment centre. Patients attended the RMOMC spent 38.9 % of their expenses on travelling. Similarly, 31.7 % of the cost of inpatients was on travel cost. The proportions of travel cost of GPD and PD visits were substantially different; normally PD clinics were located in highly populated townships but GPDs used to provide their services during off duty hours largely at their quarters adjoining to the public MC. Public MCs were much more widely spread over the district than PD clinics (Table 3A.5). Thus, the patients had to spend a relatively low proportion on travel from their total cost to see a GPD. The proportion of travel cost of government outdoor care (22.3 %) was nearly 10 % less than inpatient care. Availability of inpatient care at only 12 fixed public MCs could be one reason for this differences. For almost all other sources, the travel cost component was zero as the services of those sources, namely, VHWs, PHWs, field workers of AMC and MBCs were normally available within the close proximity of the village or at door steps of patients. Similarly, the medical officer of the employer's clinic (EMPC) in an estate in Pallepola HA used to make visits to the patient's house in serious cases.

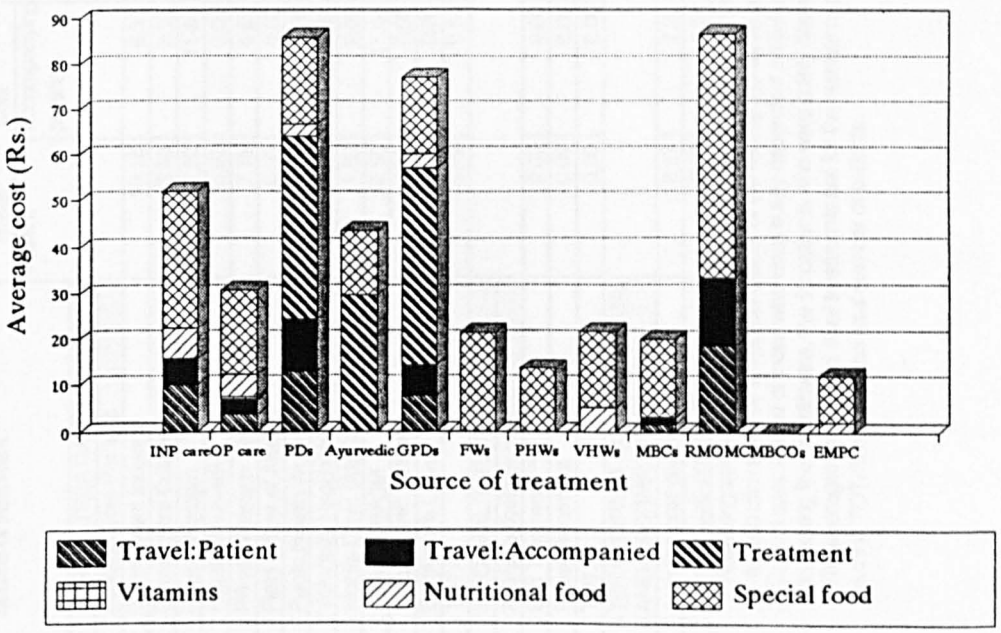
b.Cost per visit

On average, a patient spent Rs.50.79 to make a visit to a formal source

and Rs.4.16 for informal treatment (Table 5.3). Just for illustrative purpose, if the ten patients who were dependent only on self treatment were treated as ten visits, it makes the cost per visit (CPV) equal to Rs.54.21. On the other hand, for an episode of illness, a patient spent Rs.72.07 as direct cost on both formal and informal treatment; this includes Rs.22.45 on treatment and Rs.15.64 on travelling. These figures were Rs.16.89 and Rs.11.76 for CPV, respectively.

Across sources of treatment, the RMOMC had the highest CPV (Rs.87.44). This was due to the relatively small number of visits reported to the RMOMC and spending of relatively high amounts on special food by two of those patients[4]. Among other sources, PDs reported with highest CPV of Rs.86.47 followed by GPDs with Rs.77.88. Inpatient care had the next highest CPV of Rs.53.19. If the treatment from an ayurvedic doctor was skipped (due to the tiny sample size of only one visit), outpatient care at public fixed MCs would be the highest among all other sources with a CPV of Rs.31.50.

Figure 5.1: Composition of average treatment cost by source of treatment



[4] This reduces the validity of making generalizations at the levels of sources of treatment for which a relatively small number of cases was reported; such sampling problems will be taken up in Chapter 9.

Table 5.3: Average direct cost of receiving treatment by type of treatment and type of cost (Rupees)

Source of treatment		Type of Cost							TOTAL
		Travel Cost		Treatment Cost	Payment for Blood Test	Cost of Vitamins Purchased	Cost of Nutritional Food	Cost of Special Food	
		Patient	Accompanying person/s						
I.	FORMAL TREATMENT								
	Average Cost Per Visit								
1.	Government Indoor	10.18	6.35	0.00	0.00	0.00	6.84	29.82	53.19
2.	Government Outdoor	3.50	3.53	0.27	0.00	0.68	4.82	18.70	31.50
3.	Private Western	12.92	11.69	34.27	5.69	0.00	2.61	19.29	86.47
4.	Private Ayurvedic	0.00	0.00	30.00	0.00	0.00	0.00	14.00	44.00
5.	Private Western (Govt.)+	7.78	6.80	42.64	0.19	0.45	3.09	16.93	77.88
6.	Field Officer of AMC	0.00	0.00	0.00	0.00	0.00	0.00	21.40	21.40
7.	Public Health Worker	0.00	0.00	0.00	0.00	0.00	0.00	13.67	13.67
8.	Voluntary Health Workers	0.00	0.00	0.00	0.00	0.00	5.20	16.70	21.90
9.	Mobile Clinic (AMC)	1.60	2.00	0.00	0.00	0.00	0.35	17.04	20.99
10.	Clinic at RMOM	18.50	15.50	0.00	0.00	0.00	0.00	53.44	87.44
11.	Mobile Clinic (Other)++	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12.	Employer's Clinic	0.00	0.00	0.00	0.00	0.00	2.00	10.00	12.00
	TOTAL	6.22	5.54	14.26	0.81	0.43	4.02	19.51	50.79
II.	INFORMAL TREATMENT								
	Average cost per patient *								
1.	Self Treatment **	0.00	0.00	3.12	0.00	0.00	0.00	0.69	3.81
2.	Ritual Treatment	0.00	0.00	5.22	0.00	0.00	0.00	0.00	5.22
	TOTAL	0.00	0.00	3.50	0.00	0.00	0.00	0.66	4.16
III.	TOTAL DIRECT COST OF FORMAL AND INFORMAL TREATMENT								
1.	Average cost per patient	8.27	7.37	22.45	1.08	0.57	5.34	26.99	72.07
2.	Average cost per visit #	6.22	5.54	16.89	0.81	0.43	4.02	20.30	54.21

+ Receiving treatment from a Government (Western) doctor in private capacity for payment

++ Mobile clinics run by a Medical Officer of the nearby MC for all patients

** Cost of special food of those who were solely dependent on self treatment is coming under that column

In making these estimates, the 10 patients who were solely dependent on self treatment were taken as 10 visits

* The averages for self and ritual treatments are for the number of patients who took such treatment, but the TOTAL refers to the total number of patients

Among the cost components, special food had the highest average value of Rs.29.82 for inpatient care (except RMOMC). On one hand, this could be due to the lengthiness of the illness period of inpatients; and most of them assessed they were severely ill (Table 6A.10). On the other hand, some patients purchased supplementary food as well as ordinary food as they were not satisfied with the way food was prepared in the hospital.

The travel cost component varied substantially across sources of treatment depending on their location. RMOMC had the highest travel component in CPV (Rs.34.00) followed by PDs with Rs.24.61 (Figure 5.1). GPDs and outpatient care at public MCs had the next highest values of Rs.14.58 and Rs.7.03, respectively. With these observations, in general, the AC pattern of CPV did not seem to be illustrating any noteworthy differences from total cost.

5.3 Direct cost on curative care from public sources of treatment

The average cost analysis in this section is focused on all AMC supported sources of treatment: inpatient and outpatient care at fixed public MCs, MBCs, RMOMC, AMC field workers, PHWs, VHWs and MBCOs.

An initial attempt was made to estimate both total and average cost at MC level for the first visit. The questionnaire was designed in such a way that the name of the public MC was asked only for the first visit[5]. Results of this exercise are shown in Table 5A.1 and it clearly shows there was no need to go to a deeper statistical analysis at individual MC level due to the tiny patient sample size of many MCs. This led to a classification of MCs on the basis of available treatment facilities and results are given in the bottom part of Table 5A.1. This classification was done on the following manner:

a. MCs with a MIC and an FA
b. MCs with only an FA (to take BFs)
c. MCs/means of treatment with no BFF

Even with classification, some means of treatment had very few responses. Thus to make the analysis more meaningful and statistically significant all other public visits were also added into the cost estimation exercise; the type of MC attended by each patient was decided by screening the answers for questions 2.34, 2.40, 2.41 and 2.42 of

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[5] This was done especially for the purpose of collecting information for the analysis of patients' behaviour; i.e., to examine why and how patients bypassed the closest public fixed MC.

the Form 2 of the HHS.

The results of the above exercise are given in Table 5.4 and Table 5A.2 The only difference between Tables 5.2 and 3, and Table 5.4, is the reclassification of the visits made to public MCs into six sub sets according to the above classification. This exercise provided more evidence to confirm the findings of the afore-mentioned tables. For instance, AC component of special food for a visit to an MC with BTF for outpatient care was about 30 % less than for an inpatient visit. A similar but relatively smaller difference can be observed for MCs with BFF as well. The travel cost components of

Table 5.4: Average direct cost of treatment for all visits to public medical centres

Type of treatment	No.of visits	Travel cost for the patient	Travel cost for accompanying	Cost of drugs	Cost of vitamins	Cost of nutritional food	Cost of special food	Total Cost
A.PUBLIC FIXED MCs								
Inpatient care with BTF	34	10.70	6.21	0.00	0.00	6.18	30.72	53.81
Inpatient care with BFF	3	7.67	10.00	0.00	0.00	16.67	21.67	56.00
Inpatient care with NO BFF	1	0.00	0.00	0.00	0.00	0.00	23.75	23.75
Outpatient care with BTF*	173	3.88	3.80	0.40	1.02	4.31	19.53	32.95
Outpatient care with BFF	43	4.63	4.23	0.00	0.00	5.56	19.22	33.64
Outpatient care with NO BFF	46	1.02	1.85	0.00	0.00	6.04	15.14	24.05
B.OTHERS								
Field Assistants (AMC)	5	0.00	0.00	0.00	0.00	0.00	21.40	21.40
Public Health Worker	3	0.00	0.00	0.00	0.00	0.00	13.00	13.00
Voluntary Health Workers	10	0.00	0.00	0.00	0.00	5.20	16.70	21.90
Mobile Clinics (AMC)	10	1.60	2.00	0.00	0.00	0.35	17.04	20.99
Clinic at RMOM	8	18.50	15.50	0.00	0.00	0.00	53.44	87.44
Mobile Clinic (other)	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL - ALL VISITS	337	4.36	3.89	0.21	0.53	4.68	20.61	34.27

BTF = Blood testing facilities
BFF = Blood filming facilities

inpatient care at MCs with BTF and BFFwere more than twice as large as outpatient care. For outpatient care at MCs with no BFF this figure was only Rs.2.87. The implication of these cost differences was that the public MCs with no BFF were located closer to the patients than the MCs with either inpatient facilities or BTF/BFF. Table 5A.1 also shows wide travel cost differences between MCs with no BFF and others. But 14 % and 33.2 % of all public visits were made to such MCs and treatment sources with no BTF, respectively. These observations raise some queries about the distribution pattern of diagnostic facilities within the district and it seemed the interior human settlements of in the malarious zone had not received proper attention in allocating available medical inputs[6].

[6] NB: As was shown in Chapter 4, the majority of MICs and FAs were stationed in Dambulla, Galewela and Naula HAs. A MIC was appointed to Laggala-Pallegama DH

5.4 Average direct cost of recovery from illness by source of treatment

The analysis now turns to an examination of average direct cost of recovery from illness. Cost figures were also estimated for partially and not recovered patients as well, but the analysis will be confined to recovered patients. This is due to the meaninglessness of making a direct comparison of the direct cost of not recovered patients with perceivably fully recovered patients (PFRPs); the latter covers the whole period of illness due to an episode of illness but the former covers only part of it. For the analysis, patients were classified into 12 subgroups on the basis of their sources of treatment because receiving treatment from more than one source was common for many patients. The cost figures were decomposed into cost of receiving formal treatment (RC) and cost of compliance (CC) and the results are presented in Table 5.5.

a.Cost of receiving formal treatment (RC)

Among the 12 regrouped sources of treatment, western private source (hereafter private) reported the highest RC of Rs.86.13 followed by the combination of public inpatient or outpatient treatment with private treatment (Rs.73.41). The standard deviation (SD) and confidence intervals of the former were Rs.206.16 and Rs.43.06 - Rs.129.20, and were substantially higher than the latter (Rs.59.83, and Rs.54.46 - Rs.92.01). Composition of the former group with a large number of PDs and the making of the majority of private visits in the latter group for GPDs was the main reasons for the cost differences between two groups; it was noted (Section 5.2) that the travel cost to the GPDs were relatively lower than PDs. The wide variation of the RC of private doctors was due to a few extreme values in which relatively large amounts were spent only on travelling to seek treatment from a GPD (which seemed to be at an MC outside the HA).

When looking at inpatient and outpatient care, as was found earlier, the RC of inpatients (Rs.18.89) was more than twice that of outpatients (Rs.8.48). Variations in the former (Rs..034 - Rs. 37.44) registered a wider range than that the latter (Rs.6.68 - Rs.10.30). Among other reasons, this relatively small range of variations for outpatient care was due to the substantially large number of such cases (157). The small number of cases attributed to other combinations of treatment, with the possible exception of the combination of public inpatient and outpatient care, prevented taking the analysis of RC further. The RC of this particular combination was much higher than for inpatient as well as an outpatient treatment. It also had a wider range of costs. One possible reason

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in only October 1992 and there was no MIC for the endemic Wilgamuwa HA.

Table 5.5: Average direct cost on recovery from illness by source of treatment

	Source of treatment	Fully recovered patients				Other patients		
		Cases	Mean cost	Standard deviation of cost	Interval estimates at 95% level of significance	Cases	Mean	Standard deviation
1.	Inpatient care at public MCs	18				1		
	RC		18.89	40.15	0.34 to 37.44		0	0
	CC		49.86	40.17	31.30 to 68.42		11.4	0
2.	Outpatient care at public MCs	157				20		
	RC		8.48	11.67	6.66 to 10.30		9.43	12.3
	CC		35.84	34.75	30.40 to 41.28		15.66	13.49
3.	AMC Mobile Clinic (MBC)	5				1		
	RC		2.4	2.61	-0.87 to 5.67		24	0
	CC		27.16	10.26	18.16 to 36.16		22.4	0
4.	Clinic at RMOM (RMOMC)	3				1		
	RC		64	33.96	25.58 to 102.42		26	0
	CC		138.1	113.63	9.52 to 266.68		27.9	0
5.	Private western (PW)	88				20		
	RC		86.13	206.16	43.06 to 129.20		56.15	59.82
	CC		34.05	40.94	25.50 to 42.60		24.38	22.08
6.	Public field worker (PFW)	11				3		
	RC		0	0	— —		0	0
	CC		21.45	16.24	11.85 to 31.05		10.53	11.26
7.	Public INP/OP + PW	38				5		
	RC		73.41	60.63	54.13 to 92.68		48.8	14.96
	CC		46.78	41.56	33.57 to 59.99		37.88	16.48
8.	Public INP + OP	10				2		
	RC		32.30	31.96	12.49 to 52.11		20	28.28
	CC		55.02	40.26	30.06 to 79.97		56.33	13.96
9.	Public INP/OP + PFW	3				0		
	RC		16.42	16.02	-1.70 to 34.54		—	—
	CC		50.45	25.24	21.89 to 79.01		—	—
10.	Public INP/OP + MBC	3				0		
	RC		3.33	5.77	-3.20 to 9.86		—	—
	CC		24.67	26.65	-5.49 to 54.83		—	—
11.	Self treatment	6				4		
	RC		0	0	— —		0	0
	CC		41.98	62.65	-8.15 to 92.11		17.8	27.67
12.	Other **	2	—	—	—	0	—	—
	All cases	344				57		
	RC		36.79	112.33	24.92 to 48.66		28.87	43.06
	CC		38.28	39.61	34.09 to 42.47		22.23	19.68

** includes one patient took treatment from a mobile clinic run by the closest MC and one patient took treatment from a private Ayurvedic doctor
Public INP/OP = Inpatient/outpatient care at any public fixed MC including RMOMC
PFW = All field workers including FAs of AMC, PHWs, VHWs
RC = Cost of receiving treatment from a formal source (Sum of columns 1,2,3 & 4 of Table 5.2)
= Travel cost to patient and person/s accompanied + treatment cost + payments for blood test
CC = Cost of compliance for treatment (Sum of columns 5,6 & & of Table 5.2)
= Cost of vitamins + cost of nutritional food + cost of special food

for these high values was the severity and, hence, lengthiness of illness of the patients who took both inpatient and outpatient treatment (Chapter 6).

b.Cost of compliance with treatment (CC)

The combination of public inpatient and outpatient care had the highest CC value of Rs.54.59 with a confidence interval of Rs.26.71 - Rs.82.47, followed by

inpatient care with Rs.49.86 and Rs.31.30 - Rs.68.42, respectively. As was noted, higher expenses of providing special foods for inpatients and the lengthiness of the illness of inpatients were the prime reasons for these high values. As in the case of RC, if the sources of treatment with relatively small cases were kept aside, the next highest value of CC was reported for the combination of public inpatient or outpatient care with private treatment (Rs.47.09), followed by outpatient care (Rs.35.84) and private treatment (Rs.34.05). No wide variations were observed in the confidence intervals of any of these three sources of treatment.

In concluding this section, on average, the community incurred Rs.36.79 as direct cost to receive services from a formal source of treatment to get one malaria patient PFR. Consequently, an average amount of Rs.38.28 was spent by the community as a direct cost of compliance with the treatment received from a formal source (with reservation given to 6 patients who were entirely dependent on self treatment). Although the SD of RC (Rs.112.33) was much higher than that of CC (Rs.39.61), its confidence intervals were not much wider than CC. The smaller mean figure and cost intervals of CC, indeed, reflected a substantial stability or, most probably, uniqueness among patients in compliance with the treatment procedure, irrespective of the source of treatment and (probably) the socio-economic backgrounds. The slightly higher cost range of RC, in fact, indicated the observed (and obvious) cost differences in receiving services from various formal sources. It implies that the patient's cost of receiving services was substantially set off either by way of paying charges for private doctors or by spending for travel to reach virtually free public places.

5.5 Indirect cost due to illness - time cost to patients

For this analysis, patients were classified into two sub groups as PFR and partially recovered; each group was considered separately[7]. The analysis was based on output-related approach (Goldschmidt-Clermont 1987) and undertaken at the HH level (Chapter 3).

Table 5A.3 shows that 70 out of 401 patients (17.5 %) suffered economic losses due to illness[8]. Among those who were not directly affected economically[9], 107

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[7] For simplicity, those who ignored the illness (after taking some treatment) and those who were still taking treatment were also included in the second category.

[8] Engagement in an activity which contributes to any of the current income sources (in kind or money) of the household was considered as a productive work. Economic losses were measured for those activities.

were school children (32.3 %) and 38 were pre-school children (11.5 %), and another 83 were primarily engaged in HH work at the time of the onset of illness. Another 74 (22.4 %) stated that although farming was their main occupation, it was not affected by illness.

Division of labour between HH members not only for HH work but also for the productive activities of sick HH members was widely observed during the HHS. Why a considerable number of patients, whose prime occupation was farming, were not affected economically can also be partly explained on those lines. The work related to the main occupation of 35 economically active patients was shared among the other HH members. Specifically, 20 HH heads had done some additional work to recover the lost work (including HH work) of patients. With respect to farming work, however, 27 farmers stated that since there was no special agricultural work at the time of illness, it was not affected economically by illness. The term "special" had several meanings depending on the time of the onset of illness: it was not the harvesting/ farming season, preparatory period for seeding or a time that plants needed special attention from the farmer (e.g., just before the harvesting season).

Only after taking out the patients whose economic activities were not adversely affected by illness, economic loss of other patients was measured. As Table 5A.3 shows, in total, PFRPs lost Rs.17,050 of their wage income. This amount was Rs.6,515 for partially recovered patients (PRPs). Four PFRPs lost their business income; two of them were small scale vegetable traders and the other two were small scale retail traders. They lost a sum of Rs.2,550. The losses to the 20 economically affected farmers came from two directions: by paying for people hired to recover their work (Rs.7,955) and by losing a part of their potential output (Rs.14,900).

In total, PFRPs lost Rs.48,455 as indirect cost due to illness (Table 5.6). The main component of these losses, in monetary terms, was the loss of output. It was 43.1 % of the total indirect cost of patients (Figure 5.2). These losses, however, occurred in only three HAs, Dambulla, Naula and Laggala- Pallegama, where many farmers were engaged in *chena* cultivation. Although *chena* cultivation was popular in Wilgamuwa HA, no output losses were reported from it. A small sample size could be one reason for that.

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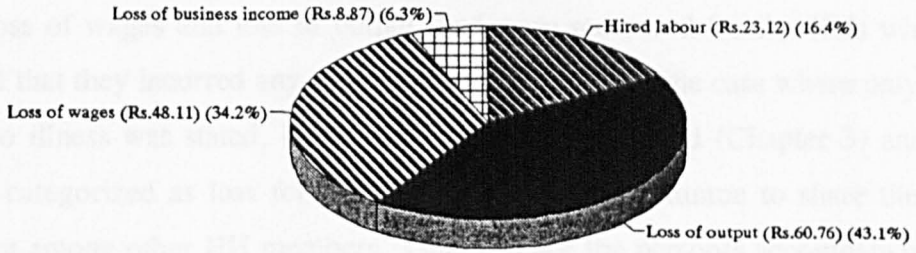
[9] To get the economically active patients separated, firstly, all pre-school children, school children, disabled, job seekers, elderly and permanently sick people were excluded. House wives who had not indicated farming, casual labourer or any other occupation as their secondary occupation were also excluded.

Table 5.6: Indirect cost for patients by health area (in Rupees)

	Health Area	FULLY RECOVERED PATIENTS					Total for partly recovered	Total for all patients	PER PATIENT	PER ECO ACTIVE PATIENT	PER FULLY RECOVER PATIENT	PER FULLY RECOVERED ECON. ACTIV PATIENT
		Cost of hired labour	Loss of output	Loss of wages	Loss of business income	TOTAL						
1	Galewela	2,375.00		3,090.00		5,465.00	2,160.00	7,625.00	95.31	206.08	79.20	170.78
2	Dambulla	3,855.00	14,400.00	4,425.00	3,050.00	25,730.00	1,600.00	27,330.00	195.21	621.14	218.05	643.25
3	Laggala/Pallegama	0.00	500.00	700.00		1,200.00		1,200.00	35.29	63.16	38.71	70.59
4	Naula	640.00	6,000.00	950.00		7,590.00		7,590.00	145.96	690.00	154.90	759.00
5	Wilgamuwa	750.00		1,000.00		1,750.00	700.00	2,450.00	61.25	153.13	51.47	134.62
6	Yatawatta	0.00		575.00		575.00	375.00	950.00	135.71	237.50	143.75	191.67
7	Ambanganga Korale	0.00		1,500.00		1,500.00		1,500.00	125.00	300.00	166.67	375.00
8	Pallepola	0.00		1,710.00		1,710.00	630.00	2,340.00	117.00	260.00	106.88	285.00
9	Rattota	335.00		1,250.00		1,585.00		1,585.00	226.43	264.17	226.43	264.17
10	Matale	0.00		1,350.00		1,350.00	1,050.00	2,400.00	266.67	800.00	192.86	675.00
		7,955.00	20,900.00	16,550.00	3,050.00	48,455.00	6,515.00	54,970.00	137.08	356.95	140.86	364.32
	AVERAGE per PATIENT	23.12	60.76	48.11	8.87	140.86	114.30	137.08				
	AVERAGE per ECON. ACT	59.81	157.14	124.44	22.93	364.32	310.24	356.95				

ECON. ACTIVE = economically active

Figure 5.2: Indirect cost for a fully recovered patient by type



On the other hand, it is notable that *chena* cultivation was prohibited in the wild life sanctuary adjoining to Wilgamuwa HA. Among other types of losses, loss of wages had the next highest proportion of 34.2 % followed by payments for hired labour with 16.4 %. While wage losses were common for all HAs, payments for hired labour were reported from only Galewela, Dambulla, Naula, Wilgamuwa and Rattota HAs. Once again, the small sample sizes of most of the other HAs could be the underlying reason for their zero values.

The indirect cost per patient was Rs.137.08 irrespective of the level of recovery. For an economically active patient this figure was Rs.356.95. When looking at PFRPs, indirect cost per patient was Rs.140.86; and it was Rs.364.32 for an economically active patient. From the average indirect cost of the PFR economically active patients more than one third (Rs.157.14) was attributed to output losses, one third was for wage losses (Rs.124.44) and Rs.59.81 for the cost of hired labour. As obviously, for PRPs, indirect cost indicators had lower values; i.e., Rs.114.30 and Rs.310.24 per patient and per economically active patient, respectively.

The indirect cost per PFRP (Table 5.6) was nearly twice the direct cost of the same[10]. Since CC is indirectly related with treatment, if CC was deducted from the denominator and added to the numerator, just for illustrative purposes, to show the proportional distribution of the receiver's cost (i.e., CC + indirect cost to the patient)

[10] [Indirect cost (Rs.140.86)]/{[RC (Rs.36.79)] + [CC (Rs.38.28)]}

and service cost (i.e., RC), the receiver's cost would stand nearly five times above the service cost.

5.6 Indirect cost due to illness for non-patient household members

Table 5.7 provides a summary of indirect cost incurred by HH members[11]. As in the case of patients' indirect cost, these cost measures were also present with respect to the affected economic activities. Two such columns in Table 5.7 are loss of wages and loss of output, and were measured for the HHs which explicitly stated that they incurred any of these types of losses. In the case where only the time lost due to illness was stated, its implicit value was measured (Chapter 3) and such values were categorized as loss for the HH as it was very common to share the work of the patient among other HH members. Time loss for the person/s accompanying the patient was also measured similarly and is under a separate column in Table 5.7. Cost of incentives is also presented under a separate column (see note in Table 5.7).

Before moving onto cost measures, the time cost of the person/s accompanying the patient to a treatment centre needs some clarification. Preliminary estimates showed that, on average, a person travelled 0.151 miles to purchase items for self treatment for the first occasion followed by 0.206 miles for the second occasion. 92.8 % and 91 % of people travelled less than quarter of a mile to purchase self treatment items for the first and second occasions, respectively. For ritual treatment these figures stood at .084 miles and 97.5 %, respectively. Furthermore, on average, while a person who went to purchase items for self treatment, spent 10.17 minute and 6.31 minutes for the first and second occasions; it was 1.78 minutes for ritual treatment. There were only three cases with extreme values above two hours for ritual treatment. All these findings led to a decision to avoid imposing a time value for those who helped the patient to get self treatment and ritual treatment because they consumed very short times. For formal treatment sources, while 25.3 % of visits were made by the patients alone, patients were accompanied by a HH member/s in 56.7% of visits. Another 16.5 % of visits were made with a relative/s or a friend/s and for the other 1.5 % visits either a relative or a friend joined a family member/s.

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[11] It was not possible or very meaningful to distinguish the total indirect cost as cost on recovery of work of the patient and cost for looking after patient. For instance, no information could be collected properly and easily on what proportion of the loss of output was due to accompanying the patient to the treatment centre and attending the patent during his/her fully disabled period.

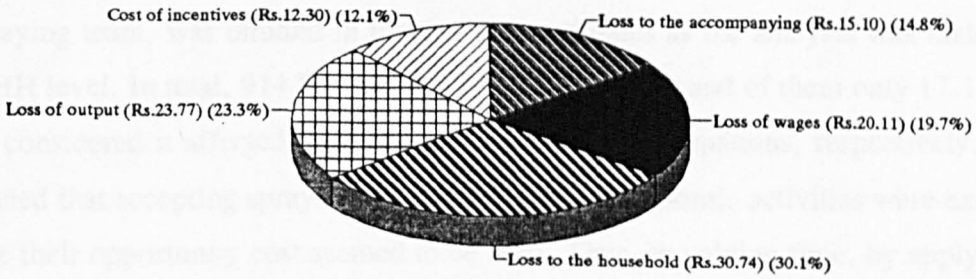
Table 5.7: Indirect cost for household members due to illness by health area

Health area	TOTAL COST FOR FULLY RECOVERED PATIENTS						TOTAL COST FOR PARTIALL RECOVER PATIENTS	TOTAL COST FOR ALL PATIENTS	PER PATIENT	PER ECO ECON. ACTIVE PATIENT	PER FULLY RECOVER PATIENT	PER FULLY RECOVERED ECON. ACTIV PATIENT
	Loss to the accompanying person/s	Loss for the household	Loss of wages	Loss of output	Cost of incentives*	TOTAL						
Galewela	898.88	1,125.00	625.00	800.00	530.00	3,978.88	1,100.00	5,078.88	63.49	137.27	57.66	124.34
Dambulla	2,246.19	2,425.01	1,805.00	2,372.84	1,150.00	9,999.04	2,562.50	12,561.54	89.73	285.49	84.74	249.98
Laggala-Pallegama	151.14	2,325.00	0.00	3,150.00	1,500.00	7,126.14	0.00	7,126.14	209.59	375.06	229.88	419.18
Naula	1,235.00	1,926.00	2,942.50	895.50	300.00	7,299.00	150.00	7,449.00	143.25	677.18	148.96	729.90
Wilgamuwa	285.00	1,500.00	950.00	60.00	500.00	3,295.00	56.82	3,351.82	83.80	209.49	96.91	253.46
Yatawatta	0.00	0.00	0.00			0.00	400.00	400.00	57.14	100.00	0.00	0.00
Ambanganga Korale	137.50	375.00	210.00	150.00		872.50	84.00	956.50	79.71	191.30	96.94	218.13
Pallepola	0.00	675.00	129.00	200.00	100.00	1,104.00	1,060.00	2,164.00	108.20	240.44	69.00	184.00
Rattota	37.50	225.00	75.00	200.00	150.00	687.50	0.00	687.50	98.21	114.58	98.21	114.58
Matale	202.50	0.00	180.00	350.00		732.50	0.00	732.50	81.39	244.17	104.64	366.25
TOTAL	5,193.71	10,576.00	6,916.50	8,178.34	4,230.00	35,094.55	5,413.32	40,507.87	101.02	263.04	102.02	263.87
PER PATIENT	15.10	30.74	20.11	23.77	12.30	102.02	94.97	101.02				
PER ECON. ACTIV PATIENT	39.05	79.52	52.00	61.49	31.80	263.87	257.78	325.57				

Econ. active = economically active

* This cost item refers particularly to food provided to the people outside the household who helped to recover the work of the patient or the other household members who attended the patient.

Figure 5.3: Indirect cost of HH members per fully recovered patient by type



In total, HH members incurred a loss of Rs.40,507.87 to look after the patients and their economic activities. From this amount almost 86.6 % was for the PFRPs. Out of the total indirect cost on PFRPs, the largest percentage of 30.1 (Rs.10,576.00) was the cost borne by HH members to look after the economic activities of the patient (Figure 5.3). On the other hand, percentages of output losses incurred by HH members and loss of wages were 23.3 (Rs.8,178.34) and 19.7 (Rs.6,916.50), respectively. The latter was largely related to the parents who abstained from work due to illness of a child/children. Cost to the accompanying person/s amounted to 14.8 % of indirect cost (Rs.5,193.71).

On average, the indirect cost of HH members to look after a patient was Rs.101.02. For a PFRP, a HH incurred an indirect cost of Rs.102.02. For illustrative purposes, these figures were measured for economically active patients and were Rs.263.04 and Rs.263.87, respectively. Thus, in conclusion, irrespective of the economic status of the patient, a HH incurred an average of Rs.101.02 as indirect cost, and this amount was slightly lower than the indirect cost of the patient which was examined in the preceding section.

5.7 Community cost of the acceptance of residual spraying

Table 5A.4 shows that 559 HHs (53.9 %) allowed sprayers to fully spray their houses. While 139 (13.4 %) allowed for partial spraying, other 316 houses (30.5 %) refused spraying. The balance of 24 houses were not sprayed for different reasons: e.g., sprayers had not visited some houses for a long time, sprayers refused as water was

not available nearby the house to prepare the mixture etc. (details in Chapter 6).

Preliminary analysis of spraying data clearly showed that HHs did not incur any noteworthy direct cost on spraying. One exception was the offering of tea to the sprayers by some HHs. Therefore, the analysis of this section was confined to the indirect cost of HHs in accepting RS fully or partially.

As Table 5A.4 indicates HH members alone arranged the house for spraying on 93.5 % of occasions. Assistance rendered by relatives, neighbours etc., and the spraying team, was omitted in making cost estimates as the analysis was undertaken at the HH level. In total, 914 HH members helped sprayers and of them only 17.1 % and 4.2 % considered it affected their main and secondary occupations, respectively. Those who stated that accepting spraying did not affect their economic activities were exempted because their opportunity cost seemed to be zero. Thus, in valuing time, by applying the output-oriented approach, emphasis was drawn to the affected occupation irrespective of whether it was the main or secondary one. For 50.2 % and 18.27 %, spraying affected their HH work and resting time, respectively. But loss of house work had to be exempted as there was no way to value it. However, the housewives who stated that their helping sprayers prevented them assisting the HH head or other members for their economic activities were included in the cost estimates. Children, elderly etc., were in the category for which accepting spraying did not have any direct effect on their main occupation[12].

As Table 5.8 shows, on the average, one hour and thirty eight minutes (i.e.,1:38) were spent by the HH members along with helpers outside the HH to arrange a house for full spraying. The average was 0:49 for a PSH. Preparation time for both FSHs and PSHs varied by HA. The highest average time for a FSH was reported in Galewela HA (2:14) followed by Laggala-Pallegama and Dambulla HAs with 1:47 and 1:46, respectively. Matale HA had the lowest average time of just 46 minutes. For PSHs, Dambulla HA had the highest time average of 1:10 followed by Yatawatta HA (1:00) and Wilgamuwa HA (0:52) and Rattota HA had the lowest average (0:08).

The indirect cost of HH members in arranging a house for full spraying was Rs.12.23 for the whole district; for PSHs it was Rs.7.95 - 35 % less than the former. Across HAs, Laggala-Pallegama had the highest indirect cost of Rs.22.10 per

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[12] This classification was done on the responses to the question 3.16 of the Form 1 of household survey: what would have been done by you if the sprayers did not come on that day.

FSH followed by Dambulla with Rs.15.45. Averages for Galewela, Yatawatta and Pallepola HAs were around Rs.12, and Matale HA had the smallest figure of Rs.4.55.

Table 5.8: Indirect cost of arranging the house for spraying by level of acceptance and health area

Health area	Average time per		Indirect cost per	
	Fully sprayed house (hours)	Partially sprayed house (hours.)	Fully sprayed house (Rs.)	Partially sprayed house (Rs.)
1.Galewela	2:14	0:45	12.09	6.25
2.Dambulla	1:46	1:10	15.45	12.34
3.Laggala-Pallegama	1:47	0:42	22.10	8.93
4.Naula	1:19	0:44	10.45	7.00
5.Wilgamuwa	1.06	0:52	8.82	11.63
6.Yatawatta	0:59	0:30	7.49	3.41
7.Ambanganga Korale	1:31	1:00	12.82	6.82
8.Pallepola	1:16	0:38	12.08	4.17
9.Rattota	0.56	0:08	4.69	0.00
10.Matale	0:46	0:37	4.55	4.68
District	1:38	0:49	12.23	7.95

The relatively high value of Laggala-Pallegama HA is due to several reasons. First, being an interior HA of the district with a considerable proportion of people engaged in *chena* cultivation, those who accepted fully spraying had to abandon their occupational work and stay at home (normally for a full working day) on the spraying day. Secondly, location of houses long distances from each other meant sprayers spent longer moving from one house to another[13]. Therefore, acceptors also had to wait for a longer time for sprayers. It is interesting to note that when the HHS was undertaken in one remote GND called Kiulwadiya in this HA, villagers helped the survey team by sending some people to the nearby jungle to pass the message to the HH heads who had been selected for the survey. They had not received the letter (sent by the investigator) as they were in the *chena* for a long time; most of them were with the whole family. Only when they made visits to the village for purchasing essential foods etc., did they collect their letters from the village. Once such people came to know about the spraying date and decided to get their houses fully sprayed, they had to spend at least a full working day for it. On the other hand, in certain areas in this HA, where gem mining was undertaken extensively (and that seemed to have led to increased breeding places though abandoned gem pits, and hence, malaria cases), those who were willing to accept

[13] Population density of Laggala-Pallegama HA was just 34.7 per sq.km., the lowest in an HA in the district. It was 104.9, 339.0 and 1028.1 for Dambulla, Galewela and Matale HAs, respectively (Statistical Abstract, Statistics Branch, Matale 1991).

fully spraying were found to be very particular about it and therefore they spent a longer time preparing their houses for spraying and to get their houses sprayed well (by assisting/insisting sprayers).

Moving on to PSHs, Dambulla HA reported the highest indirect cost of Rs.12.34 followed by Wilgamuwa HA (Rs.11.63). The average time loss for Rattota HA was zero because people who assisted sprayers were not engaged in any productive activities on that day, were economically inactive people, or both. In general, both the time spent for and indirect cost of PSHs were below the FSHs. The only exception was Wilgamuwa HA where the cost of a PSH was substantially higher than a FSH. The reason underlying this seeming contradiction was related to the classification of houses as fully and partially sprayed by respondents. Although for the AMC workers, partial spraying meant spraying outside the house, some respondents considered it in a different way. For instance, if a house was fully sprayed except the kitchen or a room they considered it as partial spraying. An attempt was made to resolve this problem by checking some randomly selected houses just after the completion of the HHS questionnaire to reconfirm whether the respondents gave proper answers. Those observations, indeed, supported the seeming misclassifications made by respondents on spraying. In Wilgamuwa and Dambulla HAs (where the difference between fully and partially averages was small) such misclassifications were more common.

Finally, it is interesting to note that the time spent and the indirect cost of HH members seemed to be related to the epidemiological characteristics of the district across HAs. In other words, in the HAs where relatively larger number of cases were reported, time spent and cost incurred by HHs also had higher values. This may be an expression of the distress and the need of people in highly malarious areas to get rid of the disease.

5.8 Community cost on self preventive measures

This section looks at three self preventive measures: MNs, repellents and prophylaxis. This section should be treated with caution as for some respondents prophylaxis was prescribed by a doctor. Due to the small number of prophylaxis users, and to make the analysis simple, however, prophylaxis was considered as a self preventive measure; cost of prophylaxis was not included under the cost analysis of formal treatment.

a. Mosquito nets

It was found that 30.5 % of HHs had MNs with a total of 482 making the

number of MNs per HH equal to 1.52 (Table 5A.5). Since the number of regular users of MNs was 982, one net was generally shared by about two people. Both the highest percentage of MN-using HHs (35.4 %) and the highest percentage of regular users (38.4 %) were reported in Dambulla HA. As Table 5A.5 indicates 75.5 % of MNs had been purchased or received within the past five years. Only 32.2 % of respondents expected to use them more than three years. The majority of respondents (i.e., 45.2 %) expected a life period of 1-3 years for their nets and 22.61 % thought that they could use them for another one year or less because those nets were purchased long ago.

Based on the purchase price of each MN, irrespective of the year of purchase, Rs.181,368 was spent by the MN using HHs making an average of Rs.573.95 per HH (Table 5.9). This means a HH spent Rs.108.10 on MNs per year[14]. The differences of these measurements across HAs reflected the level of the usage of nets; HAs with relatively high number of nets and users recorded relatively high figures. The highest cost per HH was for Wilgamuwa HA (Rs.673.17) followed by Dambulla HA (Rs.669.29) and Galewela HA (Rs.592.45). For cost per year these three HAs also had the highest three figures. Obviously, lower usage of MNs in Matale, Rattota, Naula, Laggala-Pallegama and Yatawatta HAs brought down their costs per year to about half of the above three HAs.

Table 5.9: Cost of the use of MNs per HH and per user for 1992 by health area

Health area	No. of HHs	No. of regular users	Purchasing cost per household (Rs.)	Cost per household per year (Rs.)	Purchasing cost per user (Rs.)	Cost per user per year (Rs.)
1.Galewela	108	343	592.45	117.15	186.55	36.89
2.Dambulla	112	377	669.29	125.11	198.83	37.17
3.Laggala Pallegama	17	43	334.88	63.34	132.40	25.04
4.Naula	21	52	332.43	47.34	134.25	19.12
5.Wilgamuwa	29	96	673.17	124.93	203.35	37.74
6.Yatawatta	6	10	340.83	87.99	204.50	52.79
7.Ambanganga Korale	10	28	305.70	43.93	109.18	15.69
8.Pallepola	10	26	447.50	72.10	172.12	27.73
9.Rattota	2	6	200.00	25.00	66.67	8.33
10.Matale	1	1	250.00	62.50	250.00	62.50
District	316	982	573.95	108.10	184.69	34.78

With respect to a user, on average, Rs.184.69 was spent for purchasing

[14] As Table 5A.5 indicates nearly 25 % of mosquito nets were more than five years old and about 25 % of them were 10 or more years old. As was revealed in interviews and observations, the life time of a mosquito net was largely dependent on who and how it was used, and how it is maintained. To avoid these complications, only the annual average values were measured without giving weights to different years of life of mosquito nets; i.e., original cost was divided by the life time (Chapter 3).

MNs. This figure was highest for the less endemic Yatawatta HA (Rs.204.50) followed by Wilgamuwa HA (Rs.203.35) and Dambulla HA (Rs.198.83)[15]. For cost per user per year again Yatawatta HA had the highest figure of Rs.52.79 (except Matale) followed by Wilgamuwa (Rs.37.47) and Dambulla (Rs.37.17) HAs.

b. Repellents

Two type of repellents were mainly used by the respondents: mosquito coils (40.8 %), and various types of leaves and husks (31.4 %) (Table 6A.30 and for details of repellents See Table 6A.31). Table 5.10 shows the distribution of users and direct cost of repellents across HAs[16]. Those repellents largely consisted of mosquito coils; only one and another three HHs used an insecticide spraying and *Sambrani*[17], respectively. For them Wilgamuwa HA had the highest percentage of users (62.4) followed by Dambulla HA (57.1). All the less malarious HAs reported lower usage: e.g., Rattota (12.5 %), Yatawatta (15.0 %) and Matale (15.8 %).

As Table 5.10 indicates, a sum of Rs.59,702 with an average of Rs.139.49 per HH was spent on repellents during the previous year. The AC of repellents varied notably across HAs from Rs.180.56 in Dambulla to Rs.35.50 in Matale. Again the relatively low average values were reported for the less malarious HAs as in the case of MNs. The AC of repellents per HH was nearly 20 % higher than MNs and the total annual cost of paid repellents was 75 % greater than the total annual cost of MNs.

c. Prophylaxis

Use of prophylaxis appeared to have a relatively less important place among respondents, in that, only 94 people (1.8 %) took it during the year concerned. The highest percentage of 4.59 was reported from Naula HA. There were no prophylaxis users in Matale HA. A sum of Rs.1726 was spent for prophylaxis with an average of Rs.18.38 per user. While Galewela HA had the highest average of Rs.33.00, averages of three HAs, namely, Wilgamuwa, Ambanganga Korale and Rattota were reported as zero just because the respondents received drugs from government clinics. Characteristics

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[15] The figure of Matale HA may not be very meaningful due to the tiny sample size; i.e., only one HH had MNs.

[16] No household spent any amount for leaves and husks. They were normally available in the near vicinity of houses.

[17] A mineral powder which produces a fragrant but strong smell when burnt. Though this is normally used in religious acts, these three respondents used it as a repellent.

of prophylaxis users will be examined in Chapter 6.

Table 5.10: Cost of taking prophylactic treatment per user and cost of using repellents per household for 1992 by health area

Health area	Prophylaxis			Repellents*		
	No.of people used	No.of users as a % of total population	Cost per user (Rs.)	No.of households used	No.of using households as a % of total households	Cost per household (Rs.)
1.Galewela	29	2.12	33.00	114	42.54	142.71
2.Dambulla	17	1.49	15.53	132	57.14	180.56
3.Laggala-Pallegama	10	2.82	2.50	30	40.54	135.65
4.Naula	26	4.59	16.92	33	29.20	70.18
5.Wilgamuwa	2	0.33	0.00	73	62.39	131.47
6.Yatawatta	6	2.17	0.00	11	18.97	65.91
7.Ambanganga Korale	1	0.32	20.00	9	15.00	157.22
8.Pallepola	2	0.90	10.00	15	38.46	58.78
9.Rattota	1	0.55	0.00	5	12.50	35.50
10.Matale	0	0.00	0.00	6	15.79	69.33
District	94	1.80	18.36	428	41.23	139.49

* includes all repellents for which users paid a price.

Concluding remarks

This chapter examined the cost borne by patients and their family members in seeking care for illness, and community cost of preventive measures. Although public health care services were free, patients had to spend a substantial amount on receiving those services, especially for travelling, making the difference between AC figures of receiving services from public and private sources very small. Irrespective of the source of treatment, patients spent the highest proportion of their cost of compliance on special and nutritional food.

The community cost of the main public preventive measure, residual spraying, primarily consisted of the indirect cost of time spent receiving it. This average figure was much less than the provider's cost per dwelling. However, the community incurred a substantially high cost per member for self preventive measures such as MNs and coils.

Cost figures manifested the willingness of the community to bear a relatively high portion of the cost of AMAs on curative as well as preventive care. But to make any conclusion about the observed community practices, it is essential to examine what were the gains of those practices. Moreover, a more detailed examination is required on compliance with those curative and preventive measures. While the next chapter will look at community behaviour with respect to those control measures in detail, Chapter 7 will examine the community effectiveness of them.

CHAPTER 6. COMMUNITY RESPONSE TO THE DISEASE

In this chapter, community response to malaria is examined with respect to both curative and preventive care. It examines how did the AMAs operate at the community level and the constraints faced by the community in accepting and in making compliance with them. This analysis is expected to provide materials to assess the community effectiveness of AMAs and therefore to serve the third and fourth specific objectives of the study.

The chapter begins with an examination of community behaviour in curative care followed by preventive care. The analysis will then move on to an examination of reasons underlying community behaviour. First, association between knowledge, attitudes and practices of the community with respective to curative and preventive care will be examined separately. For curative care, however, some chooser specific factors such as location of and distance to the MC will also be examined in relation to behaviour pattern of patients. The analysis will be extended to examine the hypothesized relationships between three main socio-economic indicators of community members, income, age and literacy level, and their curative and preventive behaviour. Given the free education system in Sri Lanka up to the level of university, it is presumed that literacy level and income are not closely associated with each other in determining the community behaviour. Finally, knowledge of the community will be briefly looked at by examining lay perceptions about control strategies and measures.

6.1 Community behaviour in curative care

a. Sensitivity towards illness and source of treatment

Almost 84.4 %, 78.3 %, 74.9% and 69.6 % of patients reported headache, fever, pains in joints of hands and legs, and shivering as their first symptoms of the disease, respectively (Table 6A.1). Chillness, pains in back and nausea/vomiting were reported by 39.4 %, 23.0 % and 17.9 % of patients, respectively. There was no statistically significant difference of symptoms between the two groups of patients who believed and did not believe they had malaria before seeking formal treatment, with χ^2 and P values were at 8.4845 and .58, respectively (Table 6A.1).

As the first reaction to the onset of symptoms of illness, almost 87.3 % of patients had taken self treatment, with 85.0 % taking it on the same day (Table 6A.2). Panadol, Disprin and Aspirin were the most commonly used drugs for self treatment (Chapter 5). All the patients who did not take self treatment and 97.1 % of those who

took self treatment obtained formal treatment making the total equal to 97.5 % (Table 6A.3). Out of the remaining 10 patients, six believed that they were fully recovered through self treatment and others had not taken formal treatment at the time of the investigation. It is important to note that two of those perceivably fully recovered patients (from Sigiriya GND in Dambulla HA) had taken the proper dose of anti-malarial drugs.

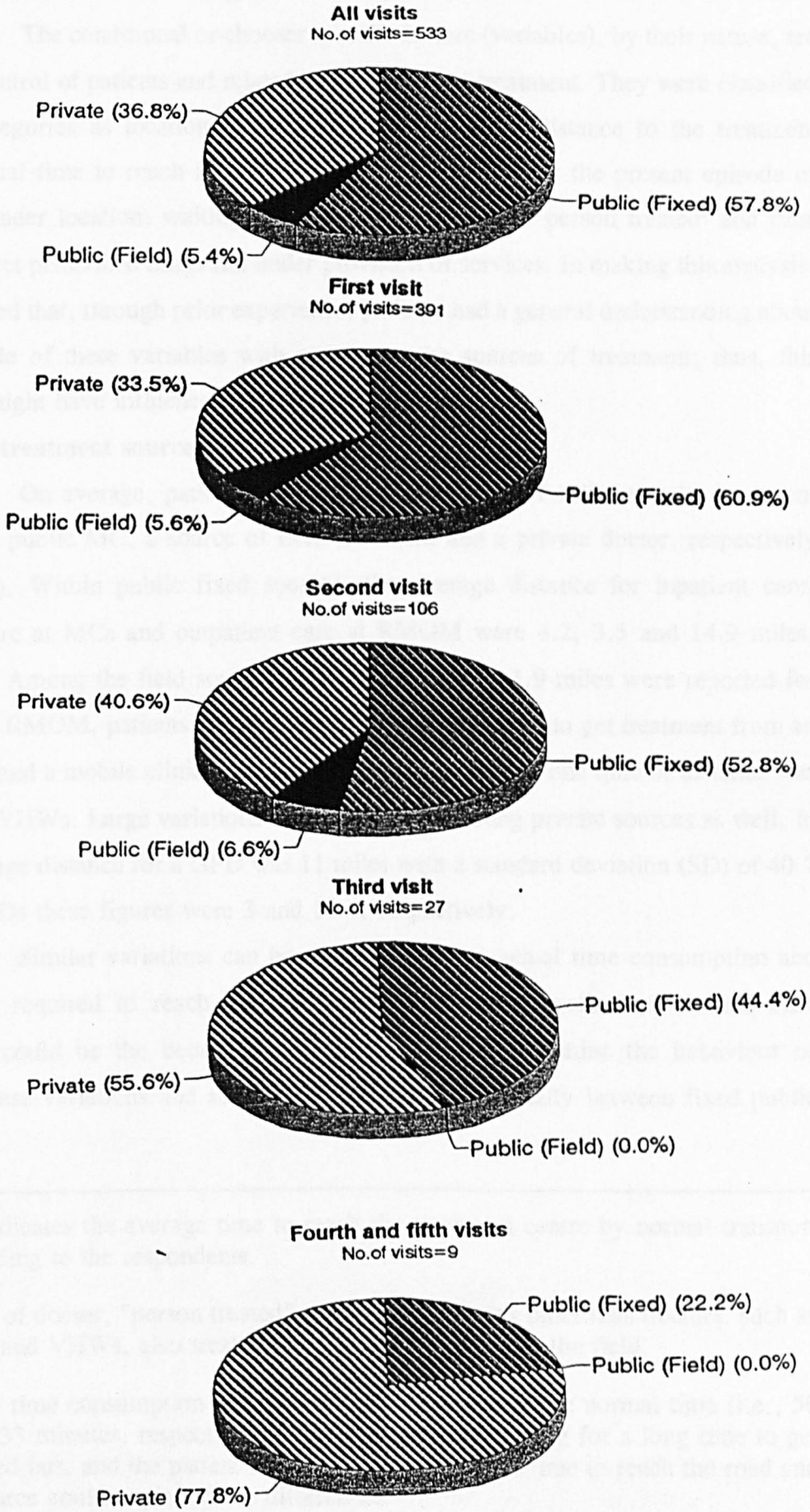
Only 4.2 % of patients took formal treatment on the same day and 39.7 % and 32.2 % did so on the following day and two days later (Table 6A.3). More than half of the patients who did not take self treatment, took formal treatment on the following day; only 8.4 % of patients took more than three days to take formal treatment.

In seeking formal care, while 97.5 % of patients made at least one visit to a formal source, only 2.3 % of them made four or five visits (Table 6A.4). Another 26.4 % and 6.7 % patients made two and three visits, respectively. On average, a patient made 1.4 visits to a formal source of treatment. Only 11 patients seemed to have ignored illness or not yet decided to continue treatment at the time of the investigation. This number rose to 15 with four patients who had not taken any formal treatment after the failure of self treatment. Thus the illness negligence rate was equal to 3.7 % of the patient population.

If sources of treatment were classified into three categories as public fixed MCs, public field and private, and compared, a clear tendency can be observed towards private sources for later visits (Table 6A.4 and Figure 6.1). No treatment was received from public field sources after the second visit. The proportion of the visits to outpatient care at public MCs dropped from 55.0 % for the firsst visit to 22.2 % for the last two visits. The proportion of visits made to private sources, however, moved up to 77.8 % for the last two visits: percentage of the visits for GPDs increased from 18.9 % for the first visit to 44.4 % for the last two visits; for PDs it moved up from 13.8 % to 33.3 %. The only exception, was the notable increase in the utilization rate of public inpatient care from 5.9 % for the first visit to over 11 % for the second and third visits.

These observations first indicate the existence of a high sensitivity towards illness within the community. Secondly, although there was a general tendency among patients to use private sources, public inpatient care did not seem to have experienced an outward movement of patients; probably as it was the final resort for severely ill patients. In the following sub sections factors underlying the tendency towards private sources will be examined in detail with respect to conditional factors and, patients' perceptions and socio-economic conditions.

Figure 6.1: Patients' behaviour in seeking care from public and private sources



b. Conditional factors in seeking care

The conditional or chooser specific factors (variables), by their nature, are out of the control of patients and related to the source of treatment. They were classified into two categories as location and provision of services. Distance to the treatment source, normal time to reach it[1] and time spent to reach it for the present episode of illness fall under location; waiting time, time spent with the person treated[2] and time spent to collect prescribed drugs fall under provision of services. In making this analysis, it was assumed that, through prior experience, patients had a general understanding about the magnitude of these variables with respect to the sources of treatment; thus, this experience might have influenced them in making a choice.

Location of treatment sources

On average, patients travelled 3.9, 1.0 and 5.1 miles to take treatment from a fixed public MC, a source of field treatment and a private doctor, respectively (Table 6A.5). Within public fixed sources, the average distance for inpatient care, outpatient care at MCs and outpatient care at RMOM were 4.2, 3.5 and 14.9 miles, respectively. Among the field sources, while a distance of 1.9 miles were reported for the MBCs of RMOM, patients travelled about quarter of a mile to get treatment from an FA, a PHW and a mobile clinic run by the closest MC. Nearly one mile of distance was reported for VHWs. Large variations can be observed among private sources as well, in that the average distance for a GPD was 11 miles with a standard deviation (SD) of 40.7 miles. For PDs these figures were 3 and 11.1, respectively.

Similar variations can be observed for the actual time consumption and normal time required to reach the source of treatment as well. But, normal time requirement could be the better conditional variable to determine the behaviour of patients[3]. These variations and seeming discrepancies, especially between fixed public

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[1] This indicates the average time to reach the treatment centre by normal transport modes according to the respondents.

[2] Instead of doctor, "person treated" was used as persons other than doctors, such as PHWs, FAs and VHWs, also treated the patients especially in the field.

[3] Actual time consumption was substantially higher than the normal time (i.e., 50 minutes and 33 minutes, respectively). Reasons such as waiting for a long time to get a less crowded bus, and the patient taking a relatively longer time to reach the road and treatment source could explain these differences.

outpatient clinics (FOPCs) and GDPs, need some clarification. First, the distance to GPDs (i.e., 11 miles) was greater than FOPCs (i.e., 3.5 miles) although most of the GPDs maintained their service stations at the adjoining quarters of the MC. Secondly, although clinics of PDs were largely located in populated townships (Table 3A.5) the average distance to them seemed to be smaller than public MCs which were more widely spread throughout the district. But the distribution of distance to FOPCs was more leptokurtic than GPDs and PDs, with kurtosis equalled to 23.8, 16.4 and 13.5, respectively. Thus the majority of patients to FOPCs travelled a distance within a smaller range than for other sources. Only 3 % of FOPC patients travelled over 10 miles, but this percentage was 6.5 and 11.9 for PD and GPD visits, respectively.

Provision of services

Among the factors related to provision of services, waiting time varied markedly across sources (Table 6A.6). Outpatient care at public MCs had the highest waiting time of 31 minutes followed by MBCs (27 minutes). This figure was relatively low at GPDs (16 minutes) and PDs (18 minutes). Time spent with the person treated did not vary much across sources, but the average time of private sources was relatively higher than public sources (i.e., 4 and 3.3 minutes, respectively). Waiting time to collect prescribed drugs, however, vary substantially across all sources. Public outpatient clinics reported the highest time of 12 minutes. For RMOMC it was only 2 minutes. Similar small averages were reported for all field sources as well. For private sources, it was 6 and 5 minutes for PDs and GPDs, respectively.

Validity of conditional factors

The statistical validity of observed differences in conditional variables was first tested with ANOVA and none of those variables gained a statistical significance or any significant R^2 value in the comparison between group variations[4] (Tables 6A.7). Secondly, statistical validity of the differences in all conditional variables across public and private sources were tested (Table 6A.8). Comparisons were made between a) FOPC vs. GPD, b) FOPC vs. PD, c) FOPC vs. GPD+PD, and d) GPD vs. PD.

With respect to the location variables examined, distance to private sources was significantly larger than public sources. However, there was not such a large

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[4] Even when the ANOVA was undertaken by combining sources of treatment with small number of responses into a few groups (e.g., all public field sources into one group), statistical results were almost the same.

difference in the distances between GPDs and PDs (P=.32). The average times spent to reach FOPCs and GPDs were almost the same. On average, patients spent relatively more time to reach a GPD than a PD. Finally, although the average time required to reach an FOPC was significantly less than a GPD, it was almost similar to a PD[5].

Among the variables on provision of services, there seemed to be no similarities between private and public sources. Within private sources, however, a similarity was observed in the waiting time at GPDs and PDs (P=.66). But the time spent at the pharmacies of those two sources were much different from each other (P=.38). Thus almost all observations made earlier on conditional variables across public and private sources are further validated by these statistical properties.

c. Patients' perceptions

For this analysis, it was assumed that the general treatment behaviour of patients was largely reflected by their choice of treatment source for the first visit. Therefore, the analysis will be largely confined to the first visit.

The majority of public (69.2 %) and private (69.5 %) patients believed that they had malaria before seeking formal treatment with P value and χ^2 equalled to .9621 and 0.022 (Table 6A.9). This indicates that it was not the attitudes towards symptoms of illness but some other factors affected the choice between public and private sources for the majority of patients. As observed earlier, self assessment about the level of illness seemed to have affected the choice of source of treatment, in that 13.5 % of public patients and 9.2 % of private patients believed they were severely ill with P value and χ^2 equalled to 0.22 and 1.524 (Table 6A.9). With respect to the knowledge about the availability of BFF at the nearest public MC almost 85.8 % of public and 85.5 % of private patients had the correct understanding with P value and χ^2 equalled to .94 and .0053 (Table 6A.10).

These three comparisons reconfirm the earlier finding that severity of illness had moved a substantial proportion of those patients towards public treatment. For instance, almost 39.1 % of patients who took inpatient care for the first visit had thought that they were severely ill before making that visit (Table 6A.11). This percentage was less than 20 for all other sources. Obviously, the most important reason for this tendency

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[5] This generalization may not be applicable to the whole district. This will be further examined in Chapter 9 along with the discussion on the validity of making generalizations for the whole district on the basis of the present data base.

was that inpatient care for severely ill patients was only available at public hospitals.

It was further examined how did the correct understanding of the BFF at the closest public MC and the level of illness affected the selection of treatment source. One of the most important finding was the bypassing of the closest public MC by severely ill patients. For the first visit, 18 % of FOPC patients bypassed the closest MC (Table 6A.12).

Over 50 % bypassing rates were reported for all the MCs with no BFF except two (Table 6A.12) and 71.4 % of those patients attended either a BH/DH or a PU with BTF and another 23.8 attended a DH or a PU with BFF (Table 6A.13). From the by passed patients of MCs with BFF, 85.7 % attended either the BH or a DH with BTF. Thus bypassing largely tended towards MCs with better treatment facilities. Interviews disclosed that the few bypassing reported for the MCs with BTF were also largely related with severity of illness to seek inpatient or better care.

With this background, the tendency towards private sources was finally examined on the basis of patients' perceptions. Almost 55.4 % of private patients highlighted supply deficiencies at public MCs and 26.2 % of them wanted to avoid waiting time and inconveniences at those MCs (Table 6A.14). Unavailability of services (20.8 %) or drugs (3.1 %) and dissatisfaction with the service (5.4 %) at the closest public MC moved other patients away from them.[6].

When moving on to second visit, dissatisfaction with the first source of treatment due to no improvement made 88.2 % and 73.7 % of public and private patients turn to other sources, respectively (Table 6A.15). Almost 70.6 % of diverted public patients sought treatment from a GPD, of them 64.7 % expected better attention from the GPD for their private patients. Supply deficiencies affected to another 11.8 % of patients to seek private treatment. Once again severity of illness seemed to be a main reason for shifting a considerable percentage of patients towards public sources for inpatient care (26.3 %). Similarly, need to get a blood test made 36.8 % of patients shifted to public sources.

After changing treatment source, although 70.6 % and 68.4 % patients of private and public patients, respectively, believed that they were fully recovered, the rates

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[6] Although severely ill patients were accepted for the MCs with inpatient facilities at any time, such facilities were not available at the closest MC of those patients. For the majority of these patients, treatment was required during night time or a weekend

of patients' satisfaction with outcome relatively higher for public sources (52.6 %).

d.Socio-economic factors

With this background socio-economic factors underlying the choice of treatment source was examined and, first, it was found that the literacy level of the HH head was not a statistically significant variable with P value and χ^2 equalled to .76 and 1.8415 (Table 6A.16). Secondly, there were statistically significant differences across age groups in making choices (P=.021, χ^2=16.4368) (Table 6A.17). Relatively high proportions of visits (around 75 %) were reported for public sources from children below 15 years and adults in the age group between 45 to 60 years[7]. Among young (20-30 years) and middle aged (30-45 years) patients this percentage was 53.4 % and 60.0 %, respectively. Thirdly, patients' behaviour was not independent from their living standards. While 32.2 % of Janasaviya[8] recipient patients made visits to private sources, a significantly high proportion of patients of other HHs (39.4 %) sought treatment from private sources (Table 6A.18). Similarly there was a clear tendency towards using private care with the increases in HH income (Table 6A.19). Percentage of visits made to public sources declined from 75.8 to 61.9 when moving away from the first to the fourth income quartile. But the latter percentage was 5.2 % higher than the percentage of the public visits of the third income quartile. This increase was primarily due to the seeking of inpatient care by 10 patients belonged to that income quartile. This indicates that irrespective of the level of income, in the case of severe illness, patients tended to take treatment from public sources.

e.Compliance

According to patients' responses[9], in general, there was a high compliance

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[7] The seeming tendency of the patients above 60 years towards private sources should be treated with caution due to the small sample size of that age group.

[8] Literally Janasaviya means strengthening people and this was the government's main poverty alleviation programme. Food Stamp Programme has been operating for a long time. Before the implementation of Janasaviya, Food Stamp Programme was reviewed and its benefits were confined to the households of the lowest income stratum. Poverty line was defined according to that income level and food stamp recipient households were gradually transferred to the Janasaviya programme. At the time of the study both programmes were operating.

[9] Please note that the respondent was not always the patient; e.g., in the case of a child it was mother, father or an elderly sister, brother etc. (see questions 4 and 5 of Form 2 of the HHS)

for prescribed drugs by about 89 % of patients taking them accordingly (Table 6A.20). 28.8 % of other patients stopped taking drugs as soon as they recovered. No improvement of the illness, side effects and aggravation of illness made 27.1 %, 20.2 % and 13.6 % of them stop taking prescribed drugs, respectively. Thus it seemed over 90 % of patients had full compliance for prescribed drugs according to their assessments.

6.2 Community behaviour in preventive care

a. Residual spraying

Coverage pattern

On average, 53.9 %, 13.4 % and 32.7 % houses were fully, partially and not sprayed at the last visit of the sprayers. The level of accepting RS was significantly different across HAs with χ^2 and P values of 49.5216 and <.05, respectively, (Table 6.1).

In general, level of endemicity did not seem to be associated with the level of accepting RS. For instance, while both Laggala-Pallegama and Naula HAs had full acceptance rates around 48 %, less endemic Matale HA reported the second highest rate of 57.9 %. Both Galewela and Dambulla HAs, however, had relatively high rates over 55 %. Similar differences were observed for partially and not sprayed rates as well (Table 6.1). Although the highly endemic Galewela HA had the second lowest rate for partial spraying (7.5 %) with over 35 % of not sprayed houses, these percentages were 22.1 and 29.2, respectively, for another highly endemic HA of Naula.

Table 6.1: Acceptance of residual spraying by Health Area*

Health Area	No. of fully sprayed houses	No. of partially houses	No. of houses not sprayed	Total no.of houses
1. Galewela	153 (57.1)	20 (07.5)	95 (35.4)	268
2. Dambulla	129 (55.8)	29 (12.6)	73 (31.6)	231
3. Laggala-Pallegama	36 (48.6)	7 (09.5)	31 (41.9)	74
4. Naula	55 (48.7)	25 (22.1)	33 (29.2)	113
5. Wilgamuwa	76 (65.0)	17 (14.5)	24 (20.5)	117
6. Yatawatta	25 (43.1)	11 (19.0)	22 (37.9)	58
7. Ambanganga Korale	32 (53.3)	11 (18.3)	17 (28.3)	60
8. Pallepola	15 (38.5)	9 (23.1)	15 (38.5)	39
9. Rattota	16 (40.0)	2 (05.0)	22 (55.0)	40
10. Matale	22 (57.9)	8 (21.1)	8 (21.1)	38
Total	559 (53.9)	139 (13.4)	340 (32.7)	1038

* percentages in parentheses

In this analysis, instead of 'refusals', the term 'not sprayed' was purposely

used to encompass refusals initiated by HHs as well as by sprayers into a single category. Fifty such houses were reported and 24 of them had not been covered by the sprayers for a long time. Malaria patients were, however, reported from all those GNDs for the HHS; and, 6 cases from the HHs which were not covered bysprayers[10]. Location of the house far away from the road, difficulty to reach the house as it was on a hill and stoppage of spraying in their locality about a year or more than a year ago were the main reasons given by respondents for sprayers' refusals of those 24 houses.

Reasons for the sprayers' refusal of other 26 houses were different; although sprayers had the practice of visiting 17 of those houses, they did not do so at their last visit for a reason unknown to the respondents. In fact, they had arranged their houses and were waiting for sprayers. Another 7 houses were visited but refused by sprayers: there was a patient in one house; the remaining stock of malathion was not enough to spray another house; no one was available to arrange the house but sprayers were not prepared to help them; water was not available in the near vicinity of another house for the sprayers to make the mixture; and, rain was the reason for the sprayers to refuse three houses. The other two houses were refused as the HH heads in each of them had an argument with the sprayers on their careless practices.

Community perceptions

With the above background, those 50 HHs will be excluded from the following analysis. Among the others, 93.9 % and 28.8 % of full and partial acceptors, respectively, and 9.0 % of refused HHs stated they normally respond to RS in that manner (Table 6A.21). This implies that full acceptors were much more firm about their response for RS than the others; i.e., the majority of them seemed to have maintained that practice for a long time.

The AMC was able to induce only 41.2 % and 10.2 % of HHs which did not have a general practice of accepting full and partial spraying, respectively, to do so for the last visit of sprayers (Tables 6A.22 and 23). In that way, prosecution announcement[11] (26.6 %), sprayers' insistence (5.9 %), explanation of the benefits of RS by sprayers (8.8 %) and announcement of the spraying day in advance (5.9 %)

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[10] Those GNDs were Vallewela in Laggala-Pallegama HA, Wegodapola in Galewela HA, Dambulla in Dambulla HA, Dunkalawatta in Matale HA and Koswana in Rattota HA.

[11] A vehicle belongs to the AMC runs across the village and announces the prosecution notice by a loud speaker.

affected the decision of those full acceptors (Table 6A.22); decisions of only 5.1 % of those partial acceptors each were influenced by the prosecution announcement and insistence of sprayers (Table 6A.23)[12].

It seems that most of the other full and partial acceptors had given priority for their convenience and household activities in making their decisions. For instance, unable to arrange the house, need to attend an important work and cooking/ having meals were the reasons for partial acceptance for 26.3 %, 8.1 % and 7.1 % of them (Table 6A.23). Related to the first reason, it was a common practice of housewives to ask the sprayers to just spray the outside of the house when the husband was out of home for work. Similarly, availability of all HH members caused to accept full spraying for 11.8 % of them (Table 6A.22). One exception was the spraying of the outside of 15.2 % of those houses in the absence of their members. Those who had a general practice of refusing spraying seemed to have given more priority to their productive work and personal commitments; 38.6 % of them had to go for work and another 19.7 % of them had to go out (e.g., hospital, relative's house, funeral, religious ceremony etc.,) on the spraying day (Table 6A.24).

In persuading HHs to accept RS, RSTs seemed to have not played an important role. Two field observations related to this issue are given below. First, it was a common perception in almost all parts of the district that behaviour of sprayers was very different from how they behaved a few years ago. One respondent from Bambaragaswewa GND in Galewela HA illuminated it: "... those days they used to come straightaway to the inside of house saying they wanted to spray the full house, so all possible furniture should be taken out. They also helped us to do so. Now it is entirely different. They get into the premises expecting a word of refusal. Even if a small child told them that they were not willing to accept RS, sprayers would turn back without making any comment".

Secondly, one observation was made during piloting at a village in Naula HA where the investigator had a brief chat with the RST in the morning. An AMC vehicle running across the village made the prosecution announcement. Investigator met the RST once again at noon when they were coming back from the village with "empty

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[12] Making the sprayers' visit during the malaria or mosquito season can not be considered as a provider's inducement for acceptance; spraying was normally carried out according to a pre-scheduled time table and the only exceptions were SPs.

malathion bags" after completing spraying. In explaining performance of "the day", the FA said that they were able to spray only 10 houses (out of 25 target houses) as all others were closed. He blamed people for their uncooperative behaviour and unawareness of the benefits of spraying. But the investigator did not ask how their malathion bags became empty.

Finally, when asked about the perceived benefits of spraying, reduction in other insects was pointed out by 82.3 % of full acceptors and 52.5 % of partial acceptors (Table 6A.25). Reduction of mosquitos was a benefit for 55.5 % of full and only 15.1 % of partial acceptors. Similarly, only 6.1 % and 5.9 % of full and partial acceptors expected control of malaria infection by spraying although 9.5 % of full acceptors did not believe it. Interestingly, about 3.5 % of all acceptors believed spraying would reduce entering snakes into the house. But for 40.0 % partial acceptors RS did not have any benefit at all and most of the HHs which accepted RS due to the prosecution announcement or insistence of the RST came under this category. Some HHs had allowed for partial spraying just because they were unable to avoid the RST. One farmer from Dambulla HA illuminated this behaviour pattern:"..we normally close the house and go out ...to the field, to the market or ...on the spraying day because we don't see any benefit of it. But some days they come little earlier. One day they told it was because most of the houses at the entry side of the village were closed. On such days, since we do not like to disappoint them (or to be impolite for them) we just ask them to spray the outside of the house and go.."

Socio-economic factors

Literacy level of HH heads and monthly income of HHs were examined with respect to the level of accepting RS. Sprayers' refusals and partial spraying in the absence of HH members were excluded from the analysis because they primarily indicated the behaviour pattern of sprayers rather than the respondents.

Literacy level was found to be significantly different in each level of acceptance with χ^2 and P values at 14.3048 and .07, respectively (Table 6.26). Both refusals and partial acceptance were positively associated with the level of literacy. While only 8.9 % and 12.7 % of illiterate and primary educated HH heads accepted partial spraying, it rose to 13.9 % and 18.4 % for the those who had education up to G.C.E. (O/L) and on or above G.C.E. (A/L), respectively. The full acceptance rate dropped from 66.1 % for the illiterate group to just 34.2 % for the highest educated group.

Income levels were also found to be statistically different for each level of

acceptance with χ^2 and P values were at 10.2496 and .11, respectively (Table 6A.27). But only partial acceptance showed a clear association with income. While 10.0 % of the lowest income quartile accepted partial spraying, that percentage rose to 17.1 for the fourth income quartile. The gradual decline of the rate of refusals (from 32.8 % to 25.8 %) markedly increased in the fourth income quartile (to 31.7 %); the rate of full acceptance had the opposite trend and moved down to 51.3 % in the fourth income quartile (from 61.7 %).

The data suggest that HHs with a lower income level had relatively less bargaining power in refusals. They either accepted full spraying or refused spraying by just leaving the house; almost 76 % of the refusals of the first income quartile occurred in that manner. 48 % of refusals of the fourth income quartile occurred by directly asking sprayers not to spray. The highest partial acceptance rate for the highest income bracket indicates that, in the case of unwillingness to accept RS, unlike the low income HHs, they had more capacity to ask the sprayers to just spray outside the house and leave. During field visits some respondents who belonged to relatively high income levels stated that, just to ensure that they did not disturb the known sprayers, they used to ask them to spray outside the house.

Compliance

There seemed to be less compliance with RS among full acceptors than partial acceptors with 66.6 % and 58.3 % of them rubbing off residuals, respectively (Table 6A.28). This was simply because there was less to rub off after partial spraying. Windows, doors and furniture were the most common items subjected to rubbing (about 45 % of all acceptors).

Almost 45.8 % of full acceptors and 38.1 % of partial acceptors rubbed off the residuals on the same day (Table 6A.29). About 25 % of all acceptors rubbed off the residuals within two hours. In general, about 65 % of all the acceptors did not allow the residuals to stay over one week.

b.Repellents

Burning mosquito coils and leaves and husks was observed throughout the district; 40.8 % and 31.4 % of HHs had those practices, respectively. The two types of repellents seemed to be treated as substitutes by the users (χ^2 = 20.3542 and P < .05) as only 22.2 % of them used both types of repellents .

The practice of using each type of repellent was significantly different across HAs with χ^2 and P values for mosquito coils and leaves and husks at 108.0113 and

< .05, and 32.3031 and .0001, respectively (Table 6A.30). While Wilgamuwa HA had the highest percentage of mosquito coil using HHs (62.4 %), it was 56.7, 42.2 and 40.5 for Dambulla, Galewela and Naula HAs, respectively. For all less endemic HAs it was less than 20 %.

Similar differences were observed for the use of leaves and husks as well: while Naula HA had the highest proportion of HHs (46.0 %), it was 35.9 %, 35.1 % and 34.2 % for Pallepola, Laggala-Pallegama and Dambulla HAs, respectively, and less than or equal to 20.0 % for the less endemic HAs.

Maduruthala leaves (*Ocimum sanitum*) was the most popular repellent with 62.3 % of HHs using them (Table 6A.31). The literal meaning of the name of this plant is mosquito plant which is believed to chase mosquitos away when it's burnt. Having Maduruthala plants around the house is also believed to be an protection from mosquitos. The other popular leaf was Kohomba (*Azadiarachta indica*) with 50.3 % of HHs using it. Coconut husks were the next popular repellent (40.2 %).

The main reason for using mosquito coils and leaves and husks was to get rid of mosquito nuisance with 94.1 % and 96.3 % responses, respectively (Table 6A.32). The need to get rid of malaria was a reason for using repellents for about 22 % users.

It seemed using repellents was a regular habit for only a small proportion of users. Almost 68.1 % of mosquito coil users and 53.1 % of leaves and husks users burnt them only during some evenings in the mosquito season and only 27.7 % and 36.8 % of them, respectively, did so every evening during the mosquito season (Table 6A.33). Other users had different frequencies in using them and about 1 % of each type of users burned them every evening during the malaria season.

There seemed to be positive associations between the use of mosquito coils, and the level of literacy of HH head and HH income (χ^2 =7.2226 and 12.9282, and P=.12 and .005, respectively) (Table 6A.34). While only 31.7 % of the HHs whose heads were illiterate used mosquito coils, this percentage rose to 42.2 for the HHs whose head had on or above G.C.E. (A/L) qualifications. Similarly, although only 34.2 % of the HHs within the lowest income quartile were using mosquito coils, it was 49.4 % for the highest income quartile.

A seeming negative association was observed between the use of leaves and coils, and the literacy level of the HH head and HH income (χ^2 =13.3826 and 8.6698, and P=.009 and .03, respectively) (Table 6A.34). 33.3 % and 31.4 % of HHs whose heads were illiterate or had secondary education, respectively, used leaves and husks as

repellents; this percentage was only 11.1 for the HHs whose head had on or above G.C.E. (A/L) qualifications. With respect to income, while 34.2 % of the HHs belonging to the first income quartile were using leaves and husks, it was 25.1 % and 30.1 % for the HHs within the third and fourth income quartiles.

c. Mosquito nets

The use of mosquito nets was significantly different across HAs with the χ^2 and P values were at 102.0004 and < .5, respectively (Table 6A.30). Dambulla HA had the highest percentage of MN using HHs (48.5 %) followed by Galewela with 40.3. All the other HAs had less than 30 % of HHs using MNs; less endemic HAs such as Matale, Rattota and Yatawatta had very low percentages of 2.6, 5.0 and 10.3, respectively.

The prime purpose of using MNs nets was to get rid of mosquito nuisance (58.5 %) and 28.5 % HHs wanted to have an undisturbed sleep by using them (Table 6A.35). Only 2.8 % sought a relief from malaria.

Almost 62.0 % of HHs reported they used MNs every day during the mosquito season (Table 6A.36) and 30.4 % used them throughout the year irrespective of the level of the presence of mosquitos. Only 3.5 % of HHs were concerned about malaria in using MNs and used them every day during the malaria season. Others used them either during the rainy season or some days during the mosquito season.

Although there were 982 regular users of MNs, only 78 % of them used them during the preceding night of the investigation day (Table 6A.37). On the other hand, MNs were largely used by children below 5 years; 40.8 % and 33.8 % of them were regular MN users and slept inside MNs during the previous night, respectively. For the all children below 15 years these percentages were 27.1 and 20.6. The lowest usage of MNs were reported for the age groups between 15-20 years (9.8 % and 7.9 %), 45-60 years (9.4 % and 8.3 %) and above 60 years (9.2 % and 6.9 %).

Only 11 (3.5 %) of the MN using HHs had a single net for each HH member (Table 6A.38). Other HHs were asked to explain why some members seemed to be not using them; the response of 35.4 % was that all the regular users shared the net/s among themselves. But unafordability was the reason for unavailability of enough MNs for 30.7 % HHs. Some members of another 20.2 % HHs were not interested in them. Using mosquito coils and insufficient space within the house each made some members of 1.9 % of HHs not use them. However, unafordability was the main reason for 45.0 % of HHs which did not have MNs (Table 6A.39). This was elaborated by

another 12.2 % of HHs as the unafordability to buy them for all members. It is worth mentioning that the majority of HHs not interested in MNs (19.1 %) belonged to less endemic HAs.

It seemed that literacy level was positively associated with the use of MNs (χ^2 = 58.3304 and P value < .05) (Table 6A.40). While only 16.7 % and 22.7 % of the HHs whose heads were illiterate and had only primary education were using MNs, respectively, almost 64.4 % of the HHs whose heads had educational qualifications on or above G.C.E. (A/L) were using MNs.

Income level of the HH was also found to be positively associated with the use of MNs (χ^2=60.5921 and P value < .05) (Table 6A.41). Although only 17.7 % of the HHs within the first income quartile were using MNs, this percentage rose to 26.9, 29.0 and 48.3 for the next three consecutive income quartiles. These results strongly support the point raised in the above paragraphs on the relationship between affordability and use of MNs on the basis of respondents' perceptions of MN usage.

d. Prophylaxis

Altogether 42.6 % of HHs were aware of prophylactic treatment (Table 6A.42) and the awareness was relatively higher in highly endemic HAs; e.g., 61.9 % in Naula HA and 10.5 % in Matale HA. But the awareness rate was very low in Wilgamuwa HA (12.8 %). One plausible reason is the avoidance of this HA by special programmes of the AMC[13] (may be due to its remote location) and administering of prophylaxis was largely done by those programmes (Chapter 4).

Only 94 respondents had prophylactic treatment during the previous year and, of them 30.9 % were reported in Galewela HA followed by 27.7 % in Naula HA. Only about 1 % of users were in Ambanganga Korale and Rattota HAs each and there were no prophylaxis users in Matale HA.

Among those who had completed the treatment by the time of investigation, 34.0 % had taken it for 12 weeks (Table 6A.43). Another 17.0 %, 12.8 % and 5.3 % had taken it for 4 weeks, 8 weeks and 3 weeks, respectively. At the time of investigation 12.8 % of them were still taking prophylaxis and the length of period varied from two weeks to six weeks.

Prophylactic treatment was largely taken by males and those who belonged to the age group of 30-45 years (Table 6A.44). Field observation revealed that most of

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[13] Not a single special programme was undertaken in Wilgamuwa HA in 1992.

the females within this age category were pregnant women; and, most of the males who had been infected malaria several times had taken it on the advice of a doctor due to fear of recurrence of the disease.

The private sector played the leading role in both prescribing and dispensing prophylaxis (Tables 6A.45 and 46). Private doctors and GPDs had prescribed it for 42.5 % and 11.7 % of users, respectively. Government doctors prescribed prophylaxis for 34.0 % of users and AMC officers did so for 7.4 % users. Almost 54.3 % of users obtained the prescribed tablets either from a private pharmacy or a private doctor; 30.9 % and 8.5 % users obtained them from government MCs and MBCs of the AMC, respectively.

6.3 Community perceptions of controlling the disease

At the end of the HHS, respondents were asked to express their suggestions about control measures and a summary of those suggestions are presented in Table 6A.47. There was an encouraging response for this request and almost 62.3 % of respondents were in a position to make at least one suggestion. The two main suggestions were a) undertaking RS in the proper manner (23.9 %) and b) controlling mosquito breeding places (23.6 %). Most of the respondents who made the former suggestion had the practice of accepting full spraying. By using the term "proper manner", they indicated, on one hand, the weaknesses of present PRSP and, on the other hand, the need to achieve a high coverage rate to make it more effective. But their emphasis focused on the behaviour of sprayers in explaining these needs.

a. Behaviour of sprayers

Some examples of sprayers' behaviour were given in section 6.2.a. Moreover, it was found that even the acceptors of RS were not very happy with the behaviour of sprayers. One respondent from Wilgamuwa HA illuminated it: " we know very well that they don't put the correct quantity of malathion to the mixture. Earlier when we had spraying for the full house, we had confidence that we were safe from malaria at least for a few weeks.....If they do the spraying well how can there be patients in sprayed houses as well...". He continued saying "you can't find even a single farmer in this locality who is not using malathion as a pesticide. It is available in some shops in the village. One kilo is only Rs.30.00. Last year it was only Rs.20.00 and some times it goes up to Rs.40.00...but, even than it's the cheapest and most effective pesticide ... for that price...for our paddy fields...". Therefore for him and other similar respondents, some strict laws were required to stop selling malathion to private shops and thus to

maintain its proper mixture in spraying. "You see this is indeed a stealing of our...public resources...and, the most unfortunate thing is they make money from a disease of the poor...you know what I mean...by selling malathion, they indeed make a crime to the society..." this was the response of a poor agriculture casual labourer in Wilgamuwa HA. As was mentioned by some respondents it was a common practice in a remote area in the district to transport malathion from the local AMC store to nearby shops by using a wheelbarrow. The community wanted to have the proper malathion mixture to get the real effect of malathion to control the disease.

Some respondents made reference to the careless behaviour of sprayers as well. According to many interviews, unlike the earlier period, sprayers were now very reluctant to spray the full house and always wanted to finish their job as early as possible: "...you know.. this is because sprayers know that they are doing a useless job. They are the people who know how much malathion is in their spray tanks..so they may think ...why do we spend time to spray just water to the walls and furniture.. let's finish it and go home soon." - an extremely provocative response from one farmer in an interior village of Naula HA.

The other aspect of the "proper manner" of RS referred to the coverage of an insufficient number of houses in a village due to refusals. However, most of the respondents who made this comment did not make any suggestions as to how to achieve a higher coverage. For most of them achieving a high coverage rate was largely in the hands of AMC workers and officers. This issue was also somewhat related to the pilferage of malathion and then to the low quality of RS. "I know that the mosquitos can't be killed by just spraying a few houses in a village. We accept spraying just as an additional measure but don't depend on it.. as you know.. it is useless. So how do you insist all the houses to accept spraying...One farmer may use malathion to his paddy field today...and can you ask him to tell the sprayers to spray his house..It is just ridiculous.." This was the comment of a farmer who had education up to G.C.E (O/L) from Dambulla HA. His and most of the other respondents' view was that any attempt of insisting that people accept RS or make them more aware of the benefits of RS would be futile due to the existing disbelief about the effectiveness of malathion within the community; this was especially due to pilferage and hence improper mixture of malathion.

b. Combating breeding places

The second major suggestion of combating breeding places was proposed by the respondents largely as an alternative to RS. They had an understanding about

mosquito breeding places and pointed to such locations around their houses and in villages including abandoned gem pits, water pools around lakes and streams, jungles etc.

c. Other suggestions

Some respondents expressed their dissatisfaction with malathion by indicating the need to change it to a better one (8.7 %). During the interviews they pointed out that the new insecticide should not be able to be used in paddy fields as a pesticide; "... if so, same agony will happen to that chemical (i.e.,insecticide) as well. The government should think about it and find out a chemical which can be used only to kill mosquitos...Otherwise that will also become a waste..",one small trader from Naula HA elucidated the characteristics of an insecticide which the community needed to replace malathion.

It is important to note that almost 24 respondents (i.e., 2.3 %) raised the necessity of introducing a vaccine for malaria; they seemed to have been influenced by the success of the child vaccination programme. Only a very few percentage of suggestions were focused on treatment facilities and, in that, improving access to treatment facilities by bringing them up to village level and improving facilities at MCs were pointed to by 1.8 % and 0.8 % respondents, respectively. An extremely low percentage of only 0.6 % was reported for MN impregnation. This was quite understandable, as was mentioned, impregnation was introduced only in December 1992 to a few villages in the district. Thus the community was, in general, not aware of impregnation. Those who made that suggestion had come to know about it through their friends in nearby villages. For 3.4 % respondents, however, using MNs by many people was a good method to control the disease in a more effective manner.

Concluding remarks

The community had a high sensitivity towards illness as well as preventive measures for the disease; the ignorance rate of the illness was negligible and almost all households maintained some self preventive measures for the disease.

Selection of the source of curative care and type of preventive care was found to be dependent on socio-economic factors such as literacy level and income. Although age and sex had some association with the behaviour pattern, they were not so strong as socio-economic factors. The level of illness as well as knowledge and attitudes about treatment sources also influenced the patients to select the source of treatment. Thus severity of illness moved a considerable proportion of patients to seek inpatient care at public sources irrespective of their socio-economic conditions. On the other hand, prior

experiences and supply constraints seemed to have diverted a large portion of patients to private sources.

Similarly, for RS, in a way, a highly rational behaviour pattern was observed by refusing it or rubbing off residuals as the community did not experience any appreciable relief from that preventive measure. In general, the community had a proper understanding about the benefits of each AMA through their experience which, indeed, has a history of nearly fifty years. Thus many suggested to introduce a method to maintain the proper mixture of malathion to make residual spraying effective and to focus on breeding places as a long lasting control measure.

CHAPTER 7. COST-EFFECTIVENESS OF ANTI-MALARIA ACTIVITIES FROM A SOCIETAL POINT OF VIEW

In serving the fourth specific objective of the study, this chapter integrates the provider's cost and the community cost of AMAs into a single framework with a view to examine their cost-effectiveness from a societal point of view. The chapter attempts to answer questions such as what would be the most cost-effective means of treatment, whether it is worthwhile to continue RS at the present level or it should be modified, what proportion of the cost of disease control was borne by the community, and how far community behaviour contributed in achieving a more cost-effective control programme.

A set of CEIs will be presented and compared. For curative care, cost per patient perceivably recovered will be compared across different means of treatment, and for the main preventive measure - RS - comparisons will be made across HAs with respect to cost per person protected (CPPP). Effectiveness and cost implications of all possible preventive measures will be examined by making a comparison between their users and non-users; household level illness rate of malaria (HLIR) will primarily be used for this purpose by focusing on community effectiveness. Because of the impossibility to measure any effectiveness indicator for activities such as entomological investigations and larvicide spraying, only per capita cost will be presented for them.

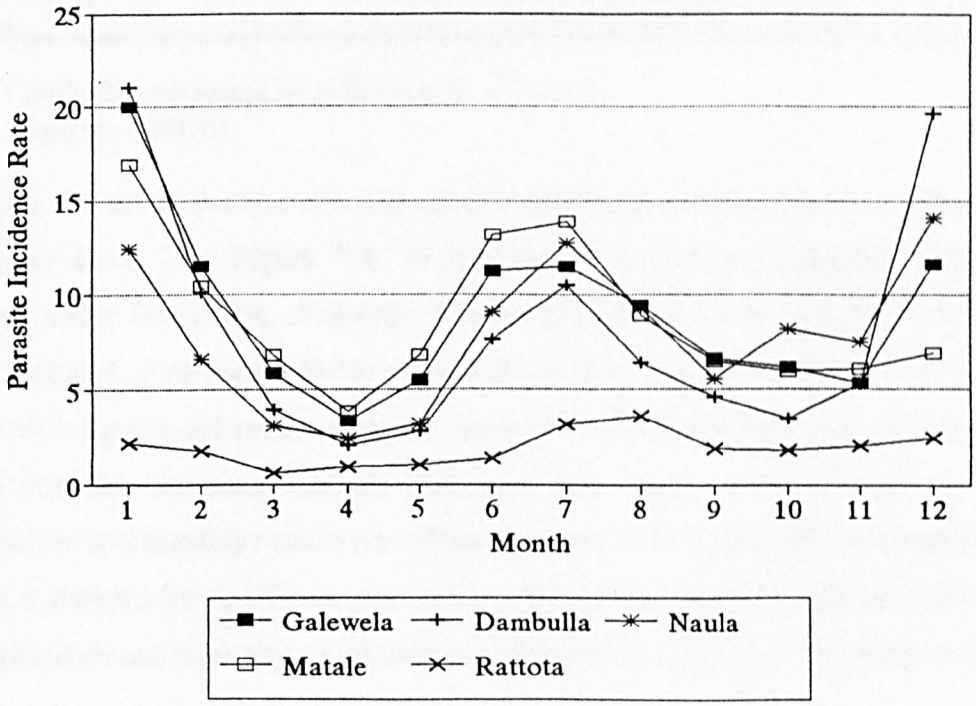
To make this analysis meaningful, all cost elements were required to express in a common time dimension; i.e., for the year 1992. This necessitated extrapolating community cost for the whole year. The extrapolation exercise was more complex for the indirect cost of illness: the direct community cost of preventive measures was estimated for the whole year in Chapter 5; and, it is quite reasonable to assume that the direct community cost of treatment is almost the same irrespective of the time of infection. This chapter begins with elaborating the problems encountered in the attempt to extrapolate indirect community cost for the whole year with the measures taken to overcome them in the follow up analysis.

7.1 Attempt to extrapolate community cost

The time period, in which the HHS was carried out (i.e., from December 1992 to mid March 1993) represents one of the two peak periods of the occurrence of the disease during a year (Figure 7.1). Since peak periods seemed to be the same for all the

five integrated HAs[1], it was explored whether it was possible to devise a method to extrapolate indirect community cost for the whole year by using a seasonal index for parasite incidence rate (PIR). In such an analysis, however, seasonal variations in productive activities in each HA should also be taken into account. Each of these two issues, seasonal variations in the PIR and productive activities, will be examined below.

Figure 7.1: Monthly Parasite Incidence Rates in 1992 by Health Area



It was first examined whether the seasonal pattern of PIR among the five integrated HAs in Figure 7.1 was the same as in the 11 individual HAs as well. Spearman rank correlation coefficient was computed for the descending ranks of monthly PIRs of seven HAs and the results are given in Table 7.1; four HAs (i.e., Laggala-Pallegama, Ambanganga Korale, Pallepola and Ukuwela) were excluded as morbidity figures of the first three were not compatible with other HAs[2] and the location of the latter was in the non malarious zone (For PIRs see Table 7A.1). One of the most important observations

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[1] NB: Although the district is divided into eleven HAs, due to some data problems, they were integrated into five HAs for the analysis of provider's cost. (Chapter 4).

[2] As explained in Chapter 4, for Laggala-Pallegama HA, blood filming was introduced only in June 1992, and none of the MCs in Ambanganga Korale and Pallepola HAs have at least blood filming facilities.

Table 7.1: Spearman rank correlation coefficient across HAs with respect to monthly parasite incidence rates for 1992

Health Area	Galewela	Dambulla	Naula	Wilgamuwa	Rattota	Yatawatta	Matale
1.Galewela	1.00						
2.Dambulla	0.94*	1.00					
3.Naula	0.91*	0.96*	1.00				
4.Wilgamuwa	0.54	0.58	0.66	1.00			
5.Rattota	0.59	0.66*	0.71*	0.87*	1.00		
6.Yatawatta	0.73*	0.77*	0.86*	0.45	0.51	1.00	
7.Matale	0.77*	0.78*	0.78*	0.43	0.38	0.83*	1.00

* Indicates statistical significance at .01 level.
Source: RMOM

from Table 7.1 is the absence of a statistically significant correlation between Naula and Wilgamuwa HAs. For Figure 7.1, Wilgamuwa and Laggala-Pallegama HAs were integrated under Naula HA. Although Wilgamuwa HA had only one MC with blood filming facilities, it is reasonable to assume that (being the leading MC in the HA) its monthly PIR figures did reflect seasonal variations in its catchment area. If a complete data set for the adjoining Laggala-Pallegama HAs were also available, a similar disassociation (presumably) could have been observed with Naula HA. Wilgamuwa HA indicates a statistically significant association with only Rattota HA. On the other hand, Rattota HA does not show any significant correlation with Galewela, Yatawatta or Matale HAs.

The reasons for those statistically insignificant relationships will be illuminated below when examining the second issue related to the extrapolation attempt. Given the general presumption that the disease normally occurs at a higher level following the rainy season, it is helpful to consider climatic conditions in the district across HAs to have a general understanding of the disease occurrence pattern and also the seasonal variations of productive activities. The district is served by two monsoons[3] as well as inter-monsoons due to its location in the middle part of the island (See Table 7A.2 for monthly rainfall figures). Matale, Rattota, Ukuwela, Yatawatta, Pallepola, Ambanganga Korale, and some parts of Dambulla and Naula HAs, which fall under either wet zone or intermediate zone, receive rain the from south-west monsoon. Other parts of the district including Laggala-Pallegama and Wilgamuwa HAs are served by the

[3] South-west monsoon from May to September and north-east monsoon from November to March.

north-east monsoon. Moreover, some areas of Dambulla, Galewela and Wilgamuwa HAs fall under the dry zone.

Due to the absence of a unique climatic pattern throughout the district, occurrence of the disease as well as initiation of productive activities based on rain water[4] seem not to take place with a uniform time schedule in different parts of the district. It was observed during field visits that during the same month, while farmers of certain HAs were engaged in the preparatory activities of cultivation, other HAs were moving closer to the harvesting season. This could be one reason for the disassociation of monthly incidence rates especially between Wilgamuwa and almost all other HAs.

Another important aspect related to productive activities is the differences between HAs with respect to the level of dependence on rain water for cultivation and, hence, for income generation. The majority of farmers in three HAs (Naula, Laggala-Pallegama and Wilgamuwa) are dependent only on rain water for their prime source of agricultural output (i.e., *chena* cultivation). In 1991, 65.32 %, 56.91 % and 43.99 % of land in these three HAs, respectively, were government forest where *chena* cultivation is normally undertaken (Table 7A.3). This percentage was, however, only 0.43, 2.20, 3.43, 5.75 and 5.98 for Rattota, Ambanganga Korale, Matale, Yatawatta and Pallepola HAs, respectively. On the other hand, large parts of Galewela and Pallepola HAs are covered by coconut cultivation in which delay in monsoons does not make an immediate impact on the crop, unlike the case of *chena* cultivation.

The observed insignificant associations among HAs with respect to the PIR seemed to be primarily related to the heterogeneity in climatic conditions, and the latter was clearly associated with productive activities[5]. This means that an extrapolation exercise of indirect community cost based on the HHS and a composite seasonal index on PIR of five integrated HAs may not generate reliable results. On the other hand undertaking such an exercise at each HA level, would not only be complex, but also be severely handicapped due to the incomplete data on incidence for the HAs with relatively

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[4] Only a very small part of the district is served by irrigation water.

[5] In making such a conclusion, some reservation should, however, be put on to the differential use of public MCs across HAs because PIRs were finally dependent on it. But the analyses in chapters 5 and 6 did not indicate any substantial differences in the use of public MCs across HAs.

poor blood testing/filming facilities[6]. For these reasons, a decision was taken not to devise a seasonal index, and to use the survey data without making any seasonal adjustments. In the analysis, averages of indirect community cost and the provider's cost were just added together in terms of episodes and average social cost figures were measured. However, due to the variation in climatic conditions in the district and, hence, its production activities, the HHS was able to capture most of the variations in productive activities across the district.

7.2 Curative care

Before moving on to average cost figures, probabilities of perceived recovery from illness (PRFI) by receiving treatment from different means of treatment will be examined to provide a basis to indicate their effectiveness. These probabilities, based on the responses of patients to the Form 2 of the HHS, are presented in Table 7.2.

Table 7.2: Probability of recovery by receiving treatment from public sector by means of treatment

Means of treatment	No. of responses	Outpatient care	Inpatient care
1. MCs with blood testing facilities	147	.721	.848
2. MCs with only blood filming facilities	28	.658	.333
3. MCs with no blood filming facilities	30	.659	---

Source: Household survey

Inpatient care at MCs with BTF had the highest probability of PRFI followed by outpatient care at the same type of MCs. Both the other two types of MCs, irrespective of the levels of the availability of BFF, had very similar probabilities for outpatient care. Inpatient care at MCs with only BFF reported the lowest probability, of just .33[7]. It is difficult to reach any firm conclusion about the quality or effectiveness of care at different types of MCs by just considering these probability figures. On the one hand, although the MCs with BTF had higher probabilities, most of them are more equipped than others. On the other hand, availability of only BFF at a MC did not seem

[6] Although it may be possible to devise a complex statistical method to estimate seasonal indices at HA level with a poor data base, such an attempt is out of the scope of this study.

[7] Although only one patient was reported full recovery by receiving inpatient care from a MC with no blood filming facilities, it was not considered due to tiny sample size.

to have increased the probability of PRFI compared with MCs with no BFF. This was probably because the availability of only an FA for blood filming has a marginal effect on diagnosis procedure. Thus the possibility of making proper diagnosis at MCs with BTF could have resulted in prescribing proper treatment for the patients and, hence, a higher probability of PRFI at those MCs.

When looking at the cost scenario of different means of treatment, nine of them were taken for the analysis (Table 7.3)[8]. On average, a perceivably fully recovered patient (PFRP) who took treatment only from public MCs spent Rs.51.47 as direct cost. This figure was Rs.120.63 for those who took treatment only from private sources, and Rs.126.68 for those who attended both public and private sources. The cost incurred by the provider to treat patients attended only at public MCs accounted to Rs.129.39 per PFRP. For a patient who attended both public and private sources, and perceivably fully recovered, government incurred a cost of Rs.149.79 for the patient's attendance at public MCs during the episode of illness as one source of treatment. Thus if the direct costs of treatment of the government and the patients' expenditure on receiving treatment (from both public and private sources) were taken together, the direct cost per PFRP was Rs.180.86 (i.e., 51.47+129.39) for those who took treatment only from public MCs and Rs.120.63 for those who took treatment only from private sources which is 33.3 % lower. In this respect, the substantially higher direct cost of public and private combination (i.e, Rs.126.68 + Rs.149.79 = Rs.276.47) is quite understandable, as some of these patients incurred cost to receive both inpatient and outpatient care, and certain patients made visits to government doctors in their private capacity either before or after taking inpatient care at a public MC. If a comparison of total direct cost per PFRP was made between outpatient care at public MCs with BTF (Rs.50.66+Rs.73.33 = Rs.124.00) and private sources (Rs.120.63), the slightly higher value of public sources would be clearly offset by their better quality of care with BTF indicating a relatively more efficiency.

Among the seven means of public treatment, the lowest patient's direct cost

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[8] Firstly, all cases treated by field sources were excluded as it was impossible to measure provider's cost for those cases in Chapter 4. This includes FAs, PHWs, VHWs, MBCOs and MBCs. Although provider's cost was measured for MBCs, it was done only for illustrative purposes as case studies. Secondly, one case treated by an ayurvedic doctor and 6 patients dependent only on self treatment were also excluded from the analysis. Details of all the excluded cases are given in footnote 1 of Table 7.3.

was reported for outpatient care at MCs with no BFF (Rs.37.30). There seemed to be no substantial difference between two means of outpatient care; i.e., Rs.50.66 for MCs with BTF and Rs.45.15 for MCs with only BFF. However, inpatient care at MCs with BTF and the two combinations of inpatient and outpatient care had relatively high patients' direct costs of Rs.68.75, Rs.72.20 and Rs.102.08, respectively; the latter two figures refer to MCs with BTF and MCs with only BFF. In general, relatively high values of these three means of treatment are understandable since, as was revealed by the HHS, the severity of the illness of most of the inpatients was normally higher than for the other patients and, hence, their illness period was also a lengthier one.

Table 7.3: Social cost of recovering per patient by means of treatment

Means of treatment	No. of patients fully recovered (1)	Direct cost: Patient (2) (Rs.)	Direct cost: Provider (3) (Rs.)	Indirect cost (4) (Rs.)	Social cost (2)+(3)+(4) (5) (Rs.)	Patient's share of direct cost [(2)/(2)+(3)] (6)	Community share of social cost [(2)+(4)/(5)] (7)
1.Public treatment							
1.1 MCs with blood testing testing facilities							
a.Inpatient care	18	68.75	371.32	255.03	695.10	15.62	46.58
b.Outpatient care	105	50.66	73.33	153.87	277.86	40.86	73.61
c.Combination of inpatient and outpatient care	5	72.20	389.85	200.00	662.05	15.63	41.11
1.2 MCs with only blood filming facilities							
a.Outpatient care	24	45.15	135.95	84.69	265.79	24.93	48.85
b.Combination of inpatient and outpatient care	2	102.08	380.71	581.25	1064.04	21.14	64.22
1.3 MCs with no blood filming facilities							
a.Outpatient care	27	37.30	95.18	165.19	297.67	28.16	68.02
1.4 Combinations of above a, b and c	7	66.11	199.74	69.58	335.43	24.87	40.45
Sub Total (Public)	188	51.47	129.39	158.98	339.84	28.46	61.93
2.Private & Public treatment	35	126.68	149.79	520.96	797.43	45.82	81.22
3.Private treatment	88	120.63	0.00	160.19	280.82	100.00	100.00
TOTAL	311	79.50	95.07	200.06	374.64	45.54	74.62

Notes:

1.Out of the 344 perceivably fully recovered patients in Table 5.5, 33 were excluded in preparing this table as provider's cost could not be measured for them in Chapter 4. They were; 11 treated by Public Field Workers (2 by FAs, 2 by PHWs and 7 by VHWs), 1 by an Ayurvedic doctor, 5 at MBCs, 1 at a MBCO, 8 by a combination of a fixed MC with a field treatment source, 1 by a combination of employee's clinic and RMOMC, and 6 by self treatment alone.

2.Patients' direct cost is the sum of RC and CC in Table 5.5.

3.Indirect cost is a re-estimation of the cost figures attributed to the fully recovered patients in Tables 5.6 and 7 with respect to means of treatment.

4.Provider's cost was measured by using the cost figures in Tables 4.9 and 4.12, and probability figures given in Table 7.2 (Details are in Chapter 3).

Treatment cost of the provider appeared to vary substantially across different means of treatment. The highest value was reported for the combination of inpatient and outpatient care at MCs with BTF (Rs.389.85) followed by the same type of treatment at MCs with only BFF (Rs.380.71). It is important to note that the lowest provider's cost per patient recovered was reported for the outpatient care at MCs with BTF (Rs.73.33) followed by MCs with no BFF (Rs.95.18)[9].

When the patient's direct cost and the provider's treatment cost were aggregated for the public sources of treatment, on average, a patient bore 28.46 % of the cost of treatment. This percentage was 45.82 for the combination of public and private treatment. In general, patients' incurred a 45.54 % of direct cost per PFRP. Across the seven means of public treatment, this percentage varied substantially, in that, as expected, relatively high values were reported for outpatient care with the highest value for MCs with BTF (40.86 %). For the other two means of outpatient care it was about 25 %. Patient's share of the direct cost was only 15.62 % for inpatient care at MC with BTF and 15.63 % and 21.14 % for the combinations of inpatient and outpatient care at MCs with BTF and MCs with only BFF. The reasons underlying these variations were explored in detail in Chapters 4 and 5 with respect to sources of treatment.

If all cost items were taken together, on average, society incurred a cost of Rs.374.64 per PFRP, of which, 74.62 % was borne by the community and the balance 25.38 % by the government. With respect to public treatment, these figures were Rs.339.84, 61.93 % and 39.07 %, respectively. In the case of the combination of public and private sources, the contribution from the government accounted for only 18.78 %.

These values as well as percentages varied substantially across means of public treatment. As Table 7.3 shows this was largely due to the variations in indirect cost. Relatively high indirect cost figures can be clearly observed for all the means of treatment which involved inpatient care. Severity and, hence, lengthiness of illness were the prime reasons for those high cost figures (Chapter 6). But among the three means of outpatient treatment, a seeming irregularity can be observed, in that indirect costs of MCs with BTF and MCs with no BFF were almost twice those of MCs with only BFF. Lack of diagnostic facilities at the MCs with no BFF, and the possibility of the high attendance

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[9] This figure was not possible to measure in Chapter 4 as morbidity data were not available for those MCs. Thus, findings of the HHS were used to make this estimate and the method adopted was explained in Chapter 3.

of severely ill patients at the MCs with BTF, could be the reasons for these cost differences, as each of them could move up the lengthiness of illness. But such a reasoning is difficult to justify as the diagnostic procedure at the MCs with only BFF was the same as the MCs with no BFF.

In this context, it should be noted that one of the most important issues concerning indirect cost was the difficulty of generalizing reasons for its variations across means of treatment, due to several reasons. Primarily, the way the members of the patient's HH were affected by illness varied on the basis of the socio-economic status of the HH and seasonal factors. For instance, the illness of a patient of a farming HH which had just completed the harvesting did not affect much the productive work of HH members. On the other hand, the illness of even a child during the seeding season may force HH members either to spend some additional time or to hire labour for the recovery of the productive time lost due to attending the patient. Similarly, although farmers who are engaged in *chena* cultivation may experience severe output losses (from damages by wild animals) due to their absence from the field during the illness period, such problems are not faced by the other farmers (Chapter 5).

Due to the seeming irregularity of the indirect cost across HAs, means of treatment, and also among patients, and this could be a common feature in many endemic areas, attempts should be made in future research to develop methodologies to calculate and generalize indirect cost across different socio-economic groups. This is extremely important as a large proportion of the community cost takes the form of indirect costs as revealed in this study.

7.3 Residual spraying

As explained in Chapter 5, the cost to the community in receiving RS includes only the indirect cost of time spent by HH members to arrange the house for RS. Cost of the provider is the same as that presented in Chapter 4. These two types of costs are integrated and presented in Table 7.4, along with a new measure of CPPP.

The provider and the community together spent Rs.210.66 to protect the members of a HH which accepted full spraying during the year concerned. This amount was Rs. 74.09 for PSHs. Unlike the case of treatment, only 5.81 % and 10.73 % of the social cost per FSH and PSH, respectively, was borne by the community. Across HAs these figures vary substantially and for FSHs, Naula reported the highest social cost of Rs.221.88 followed by Galewela and Dambulla with Rs.215.47 and Rs.215.37, respectively. No further explanations are required for these variations as they

were analyzed in Chapters 4 and 5, in detail.

Table 7.4: Average cost of provision and acceptance of residual spraying for fully sprayed houses by health area

Health area	Provider's cost per house	Community cost per house	Social cost per house	% of the community cost from social cost	Cost per person protected (per year)
A. FULL SPRAYING					
1. Galewela	203.38	12.09	215.47	5.61	172.94
2. Dambulla	200.27	15.10	215.37	7.01	177.37
3. Naula	209.66	12.22	221.88	5.51	179.16
4. Rattota	165.21	10.11	175.32	5.77	148.58
5. Matale	172.60	6.11	178.71	3.42	151.15
District	198.43	12.23	210.66	5.81	171.97
B. PARTIAL SPRAYING					
District	66.14	7.95	74.09	10.73	60.49

NOTE: First four columns with figures refer to the cost of one spraying cycle and for the last column it was assumed that the acceptance rate was the same for all the four spraying cycles of the year.

On average, a social cost of Rs.171.97 and Rs.60.49 was spent to protect each person in a FSH and a PSH, respectively, during the year concerned. These averages also varied across HAs and for full spraying, Naula had the highest value of Rs.179.16 followed by Dambulla and Galewela with Rs.177.37 and Rs.172.94, respectively. The lowest average was reported for the Rattota HA (Rs.148.58). No decomposition of these averages were made with respect to the provider and the community as those proportions were the same as for the acceptance of RS (i.e., column 5 of Table 7.4).

In interpreting these average cost figures, some reservation should by put on, particularly, to the CPPP. First, resistance to the insecticide was a very well accepted fact for the AMC as it was highlighted by almost all AMC officers during discussions. Secondly, the quantity of malathion used per dwelling varied substantially across HAs (Chapter 4). Thus the validity of even an assumption that RS provided full protection for the population in the FSHs is highly questionable. Thirdly, how to distinguish between fully and PSHs with respect to the rate and level of protection of each is also an unanswered question. Fourthly, compliance seemed to have played a critical role in

determining the protection rate (Chapter 6). Thus in the community context, issues such as what quantities of the insecticide were used in each HA and what would be the effectiveness of the insecticide if it was used with the proper mixture seemed to be only some of the factors in determining the level and rate of protection; community behaviour

Table 7.5: Acceptance of and compliance with residual spraying and RIMI

Acceptance/compliance	N	% of households with at least one patient (HLIR)*	% of households with no patient
1st COMPARISON			
a.Accepted (full or partial)	698	28.8	71.2
b.Not sprayed	340	29.4	70.6
χ^2			.04203
P value			.83757
2nd COMPARISON			
a.Accepted (full or partial) but rubbed	453	27.6	72.4
b.Accepted (full or partial) not rubbed	245	31.0	69.0
c.Not sprayed	340	29.4	70.6
χ^2			.94879
P value			.62226
3rd COMPARISON			
a.Accepted (partial) but rubbed	81	18.5	81.5
b.Accepted (partial) not rubbed	58	22.4	77.6
c.Accepted (full) but rubbed	372	29.6	70.4
d.Accepted (full) not rubbed	187	33.7	66.3
e.Not sprayed	340	29.4	70.6
χ^2			7.62835
P value			.10618

* HLIR = household level illness rate of malaria

should also be brought into the scenario to obtain more reliable and valid results. In this context, using the data of the HHS, some comparisons were made between level of acceptance and compliance, and reported incidence of malaria-like illness (RIMI) (Table

7.5)[10].

First, a broad comparison was made between acceptance of RS and RIMI. RS did not seem to protect acceptors from infection as the probability of effective protection was only .16; i.e., the P value and HLIRs of this comparison indicate that irrespective of the acceptance or refusal of RS, there was a .84 probability of having at least one malaria-like patient in about 29 % both types of HHs. However, some reservation should be given to this tentative conclusion as there is a possibility to get infected the disease outside the house particularly for those who work in the field.

Compliance with RS was added to the second comparison at a broad level. The P value and HLIRs indicate that there was a .62 probability of at least one member of about 30 % of HHs had malaria-like illness irrespective of the level acceptance of and compliance with RS.

Results of the third comparison were very provocative, in that, there seemed to be a negative impact of full acceptance and full compliance on infection, the highest HLIR was reported for HHs with full acceptance and full compliance (33.7 %); it was only 29.4 for unsprayed HHs and 22.4 for those who accepted partial spraying and did not rub the residuals off; HLIR was only 18.5 % for those who accepted partial spraying and rubbed off the residuals.

With this background, first, the HAs and GNDs from which the full acceptors, full compliance and a positive HLIR were reported were examined. There were 63 such HHs, of which 26 (41.2 %), 18 (28.6 %) and 12 (19.0 %) belonged to the highly endemic HAs of Naula, Dambulla and Galewela, respectively.

From the Naula HA, 5 such HHs were from Handungamuwa GND and 4 each from Naminigama and Vellewela GNDs. While the former two were located in close proximity to forests, the latter was in a gem mining area where a set of MBCs was carried out by the RMOM just before the HHS. Another 4 HHs in Naula HA belonged to Senagama GND. From Dambulla, 5 HHs belonged to Nagalawewa GND and from Galewela 4 were reported from Ralalarotawewa GND. In general, all these GNDs were found to be highly endemic during field visits and this was confirmed by the discussions with AMC officers and by screening available epidemiological records. Thus it seemed

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[10] In making these comparisons dates of the acceptance of spraying and occurrence of illness were not examined in detail. However, Chapter 6 clearly showed that about half of the HHs had a firm commitment for spraying which was undertaken in every three months. Irregularity was found especially for partial acceptance.

that, irrespective of the acceptance and compliance of the community, the PRSP did not seem to be much effective in controlling the disease in highly endemic areas.

Secondly, it was examined whether there was a relationship between the HLIR and the practice of using other preventive measures; HLIR was not found to be independent from the practice of burning coils (χ^2 = 5.8257 and P value = .0158) and there was a positive relationship between the two variables; HLIRs of HHs which burned and did not burn coils were 33.1 % and 26.2 % , respectively. Similar results were found for the practice of burning leaves and/or husks with χ^2 at 1.9463 and P value at .1630. While the HLIR of the HHs who had burned leaves and/or husks was 31.9 %, it was only 27.7 % for the others. The HLIR had an inverse relationship only with the use of mosquito nets with χ^2 at 3.5270 and P value at .0603; mosquito net using HHs had a HLIR of 25.0 %, and it was 30.7 % for others.

Table 7.6: Use of self preventive measures by acceptance of and compliance with residual spraying, and RIMI among household members

Acceptance, compliance and infection*	Total no. of HHs	% of MNs using HHs	% of CLs using HHs	% of both MNs and CLs using HHs	% of PRT taking HHs	% of HHs with no other preventive measures
1.FULL SPRAYING						
a.Not rubbed off but infected	63	22.2	71.4	14.3	4.8	20.6
b.Not rubbed off & not infected	124	21.8	58.1	10.5	8.1	29.0
c.Rubbed off & infected	110	23.6	63.6	12.7	5.5	25.5
d.Rubbed off but not infected	262	33.6	59.2	20.6	2.3	27.9
Sub total	559	27.7	61.2	16.1	4.5	26.8
2.PARTIAL SPRAYING						
a.Not rubbed off but infected	13	53.8	46.2	15.4	15.4	15.4
b.Not rubbed off & not infected	45	22.2	28.9	13.3	28.9	48.9
c.Rubbed off & infected	15	33.3	66.7	26.7	20.0	13.3
d.Rubbed but not infected	66	40.9	48.5	19.7	6.1	28.8
Sub total	139	35.3	43.9	18.0	15.8	32.4

* Indicates whether any household member had malaria-like illness during the recall period of the HHS.

HH = household, MNs = mosquito nets, CLs = coils/leaves/husks or a combination of them, PRT = prophylactic treatment

A summary of the us of self preventive measures is given in Table 7.6. A simple comparison shows that the proportion of HHs which used each self preventive measure was higher among the partial acceptors: the only exception were coils, and leaves and/or husks. But there seemed to be no tendency among the HHs who had at least one patient, to have a lesser inclination towards self preventive measures or vice versa. For instance, the highest percentage of mosquito net usage (53.8 %) was reported for the HHs who did not rub off residuals but had at least one of its members infected; the highest percentage of both MNs and coils and/or leaves usage was among the HHs who

rubbed off the residuals and had at least one patient during the recall period.

With this background, differences among the five types of HH in the third comparison of Table 7.5 (who had at least one patient) with respect to the usage pattern of self preventive measures were examined. There were some differences in the frequencies of burning leaves and/or husks and coils. But the usage pattern of MNs was almost the same among all five groups. In this context, it is important to note, as Chapter 6 showed, that the use of self preventive measures was more common in highly endemic HAs and, hence, had a seeming correlation with the mosquito density; further, use of MNs had an association with the HH income level.

In summing up, on the basis of the data used for this analysis related to the provider and the community, it is difficult to come to any positive conclusion about an appreciable effectiveness of RS at household level. But in making such a conclusion some reservation should be given to the fact that malaria-like patients were not reported for about 70 % of the HHs covered by the HHS. The RS may not be capable of preventing the occurrence of the disease at HH level but controlling epidemics and outbreaks. On the other hand, due to the seeming less effectiveness of the acceptance of and compliance with RS along with the use of self preventive measures at HH level, it is justifiable to interpret the individual and HH level cost measurements presented in Table 7.4 as cost per person/house "to be protected" rather than "protected".

7.4 All Curative and preventive measures

Public and community costs incurred for each curative and preventive measure are presented in Table 7.7 at the individual level. In estimating these averages, while the total population of the malarious zone was taken as the denominator for public cost, the total population covered by the HHS was taken for the community cost.

During the year concerned, the government spent Rs.166.69 per person on control of malaria whilst the community made a contribution of Rs.29.90 per member. This makes the contribution from the community on malaria control equal to 15.21 % of total social cost. With respect to curative care these figures stood at Rs. 24.48, Rs.5.50 and 18.36 %. This means that, to receive treatment from any source of treatment and for compliance, the community spent Rs.5.50 per community member. This figure, however, is likely to be an underestimate due to the reasons given in the first section of this chapter. For preventive care while the government spent a sum of Rs.142.21 per person, the community contribution was Rs.24.40 per person making the latter equal to 14.64 %.

Table 7.7: Social cost per person per year on curative and preventive care for malaria by source (Rs.)

Control measure	Public contribution	Community contribution	Proportion of the community contribution (%)
1.Curative care a.Treatment	24.48	5.50+	18.36
2.Preventive care a.Residual Spraying	133.45	6.09++	4.36
b.Prophylactic treatment	1.34	0.33	19.71
c.Mosquito nets	0.25	6.54	96.36
d.Repellents	0.00	11.44	100.00
e.Other*	7.18	0.00	0.00
Sub Total	142.21	24.40	14.64
TOTAL	166.69	29.90	15.21

+ Direct cost of treatment for the one month recall period. Indirect cost per person for the same period was Rs.10.53.
++ Indirect cost of accepting residual spraying for the whole year
* Indicates entomological investigations, larvicide spraying etc.,

Among the five types of preventive measures, the public contribution for RS gained the highest value withRs.133.45 per person to protect. The community contribution for this measure was only 4.36 %. The highest contributory proportions attributed to the community for preventive measures were MNs and repellents. Since the MNIP was still at its infant stage, almost 96.36 % of the cost of MNs was borne by the community making cost per community member equal to Rs.6.54. Although the government had not made any contribution for repellents, exceeding all other preventive measures, the community spent an average of Rs.11.44 per its member for the use of repellents. It seemed that the initiation for prophylaxis was largely coming from public sources, with only 19.71 % as a contribution from the community.

Just for illustrative purposes, if the cost elements of RS were excluded from Table 7.7, it would show that almost 67.63 % of the cost per person for preventive measures and 41.74 % of the cost per person on malaria control would have been borne by the community. With indirect cost of illness the latter percentage would at least be 50.81 %.

CHAPTER 8. POLICY OPTIONS TO ENHANCE COST-EFFECTIVENESS OF AMAs

The last few chapters were devoted to assess the cost-effectiveness of AMAs from a societal point of view. This analysis provided a basis to make some conclusions about control strategies, measures as well as the organizational structure of the control programme. However, a critical question that arises in this context is how far the policy makers can use these findings to improve the cost-effectiveness of AMAs. For instance, if the malathion RS was found to be a waste of resources, what would be the reaction of policy makers ? They may react in several ways: changing the insecticide to a new one, abolition of the PRSP with the introduction of one or more new control measures etc. Thus it is a responsibility of the evaluator to make some suggestions for policy makers in this endeavour.

When looking at the analytical framework of this study, it can be seen that the CEA is a static analysis. It is also the case that the present study is based on a data base from a previous period (1992). After completion of data collection for the study, the disease itself as well as the control programme may have gone through various changes. It was the case that the whole organizational structure of the AMC was going through a transition during the study period as a result of the implementation of a decentralized administrative set up. Another example is the diversion of the current attention of the AMC towards introducing new insecticides for spraying. Moreover, political changes and hence policy changes also have occurred within recent periods[1].

Such changes could be incorporated into the study in the form of a sensitivity analysis and therefore increase the utility for policy makers. Undertaking a sensitivity analysis for a set of potential options would provide a strong basis and guidelines to policy makers as to how to improve the cost-effectiveness of AMAs. In formulating potential policies for such an analysis, emphasis should be placed on the findings of the study as well on current changes in the AMC and (if applicable) policies.

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[1] The newly elected government (in August 1994) has already displayed the welfarist nature of its policies. The Prime Minister's first policy statement has explicitly expressed the necessity to give special protection to the poor. In the health sector, according to a statement of the Minister of Health, stringent regulations are going to be imposed to control private nursing homes (i.e., maternity homes) and hospitals as a means to protect the poor (Sunday Observer, September 18, 1994). This indicates that the government may pay more attention to malaria as a disease of the poor as was clearly shown in this study.

In that way, a dynamic nature can be incorporated into the CEA; and, the undertaking of a CEA can be further justified on practical grounds.

In serving the fifth specific objective of the study, this chapter examines the cost implications of two well defined policy options (POs) for controlling malaria in Matale district as a pilot project. Each option will be explained in detail to provide a basis for cost calculations and justified using the findings of the present study and other relevant studies reviewed in Chapter 2. Indicators of the potential effectiveness of the proposed control measures of each option will also be considered. In choosing the options, special emphasis will be placed on the guidelines of the WHO's Global Plan of Action for malaria control (WHO 1993) which is the most recent comprehensive review of control strategies and measures in a global perspective.

8.1. Policy option 1

The first policy option is as follows;

By reducing the current AMC budget by about one third:

1. Replace malathion with a new insecticide for residual spraying
2. Reduce the overall expenditure on insecticide by 50 % and introduce selective residual spraying
3. With the remaining 50 % of funds saved by above (2),
   I. Augment case detection and treatment
   II. Strengthen the health information system (HIS)

a. Introducing a selective residual spraying system

The PRSP, which used malathion, was found to lack effectiveness, particularly when assessing its community effectiveness in Chapter 7. Compared to other preventive measures, PRSP was highly inefficient in that it consumed a large proportion of health resources without any apparent positive effect at community level.

Full acceptance of RS was reported as 62.0 % in the AMC records for 1992 but was only 53.9 % from the community point of view[2]. According to these sources, the refusal rate of spraying was 21.1 % and 32.7 %, respectively.

The community, indeed, had very sceptical views about the effectiveness of malathion spraying; only 6.1 % and 5.0 % of full and partial acceptors believed that

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[2] Although the latter figure refers to the sprayers' last visit, it may not be an underestimate as the HHS was undertaken during one of the peak seasons of the occurrence of malaria during the year.

it would control the infection of malaria (Table 6A.25). Even the full acceptors, who had fully complied with spraying, did not experience any positive effect of spraying in terms of malaria; this was borne out as such HHs had the highest HLIR of 33.7 % (Table 7.5).

The responses of the community members in general indicated that for them, malathion spraying was a waste of public resources; and 23.9 % of HHs expressed the need for a "proper" spraying system (Table 6A.47). This largely referred to the improper mixture of malathion; and field observations revealed it was due to the pilferage of malathion for use as a pesticide in paddy fields. Even the AMC has pointed to pilferage as an intractable problem (AMC 1989). Although a stringent supervisory system could handle this problem, such an attempt was not observed during the field work period.

Even with this gloomy scenario of the effectiveness and supervision of PRSP, the AMC contributed a malathion stock of 0.136 million kgs. to the AMAs in Matale district in 1992. With all other expenses (e.g., wages and salaries) Rs.133.45 was spent by the AMC "to protect" each person in the malarious zone through RS (Table 7.7). the total cost of spraying was 80 % of the total cost of AMAs in the district. How far the spending of such an enormous amount of public resources on malathion spraying can be justified is highly questionable.

With this background, even though no evidence is available from an epidemiological trial, the findings of this study clearly indicate the necessity to make some changes in the RS programme if policy makers still need to continue it as a control measure. What are those changes ? Should the AMC take some stringent measures to stop pilferage of malathion? Should malathion be replaced by a new insecticide? Or should the AMC introduce some new control measures after a complete abolition of the PRSP?

The AMC was felt that public support was essential to handle the issue of pilferage (AMC 1989). However, with the lack of powers to supervise field level activities after the abolition of the vertical programme, both the DAMC and the RMO did not seem to be in a position to undertake any effective measures in the form of a strict supervisory system. But even before the abolition of the vertical programme, the AMC did not appear to be in a position to find out the sources of pilferage.

It is worth reemphasising that powers for the supervision of field level operations are now in the hands of DDHSs. Thus in addition to the management of all other preventive work, DDHSs now have to look after AMAs as well. For many

employees of the RMOM, this has resulted in a slackening of supervision of AMAs at HA level. Under these circumstances, any proposal of the DAMC to ensure the proper mixture of malathion in RS would most probably be futile if it does not have a component of community participation. It is clear that the pilferage could be handled only if the DAMC could devise a simple method to ascertain the proper mixture at the HH level by HH and/or community members and implement it with community participation. Without focusing much on such aspects, however, the DAMC is now engaged in introducing new insecticides. The need to introduce a new insecticide was raised by some respondents (8.7 %) of the HHS as well (Table 6A.47). One of their main concerns was that the new insecticide should not be able to be used as a pesticide in paddy fields.

With this background, the first policy option (PO1) suggests a reduction of the expenses on malathion by 50 % and to introduce a new insecticide which matches with community requirements[3]. The MoH has already stopped importing malathion. The choice of insecticide could be dependent on the results of the insecticides which have already been introduced in some other districts. The reduction of expenditure on insecticide by half is consistent with the present policies of the AMC[4] as well. The new "Global Malaria Control Strategy" also recommended a selective application of malaria control measures particularly with respect to RS (WHO 1993). In introducing this policy, the DAMC has specifically mentioned the need to control the existing practice of excessive coverage of houses by the PRSP through a selective residual spraying programme (SRSP). Thus the DAMC stressed that the limited stocks of insecticide dispatched to the regions should be utilized in the most cost-effective manner (DAMC circular 1993).

Although it was not clearly indicated in this policy statement what percentage of the supply of insecticide would be reduced, the current supply of malathion to the district is less than half of its 1992 figure[5]. With the seeming less effectiveness of

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[3] It is worth mentioning that there is no possibility to meet the community requirement to introduce a new insecticide which cannot be used as a pesticide for paddy fields. None of the new insecticides was found to have that property (personal communication with Prof. Cris Curtis). Thus, it is essential to introduce a strict supervisory system with community participation when the new insecticide is introduced.

[4] Circular dated 29.6.93 of the Director/ DAMC to all RMOs explains the present policies of AMC.

[5] Personal communication with the RMO, Matale (September 1994).

malathion spraying, spending of even 50 % of the funds on a new insecticide may generate more cost-effective outcomes if it was used in the proper mixture and not used as a pesticide for paddy fields through a strict supervisory system with community participation[6]. Selection of areas for the new insecticide could be made on the guidelines given by the WHO's Global Malaria Control Strategy (WHO 1993).

b.Augmenting case detection and treatment

Throughout the district only 10 out of 31 MCs had BTF and another 4 had BFF. The present study found that only 38.1 % of suspected malaria patient visits were made to sources with BTF and another 8.5 % to sources with BFF. There was a tendency among the patients, who bypassed the closest MC, to attend a MC with BTF (Table 6A.13). This tendency and the movement towards private practitioners, who normally did not have BTF, raised the need for the DAMC to take some concrete measures to augment the case detection mechanism at both public and private sources to the greatest possible extent.

Augmentation of case detection and treatment (ACDT) is related to the implementation of the SRSP as well. Confinement of the main preventive activity of spraying to selected areas raises the need to introduce some substitute control measures into the areas which excluded from the PRSP. ACDT in those areas could be one of those substitute measures. This policy measure is, indeed, one of the new policy measures of the DAMC as well; the policy statement of the DAMC specifically emphasised the need for "early detection and prompt treatment" of malaria cases.

ACDT could take three forms according to the policy statement of the DAMC: alerting officers in the MCs with respect to the need for this measure, ensuring adequate supplies of anti malarial drugs and organizing MBCs in areas where MCs are scarce. The first two suggestions seem to be a reemphasis of the need to regulate some existing practices of the AMC rather than new policy measures. MBCs were also a routine activity of the AMC.

The findings of this study, however, indicated that the ACDT could take the form of strengthening the MCs which lacked BTF. If the MCs in the non malarious

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[6] Although the community willingness to take part in such a programme was not directly examined through the HHS questionnaire, interviews and discussions with community members clearly indicated their willingness to take part in it. Thus it is in the hands of the DAMC to devise a method to win community support for its RS programme.

zone and low endemic areas were excluded, at least 9 MCs may need a MIC for ACDT to a satisfactory level. Therefore it is suggested to train 9 MICs in a one year crash programme and station them at those MCs[7]. However, as an immediate step towards enhancing surveillance, and also to lay down a basis to station newly trained MICs, it is possible to station FAs at 9 MCs. The FAs who will be released from the curtailed PRSP could be used for this purpose. Since two of the MCs, to which MICs will be attached, already have FAs, two out of the 9 FAs could be stationed at another two MCs depending on the endemicity of their catchment areas[8].

For ACDT, the AMC seemed to be focusing more on MBCs. The routine practice of the AMC was to conduct MBCs when outbreaks or epidemics were reported. In chapter 4, MBCs were found to be an expensive means of detection and treatment compared to fixed MCs with BTF. As a temporary measure until the stationing of new MICs, however, MBCs could be the only viable measure in this endeavour. The available MICs could be used for this purpose. It is suggested to conduct MBCs within the first year especially in the areas where no MCs with BTF are available and from the second year onwards MBCs could be confined to outbreaks and epidemics which cannot be handled with the capacity of the MCs in the respective areas. Therefore, allowing MICs to work with private doctors could most probably be allowed from the second year onwards (see footnote 8). Given the availability of manpower, at most 250 MBCs could be undertaken during the first year with 10 at each weekend for about six months (see Section 2 of Appendix 2 for details). The six months could cover the two peak seasons of the occurrence of malaria in a year[9].

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[7] They are Kalundawa and Lenadora CDs in Dambulla HA, Wahakotte CD in Galewela HA, Hettipola PU, Hattota Amuna and Maraka CDs, and Handungamuwa RH in Wilgamuwa HA, Opalgala CD in Naula HA and Rattota DH in Rattota HA. No MIC is required for Aluwihare and Aluthwewa CDs; the former is located very close to Matale BH and a very few cases were reported from the latter. However, if further information was available on the endemicity of the catchment areas of Aluthwewa and other MCs a different distribution pattern of MICs could be decided.

[8] These measures do not necessarily mean an attraction of more patients towards public MCs from private sources. There were many reasons for patients diverting from public to private sources. As an additional measure, the DAMC could, however, explore the possibility of public and private collaboration in case detection by allowing MICs to work with private doctors and charge a fee to private doctors.

[9] Using the two RMOM vehicles and the three AMC vehicles at DDHSs should be feasible with the curtailing of residual spraying by about 50 % in terms of houses.

All attempts could be made to undertake MBCs without hampering the routine surveillance activities of the control programme[10]. Depending on malaria patients' attendance at the MCs where MICs are available, some of them could be considered to be released to take part in MBCs on weekdays, especially during outbreaks and epidemics. On such occasions, the RMO could decide whether the priority be given to the MC or the area where the MBC is going to held, after consulting with the medical officer in charge of the MC and the respective DDHS. As a complementary measure to augment treatment, it is suggested to improve the drug distribution method to VHWs. This could be easily done by making a small travelling allowance for them to make visits to the corresponding DDHS office when they face drug shortages. The observed enthusiasm in treating patients and disappointment with the shortages of drugs among the VHWs during the discussions, clearly indicated that a small travelling allowance would be a sufficient incentive for them.

c.Strengthening the health information system

The HIS could be developed to provide a strong data base to undertake regular assessments of all AMAs especially to forecast epidemics and outbreaks. It could collect data on all AMAs in detail; e.g., patients examined, confirmed and treated with their basic socio-demographic particulars, houses sprayed with basis socio-economic particulars etc. Thus it would help the RMO and other health managers to scrutinize the SRSP and other control measures continuously and also to take more efficient managerial decisions on control measures. Moreover, the proposed HIS could provide a basis for the RMO, DDHSs and also the DPDHS to evaluate the performance and productivity of all employees under their supervision. It is proposed to deploy a Health Information Assistant (HIA) at six DDHS offices (with a computer for each) to cover the whole district. A Health Information Officer (HIO) attached to the RMOM could supervise the information network.

d.Other AMAs

Funds for all other AMAs could be allocated just to maintain them as they

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[10]It was observed during the latter part of the field work period (i.e., mid 1993), the MICs and FAs attached to RMOM were engaged in the MBCs held on weekdays. On certain days, the RMOM was deserted with only a few workers. These MBCs were supported by a World Bank project. With the deployment of 9 new FAs at MCs with no BF facilities, however, the engagement of MICs at RMOM in MBCs on weekdays may adversely affect their routine work schedules. Therefore all attempts could be made to use the MICs at the RMOM for the MBCs held at weekends.

were during the study period. This includes entomological investigations, Abate spraying, seasonal spraying, special spraying etc. This means that the RMOM could take the initiative to conduct special programmes during outbreaks/ epidemics as was done earlier.

f.Cost implications

Cost structure

Table 8.1 presents the cost scenario of the PO1 after the initial calculations. In total it would cost Rs.27.43 millions for the first year and Rs.27.15 millions for the following year. This makes a reduction of the total cost of AMAs by 31 % and 32 % in the two years, respectively.

Even after the introduction of the SRSP, about 60 % of the total funds will be absorbed by RS. MBCs would account for only 1.9 % of the total cost in the first year. In total, the ACDT would consume 4.96 % and 4.24 % of the total expenditure in the two years, respectively (Table 8A.4). During the second year, some proportion of the funds of this measure could be allocated to purchase microscopes for the newly trained MICs. The allocations for the HIS stand at 6.15 % and 4.01 % for the two years (Table 8A.8). The higher proportion for the first year is due to the purchase of seven computers. Finally, 1.84 % of the funds of the second year is allocated to undertake a review of the implementation of the new policy.

Table 8.1: Policy option 1: Projected cost for the first two years

(in Rs.millions)

Activity	1992	1st Year		2nd Year	
	%	Amount	%	Amount	%
a.Residual spraying	80.1	16.19	59.01	16.19	59.62
b.Augmentation of case detection and treatment					
- Mobile clinics	0.9	0.52	1.90	0.10	0.38
- FAs/MICs at 9 MCs*	13.4	0.77	2.79	1.00	3.68
- VHWs**	0.6	0.08	0.27	0.08	0.28
c.Health information system	0.0	1.69	6.15	1.09	4.01
d.Other AMAs	5.0	8.20	29.88	8.20	30.19
e.Review	0.0	0.00	0.00	.50	1.84
Total	100.0	27.43	100.00	27.15	100.00
As a % from 1992 cost	100.0	68.98		68.28	

* The % for 1992 refers to detection and treatment except MBCs
** The % for 1992 refers to training and supervision of VHWs
Source: Appendix 2 provides details of estimation methods and sources of data.

Cost details of the SRSP are given in Table 8A.1. The AMC could select

any of the three new insecticides considered in the cost analysis of PO1: Sumithion (Fenitrothion), Icon (Lambda-cyhalothrin) and Vectron (Etofenprox). However, the main problem encountered in the cost analysis was the insufficiency of the allocated funds to purchase the total quantity required from any of the three new insecticides to cover 50 % of targeted houses. Two options are available to resolve this problem. First, if a reduction in the total cost of AMAs is left out as a secondary objective, the DAMC could select any of the three new insecticides. Even so, the savings of the PO1 (Table 8.1) would not be less than 14 %[11]. Secondly, if reducing the total cost is a prime objective, the allocated amount could be used to select any preferred insecticide and cover a smaller number of houses. However, the first option could be the most appropriate one because with that it is possible to cover half of the population in the malarious zone even with a 14 % reduction of total AMC funds.

Predicted outputs and average costs

With the assumption of SPR equal to 20 and 15 for the first and second years, respectively (Appendix 2), MBCs would examine 25,000 and 5,000 patients during those two years, respectively (Table 8A.5). Thus 5,000 and 750 positive cases would be treated by the MBCs. This makes the cost per smear equal to Rs.9.66 in each year. Cost per case detected would be Rs.48.31 and Rs.64.42. Cost per case treated would stand at Rs.40.62 and Rs.51.98, respectively. The higher cost averages for the second year is due to the smaller SPR and relatively high contributions from all other inputs such as manpower and transport compared to the first year.

Through the SRSP, 30,000 houses with a population of 150,000 could at most be covered (Table 8A.3). If the amount spent for the new insecticide was strictly restricted to half of its 1992 amount, the maximum number of houses protected would be 20,000 (Icon) 18,000 (Sumithion) and 15,000 (Vectron). In making all these estimates, the refusal rate was assumed to be negligible on the basis of community suggestions (Chapter 6). The CFSH would be Rs.298.98, Rs.354.42 and Rs.383.88 for Icon, Sumithion and Vectron, respectively. Similarly, the CPPP would stand at Rs.119.59, Rs.141.77 and Rs.153.55, respectively. Although the CFSH of any new insecticides is

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[11] The highest amount to be spent in addition to the allocated funds would be for Vectron (Rs.6.8 millions - Table 8A.1). Thus for instance, the total cost of PO1 for the first year would rise to Rs.34.27 millions making the savings equal to Rs.5.5 millions or 14 % of the total cost in 1992.

higher than malathion, CPPP is less than malathion (Rs.133.45) for Icon by 10.4 %[12]. Thus given the achievement of a proper mixture through a community supported supervisory system along with full acceptance and compliance, the new insecticides likely to be more cost-effectiveness than malathion.

8.2.Policy option 2

The second policy option is as follows;

Assuming the current AMC budget remains the same:

1.Replace malathion with a new insecticide for residual spraying

2.Reduce the overall expenditure on insecticide by 75 % and introduce a selective residual spraying system

3.With the remaining 75 % of funds saved by above (2),

I.Augment case detection and treatment

II.Enhance mosquito net impregnation through community participation and by providing mosquito nets for the deserving low income households at a subsidized rate

III.Strengthen the health information system

This policy option is different from the previous one in two ways. First, it suggests a higher reduction rate in expenditure on malathion. The justification for changing the insecticide and reducing its cost component in the total budget is the same as in the PO1; but the higher reduction rate in insecticide expenditure needs some explanation. This policy measure was devised with the purpose of diversifying control measures by introducing a new insecticide and also by providing assistance to deserving community members to use IMNs. Therefore, it is essential to divert some additional funds from spraying to a MNIP. The way those funds could be used will be explained and justified in the next sub section.

a.Mosquito net impregnation

The present study found that community members had a willingness to bear a large proportion of the cost of controlling the disease by undertaking a wide range of self preventive measures (Chapters 6 and 7). MNs and repellents were the most commonly used preventive measures. Although some authors (Ongore et al 1989) have

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[12] These estimates, however, lack one important cost element - safety measures for the sprayers including cholinesterase tests. This was not measured due to the unavailability of data. Phillips and Mills (1991) found that the cost of safety was about 2 percent of the cost per structure sprayed.

examined the utilization habits of repellents, no sufficient evidence is available in the literature, except for a few studies (e.g., Coene et al 1989, Ansari et al 1990 and Sharma et al 1993), on their effectiveness as well as on the mechanisms through which they can be introduced to the community. Therefore, introducing repellents as a new AMC supported control measure was ruled out. However, MNI seems to be an appropriate control measure as well as a means through which a close link can be built up with the community. It is possible to test whether the community has the expected compliance with IMNs and to measure their effectiveness at HH level. A reasonable range of literature is available on the effectiveness as well as cost-effectiveness of bed net impregnation programmes (Lin 1991, Masega et al 1991, Alonso et al 1991 and Picard et al 1993).

The field observations and discussions with community members clearly indicated a high feasibility to introduce the MNIP in many parts of the district through community participation. Almost 30.4 % of the HHs in the malarious zone had MNs although only 3.5 % of them had enough nets for each HH member; and 35.4 % of them shared nets among HH members (Table 6A.38). But it is important to note that some members of 30.7 % of the HHs with MNs did not use them due to unaffordability. Furthermore, unaffordability was the reason for 45.0 % of the HHs who did not have MNs (Table 6A.39). Another 12.2 % of those HHs revealed an important aspect of the relationships within rural families (or HHs) that they did not use MNs because they were unable to buy them for the whole family.

With this background, MNIP should focus not only on the HHs who have or can afford MNs but also on the HHs below the affordability level. Thus part of the savings of the curtailed PRSP could be used to subsidize MNs for the most deserving sections of the community who wish to use them[13]. With the reduction of expenditure on insecticide by 75 %, it is possible to spend about 50 % (Table 8.2) of the total malaria budget for the MNIP including the subsidy of nets.

Assessment of the eligibility to receive MNs could be made with the assistance of GNs. Due to the limitation of funds, priority could be given to HHs with infants and/or children. Similarly, HHs with an insufficient number of nets due to

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[13] Provision of free MNs was done under the government's poverty alleviation programme (i.e., Janasaviya) as well but at a marginal level. Only three such households were reported in the HHS.

unaffordability could be given a preference in providing subsidized nets.

MNI could be conducted in all possible parts of the district irrespective of the coverage of spraying. It was assumed that no PRSP will be carried out at the HHs with sufficient number of IMNs for all members and if cases were reported from those HHs, only focal spraying will be conducted at them.

MNI could be completed just before the outbreak of malaria in June and December. The period of one and a half months prior to the outbreak could be used for impregnation. The preceding one and a half months period could be used to identify receivers of subsidised nets and MN users who are willing to get their nets impregnated. The PHIs, FAs and SMOs who were released from the PRSP and the vehicles previously used for it could be used for these purposes. Those PHIs, FAs and SMOs could be given a training in impregnation.

b.Other considerations

Other measures of this policy option are largely the same as in the PO1. One addition is enhancing the role of VHWs. VHWs could be recruited from all GNDs, particularly, to support the MNIP through means of health education and organizing impregnation sessions. They can, however, be used to support the treatment programme as well. They could be properly trained and paid an allowance on the basis of their performance.

c.Cost implications

Cost structure

Table 8.2 presents the cost scenario of the second policy option (PO2) after the initial calculations. In total it would cost Rs.39.77 millions in each year, which is indeed the total cost of AMAs in 1992.

After the introduction of the SRSP, only 21.20 % of the total funds will be absorbed by RS. Although the total cost of measures for ACDT and the HIS would be same as in the PO1, this shares would be smaller than the PO1 obviously due to the high total cost of the PO2. Specifically, MBCs, training new MICs along with stationing FAs to MCs and payments for VHWs would account for only 1.31 %, 1.92 % and 0.19 % in the first year, respectively (Table 8A.4). During the second year, however, a larger proportion of 5.03 % would go to the undertaking of a review of the implementation of the new policy (Appendix 2).

From the PO2, the largest proportion of funds would be consumed by the MNIP. During the first year, 13.71 % and 36.82 % of funds would be consumed by the

impregnation of nets and MN subsidy, respectively, and these percentages would be 17.14

Table 8.2: Policy option 2: Projected cost for the first two years
(in Rs.millions)

Activity	1992	1st Year		2nd Year	
	%	Amount	%	Amount	%
a.Residual spraying	80.1	8.43	21.20	8.43	21.20
b.Augmentation of case detection and treatment					
- Mobile clinics	0.9	0.52	1.31	0.10	0.26
- FAs/MICs at 9 MCs*	13.4	0.77	1.92	1.00	2.51
- VHWs**	0.6	0.08	0.19	0.08	0.19
c.Health information system	0.0	1.69	4.24	1.09	2.74
d.Mosquito net impregnation					
- Impregnation	0.2	5.45	13.71	6.82	17.14
- mosquito net subsidy	0.0	14.64	36.82	12.06	30.32
d.Other AMAs	4.8	8.20	20.61	8.20	20.61
e.Review	0.0	0.00	0.00	2.00	5.03
Total	100.0	39.77	100.00	39.77	100.00
As a % from 1992 cost	100.0	100.00		100.00	

* The % for 1992 refers to detection and treatment except MBCs
** The % for 1992 refers to training and supervision of VHWs
Source: Appendix 2 provides details of estimation methods and data sources.

and 30.32 for the second year[14]. Cost details of the MNIP are given in Table 8A.6.

Just as in the case of the PO1, the cost of introducing the three new insecticides was estimated (Table 8A.2). Similarly, the allocated amount for the SRSP is not sufficient to introduce any of the three new insecticides to cover a quarter of houses in the malarious zone. Table 8A.2 indicates that in shifting to a new insecticide, the AMC has to spend at most an additional Rs.3.4 million (for the most expensive insecticide). This would be about 9 % of the total cost of AMAs in 1992. If the DAMC is not willing to bear that cost, the only alternative is to confine the SRSP to the allocated amount and cover a smaller number of houses.

Predicted outputs and average costs

The predicted outputs and average cost measures of MBCs are as same as

[14] For these estimates, the total cost of MNs was taken to show implications of the subsidy on AMC budget.

the PO1. Through the SRSP, 15,000 houses with a population of 75,000 could at most be covered (Table 8A.3) if the DAMC is willing to spend the 9 % additional cost explained above. Otherwise, the SRSP would be able to cover at most 9,500 (Icon), 8,500 (Sumithion) and 7,300 (Vectron) houses. Once again, the refusal rate was assumed to be negligible as in the case of PO1. The CFSH would be Rs.310.18, Rs.365.62 and Rs.395.07 for Icon, Sumithion and Vectron, respectively; CPPP would stand at Rs.124.07, Rs.146.25 and Rs.158.03, respectively. As in the case of the PO1, CPPP figure for Icon is smaller than malathion and some provision could be made for safety measures.

During the first year, the MNIP could impregnate 52,800 nets, of which 24,650 would be provided at the subsidised rate (Table 8A.7). This makes the number of people protected equal to 105,600. The underlying assumption was that, on average, each net will be shared by two people (Appendix 2). With the provision of an additional 20,410 nets during the second year, the total number of nets impregnated could move up to 73,210 with 146,420 people protected. On average, Rs.79.37 and Rs.63.12 per person would have to be spent by the AMC on protection during the first and second years, respectively[15]. If the community cost was also added, CPPP would be Rs.114.16 and Rs.108.13 for the respective years. The smaller average costs for the second year reflect economies of scale in impregnation with a substantial increase in the number of nets impregnated. These averages may further drop down in the following years.

Concluding remarks

This chapter has examined cost implications and possible outputs of two well defined POs with a view to improving the cost-effectiveness of AMAs in Matale district as a pilot project. The PO1 could save at least 14 % of the AMC funds. The PO2 could be implemented either with the same funds or by spending at most 9 % more funds. But the PO2 is a more diversified control programme than the PO1. The two POs have some similarities. Specifically, the components of ACDT, and strengthening the HIS are the same. The former is expected to detect at least 5,000 and 750 cases in the first and second years with CPCD equal to Rs.48.31 and Rs.64.42, respectively. With the installation of six computers with the HIAs in six DDHSs, HIS would be able to generate a strong data base to review all control measures continuously and to assist the health

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[15] For these calculations annualized costs of mosquito nets were used assuming a five year life period.

managers to take better control and managerial decisions even at the levels below the HA.

One difference between the two options is the percentage of reducing expenditure on the insecticide for RS: it is 50 % and 75 % for the first and second options, respectively. However, it is expected that the DAMC would decide what would be the new insecticide to substitute for malathion. To provide some guidelines to DAMC, the cost implications of three new insecticides were estimated. With the introduction of a new insecticide, PO1 and PO2 could protect almost 150,000 and 75,000 people, respectively, through SRSP. The CPPP would be smaller for only one of the new insecticides compared to malathion in both POs. The PO2 has a component of MNI with the provision of subsidized nets to deserving community members. It accounts for about half of the total cost of AMAs. The MNIP could protect 105,600 and 146,420 people in the first and second years with CPPP at Rs.79.37 and Rs.63.12 for the provider and at Rs.114.16 and Rs.108.13 for the society, respectively; and these average cost figures are lower than the SRSP.

These POs are only illustrative examples for the DAMC to be considered for the improvement of its AMAs in the district as a pilot project. In the implementation of any of these POs, the MoH and the DAMC may need to make some changes in the existing financial and administrative procedures. These POs may be able to obtain community support due to the matching up of most of them with community needs. In this way the proposed POs could pave the way for the AMC to reduce its seeming isolation from the community, to improve acceptance of and compliance with its control measures.

This exercise did not consider some seemingly useful measures such as source reduction. The field observations as well as community perceptions about control measures clearly indicated the need for enhancing source reduction measures. But undertaking a costing exercise for such a policy proposal was hindered due to lack of information. It could be considered as an area for the DAMC to undertake a feasibility study.

CHAPTER 9. DISCUSSION

This study was an attempt to assess the cost-effectiveness of AMAs in Sri Lanka from a societal point of view. For this purpose a case study was undertaken in Matale district which reflected many features of the malarious zone in the island. A few studies have been undertaken on a similar line but the focus of this study was much wider than most of them. It was an attempt to widen the scope of the CEA by incorporating community behaviour into it particularly with respect to acceptance of and compliance with AMAs. This chapter first presents the main findings of the study in order to provide a basis to examine how far the study was able to achieve its objectives. The second section will examine whether the study was able to achieve its objectives. It will also examine the methodological advancements of the study as well as the methodological problems encountered in achieving the objectives of the study and, hence, the limitations of the study. Finally, the chapter will look at the validity of the data base on which the study was undertaken.

9.1 Findings of the study

a.Financing sources

During the study period of 1992, publicly provided AMAs in the district were financed by two sources: government and the community. Government contributions totalled Rs.39.77 millions, of which 28.6 %, 10.8 % and 60.6 % came through the allocations of the DMB, the DHB and the DAMC, respectively (Table 4.1). On average, the government spent Rs.166.69 per person per year. Approximately, the community spent a direct cost of Rs.23.81 per person per year making its direct contribution for AMAs equal to 12.5 % (Table 7.7). If community cost for the episodes of illness ocurring outside the recall period and indirect cost of spraying are also added, this percentage may exceed 20[1].

b.Financing for what?

From public funds, 84.2 % was used by DDHSs, 10.6 % by the MCs and

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[1] This indicates an approximate measure of the community contribution cost per person. Indirect cost due to illness for the recall period of one month and indirect cost of accepting residual spraying for a year were taken for this estimate. But it should include both the direct and indirect costs of the episodes of illness occurring outside the recall period as well. Methodological problems encountered in estimating total community costs will be taken up in the next section.

the balance of 5.2 % by the RMOM. In total, 79.4 % of public funds went for RS followed by 10 % and 4 % for case detection and treatment at fixed MCs, and in the field, respectively (Table 4.8). Only 1.5 % went for other control measures such as MNI, larvicide spraying and prophylactic treatment. The remaining (4.4 % of funds) was used for supportive activities such as health education, entomological investigation, and training and supervision of VHWs. Average figures of public funds per person per year were Rs.133.45, Rs.24.48, Rs.1.34 and Rs.0.25 for RS, curative care, prophylactic treatment and MNI, respectively (Table 7.7).

Community funds took a different direction in that the highest average cost per person per year was for repellents which consisted of mosquito coils, and leaves and husks (Rs.11.44); no cost was involved in the latter. This was followed by MNs (Rs.6.54), the indirect cost of accepting RS (Rs.6.09), and direct cost of curative care (Rs.5.50) (Table 7.7)[2].

There was very limited scope to compare these figures with other countries. Apart from the notable differences in the control programmes in many countries, none of the studies have estimated both community and public costs for all AMAs. Within the CEA framework, it was Mills (1989, 1992 and 1993a) who went the furthest from the provider's cost in the analysis, but the author faced a data problem in estimating shares of community and public contributions for each control measure.

c.Two approaches in response to the disease

At the per person level, while the AMC[3] spent almost 80 % of funds on RS, 75 % of direct community contributions were used for substitute (self) preventive measures such as repellents and MNs. Percentages of the contributions of the two sources on detection and treatment were 14.7 and 23.1, respectively. This clearly indicated that the AMC and the community had two different approaches towards the control of the disease. The AMC had this approach for a long time; even in 1982, at the national level, the AMC spent 56 % of its funds on malathion (AMC 1982). It was only in the late 1992 that MNI was introduced as a new preventive measure. But, it was not the DAMC but

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[2] Cost of curative care for the episodes of illness occurring outside the recall period was not taken for this comparison due to the imposibility to measure it. For the indirect cost of accepting RS, four times of its figure for the sprayers' last visit was taken as an approximation.

[3] Hereafter public involvement in the control of the disease will be termed AMC, for which the DAMC was the main contributor and policy making body.

that the MoH provided permethrin for the MNIP in the district through its provincial allocations. With respect to the community approach, this study showed that the community was highly sceptical about the effectiveness of the AMC provided preventive measures and tended to use self preventive measures depending on the knowledge, attitudes, perceptions as well as affordability. These two approaches of the community and the AMC, and their gains will be presented below.

d.What were the gains of the AMC and the community ?

The gains of the AMC and the community should primarily be evaluated with respect to their stipulated goals. For the AMC no recent policy statement or plan was available to identify its goals but when allocating funds for it, the programme budget had highlighted the purposes of allocating funds for the AMC (Government of Sri Lanka 1992) and they were presented as eight activities. They include RS, surveillance, treatment, entomological investigations, training, field research etc. Nonetheless, except in a special case, the objectives of any control programme are well understood and the community stipulations on the disease are also quite clear. This study showed that through all control measures the community wanted not only to get rid of malaria but also of mosquito nuisance. These two objectives seemed to be conjoined with each other. For instance, when a respondent in an endemic area was saying avoidance of mosquito nuisance was the objective of using mosquito coils it indirectly indicated the need of avoiding infecting the disease as well[4]. Along with a brief examination of such issues the gains of the two approaches of the community and the AMC will be discussed below under a separate heading for each control measure.

Residual spraying

In assessing the gains of PRSP, coverage levels and patterns were first examined as the initial indicators to reflect its outcomes. However, there was a noticeable difference between the spraying coverage rates in the RMOM records and the HHS for the last visit of sprayers[5]. For all HAs the full acceptance rates of the former were

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[4] N.B.: With the operating of a control programme in the malarious zone of the island for over a half century, the respondents had an appreciable understanding of the causes of malaria.

[5] Most of the sprayers' visits, to which the HHS respondents refered, had made during the peak season of malaria. Acceptenace rates could be lower for the sprayers' visits made in the off-peak season. Therefore, there seemed to be no downward bias in the coverage rates measured on the basis of the HHS.

higher than the latter and refusal rates had the opposite pattern (Tables 4.6 and 6.1). The largest differences were reported from the less endemic Rattota and Matale HAs. The most noticeable difference was for the non spraying rates of Rattota HA (i.e., 11.0 % and 39.0 %). The average quantities of malathion used per house sprayed in these two HAs were much lower than other HAs (Table 4.14).

What were the reasons underlying these differences ? The RMOM employees were not in a position to explain the reasons for the lower coverage rates in highly endemic HAs. They depended on the reports received from HAs in preparing their records. What would have been the answer of the DAMC for such a question ? No recent DAMC report has looked at this issue and particularly the quality of the services of AMC employees[6]. One of the DAMC's main concerns was the intractability of pilferage of malathion (AMC 1989). The field observations did not support an explanation such as that the high coverage rates and lower average malathion quantities used per house in Rattota and Matale HAs were due to small house sizes in those HAs.

However, some explanations could be found for these seeming contradictions in the PRSP figures from community responses. In the Rattota and Matale HAs, HH members spent relatively little time to arrange houses (Table 5.8) which led them to incur a small indirect cost of accepting spraying (Table 7.4). It was observed during field visits that the respondents in these two HAs were, in general, not interested in RS just because of the lower endemicity. With this experience, it is extremely difficult to find any valid reason for the seemingly doubtful high official coverage rates for those HAs. Therefore the discussion focuses more on general features of community response to the PRSP rather than the HA level variations.

In general, there was a dissatisfaction within the community about the behaviour of sprayers. Their impression was that the sprayers' attitudes and behaviour had substantially changed during the previous years and now they always tended to avoid spraying. Specifically, they seemed to arrive at houses expecting a word of refusal. 4.8 % of surveyed houses were avoided by sprayers. Although nearly half of those HHs were not aware of the reason for avoiding their houses, some others pointed to the bad location (e.g., far away from the road or located on a hill) could be the reason. For the HHS, malaria patients were reported from all the GNDs where sprayers' refusals occurred.

Among the HHs who refused spraying, the majority seemed to have

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[6] No DAMC administration report was published after 1991.

considered their productive work and/or personal engagements were more important than spending time for accepting spraying (Table 6A.24); this could be largely due to the not displaying of any positive effect by accepting spraying (Table 7.5). Only 50.1 % of the HHs had a general practice of accepting full spraying and hence a firm commitment for RS (Table 6A.21). This gloomy scenario of the acceptance of the PRSP was further aggravated when looking at the compliance with residual spraying. From full and partial acceptors, only 33.4 % and 41.7 % allowed the residuals to stay; and, 49.6 % and 42.4 % rubbed off the residuals on the same day, respectively (Table 6A.29).

Why did the community behave like this ? Even among the full acceptors, only 6.1 % believed full spraying would control malaria infection (Table 6A.25). The majority of them (82.3 %) experienced a reduction of other insects; and for 55.5 % of them spraying resulted in a reduction of mosquitos. On the other hand, 40.0 % of partial accepters did not expect any benefit from spraying; they allowed partial spraying just as a practice, to please the known sprayers, to avoid the prosecution etc. HHs belonging to higher income brackets allowed partial spraying because they seemed to have more bargaining power to deal with sprayers in the rural social-cultural environment in Sri Lanka (Table 6A.27). Moreover, the highest full acceptance rate (66.1 %), and lowest partial (8.9 %) and refusal (25.0 %) rates were reported from the HHs with illiterate heads (Table 6A.26). This indicates that those who had high literacy levels were less reluctant to refuse spraying and moved into self preventive measures which seemed to be more effective than spraying from their point of view (Table 6A.34).

The community's dissatisfaction with the PRSP was clearly illuminated when the respondents were expressing their views about a better control programme in that 23.9 % suggested the need for a proper spraying system (Table 6A.47) with the "proper mixture of malathion" and better behaviour of sprayers. Their dissatisfaction was further manifested by their suggestion to focus control measures on mosquito breeding places (23.6 %). "Why do they spend public money to spray "water" to our walls.....Mosquitoes are there.." a farmer from Wilgamuwa HA expressed his dissatisfaction by pointing to the nearby water holes. Further, 8.7 % of respondents expressed the need to change the insecticide into a better one. At discussions many of them stated that the new insecticide should not be capable of having used a pesticide in paddy fields. This was a clear indication of the community understanding of the pilferage of malathion. It was observed that malathion was readily available at some retail shops in villages for a price between Rs.30.00 to Rs.40.00 per kg.

In spite of these gloomy attitudes of the community on the PRSP, the AMC had incurred Rs.198.43 per FSH in 1992. With a doubt of the benefits, however, the community also incurred an indirect cost of Rs.12.23 per house in accepting full spraying in one cycle. In general, through the PRSP, the AMC spent Rs.133.45 per year to protect a person in the malarious zone from the disease and the community spent an indirect cost of Rs.6.09 per person per year to accept it (Table 7.7).

What were the outcomes of these spendings? It was found that HLIR of fully or partially sprayed HHs and not sprayed HHs were not statistically different from each other (Table 7.5). This indicated that there was a probability of .24 of having at least one malaria patient in any HH irrespective of the level of accepting residual spraying[7]. However, when compliance with RS was added to this comparison, the highly suggestive result was that, among all HHs, the highest HLIR of 33.7 % was reported for the full accepters with full compliance for RS. Interestingly, HLIR was 29.4 % for HHs which refused spraying and only 18.5 % for HHs which accepted partial spraying and rubbed off residuals (Table 7.5). However, more likliness among the HHs in the (highly endemic) areas with higher risk to accept spraying and visa versa could be an explanation for these associations.

As stated, there was a firm commitment to RS among the HHs which had a general practice of full acceptance. This seemed to have led them to use self preventive measures in lower proportions except repellents (which have so far not been adequately proved effective) (Table 7.6). In fact, the HHs with partial acceptance had a high inclination to use MNs, combination of MNs and repellents, and prophylaxis.

With this seeming ineffectiveness of malathion spraying, it was suggested that the PRSP might be made more effective and more efficient, as well as some social justice could be incorporated to the AMC spendings, if the insecticide was changed into a better one with available funds. By reducing about half of the expenditure on the insecticide and introducing a SRSP with a new insecticide, the DAMC could save at lest 10 % of its funds; the replacements considered were Sumithion (fenitrothion), Icon (lambda-cyhalothrin) and Vectron (etofenprox) given that they considered to be more effective than malathion (Table 8.1). However, to achieve a more cost-effective PRSP, the DAMC would need to make a strenuous effort to introduce an effective supervisory system for the PRSP in collaboration with the community at HH level.

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[7] .837 X .29 ; where .29 ≈ HLIR of all HHs (Table 7.5).

Case detection

APCD was the prime means of case detection, accounting for 96.4 % of positive cases (Table 4.4). The contribution of ACD was only 2.8 %. In total, 22,202 cases were detected with an SPR of 25.5. However, SPRs of ACD (14.8) and PCD (15.9)[8], were much less than APCD (26.2).

The productivity of the surveillance mechanism was found to be highly skewed across MCs including the RMOM which was responsible for testing smears collected at the MCs without MICs (Table 4.5). The number of BFs examined per day gradually moved up from CDs (e.g.19.85 at Kimbissa CD) through other types of MCs to DHs (e.g. 63.77 at Galewela DH) and sharply dropped down at the BH (24.67). Similarly, the number of cases detected per day moved up from 4.81 at Kimbissa CD to 15.50 at Galewela DH and dropped down to 2.97 at Matale BH.

On average, a MIC examined 27.5 BFs per day with 7 positive cases. The former was far less than the current AMC standard (i.e., 65 BFs per day). Even though it was not possible to find out how and when this standard was devised, if it was taken as an acceptable criterion, these figures indicate a severe underutilization of MICs at many MCs and also at the RMOM laboratory. Only one MC (Galewela DH) reached close to the AMC standard. Even though the BT averages depend on patients' attendance, there seemed to be a maldistribution of BT facilities within the district. The highly malarious HAs of Laggala-Pallegama and Wilgamuwa appeared to be neglected in stationing FAs and MICs. No MIC was at any of the MCs in Wilgamuwa HA; only Hettipola PU had an FA. The only FA in Laggala-Pallegama HA was stationed at its DH in June 1992 and the MIC in October 1992. But Laggala-Pallegama DH reported the district's highest SPR of 40.10. The remoteness of these two HAs seems to be the reason that the AMC had paid less attention to them in its surveillance programme[9].

During the study period, the routine surveillance programme of the AMC at MCs was changed only on two occasions. They were the stationing of FAs to collect BFs at Wahakotte and Lenadora CDs for short periods when outbreaks were reported from those areas. No MICs were, however, diverted from MCs with relatively fewer

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[8] PCD was abandoned in mid 1992.

[9] It may also be important to note that not a single special spraying programme was undertaken in Wilgamuwa HA in 1992. The only special spraying programme in Laggala-Pallegama HA was conducted in a village located at its edge and close to Matale city.

patients to those MCs. But the RMOM conducted a series of MBCs in many villages and this will be taken up later.

The community had to pay the price of seeming maldistribution of surveillance facilities within the district. This was primarily due to the bypassing of closest MCs especially for severe illness because the community had a good understanding of the availability of BF facilities at the closest MC (Table 6A.10). Thus, the severely ill patients bypassed the closest MC with only BFF or no BFF and attended a MC with BTF, resulting a statistically significant relationship between the severity of illness and bypassing. Almost 95 % of bypassing patients of the catchment areas of CDs and RHs with no BFF attended a higher level MC (i.e., DH, PU or BH) with BTF for the first visit (Table 6A.13). Similarly over 85 % of bypassing patients of CDs with BFF attended an MC with BTF for the first visit. Moreover 33.3 % of patients who bypassed the closest MC for the first visit stated that it was due to the non availability of BTF. Obviously bypassing always involved a higher travel cost as well as a time cost (for the accompanying person).

As mentioned above, the only solution of the AMC for the irregular distribution of surveillance facilities was to undertake MBCs. About 40 such clinics were held during the year[10]. Two case studies were undertaken on MBCs and they were an expensive affair compared to fixed MCs in detecting cases. Although the CPCD at MCs with BTF and BFF were Rs.53.96 and Rs.40.90, respectively, it was Rs.94.10 for the MBC at Millawana estate. The CPCD of the Hattota Amuna MBCs was Rs.171.76. One apparent reason for the lower cost-effectiveness of MBCs was their poor location. For instance, Hattota Amuna MBCs were held close to the Hattota Amuna CD where the Assistant Medical Officer was even engaged in private practice.

In examining the value of conducting MBCs, it is important to note that, in general, patients had a good understanding of the symptoms of illness through experience and a high sensitivity towards illness by taking early formal treatment (Tables 6A.1, 6A.2 and 6A.3). Almost 75 % of patients took treatment from a formal source within two days. As was seen, association between bypassing and severity was also an evidence of high sensitivity towards illness. Thus, no firm justification was found for the undertaking of an MBC close to a fixed MC at weekends (e.g., at Hattota Amuna).

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[10] The exact number was not possible to count due to unavailability of feedback reports from some MBCs.

Although there were valid reasons to undertake MBCs at Millawana estate, continuation of the MBC for 15 weeks tended to reduce the patients' attendance at the last few clinics and to move up CPCD.

With these findings, it was clear that the surveillance mechanism of the AMC was largely confined to MCs with BTF or BFF and a few MBCs[11]. Even within MCs, no flexibility was observed in diverting surveillance facilities to deserving areas with outbreaks or epidemics of the disease. On the other hand, patients' need for case detection (or proper diagnosis) was largely confined to severely ill cases. Thus, spending resources of the AMC on MBCs in such a haphazard manner cannot be economically or socially justified. In the policy analysis the cost of training 9 MICs through a crash programme was examined to avoid unnecessary spendings on MBCs and to redress the existing maldistribution of surveillance facilities (Chapter 8). Until the completion of the MICs' training programme, however, the undertaking of MBCs was suggested to be feasible as a temporary measure to augment case detection and treatment.

Treatment

Provision of treatment for malaria patients was primarily in the hands of the MoH. The AMC's involvement was to provide FAs and MICs to assist the MCs in diagnosing cases, supplying drugs to MCs, undertaking MBCs and also to provide drugs to the patients in the field. This sub section will look at the important aspects of these issues.

The discussion begins with an examination of how the community responded to illness and its attitude towards publicly provided treatment facilities. As explained, first, an appreciable sensitivity towards illness was observed in field investigations. A quick response to illness was found to be a common phenomenon throughout the district irrespective of the socio-economic conditions of patients with almost 85.0 % of patients taking some kind of self treatment on the day symptoms appeared (Table 6A.2). Only 9.5 % of patients tended to rely on ritual treatment but as a partial measure (Table 5.1). Panadol, Disprin and Aspirin were the most commonly used drugs in addition to a traditional herbal mixture called *Paspanguwa*. The failure of self treatment led the majority of patients to seek early treatment from formal sources (Table 6A.3).

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[11] FSs and MBSs did not play any important role and they will be taken up in the sub section of "Other AMAs".

The conditional factors such as distance, time required to reach the treatment source, waiting time and time spent with the person treated varied significantly across sources of treatment indicating they had some effect on selection. For instance, patients travelled longer distances to consult private than public doctors; and the highest waiting time was reported for the public MCs (Table 6A.6).

Socio-economic conditions played an important role in determining the source of treatment. There was a tendency towards private sources when the HH heads had a relatively high literacy level (Table 6A.16). Parents of the children below 15 years showed a tendency to take them to public MCs (Table 6A.17). Patients belonging to high income brackets and not receiving government subsidies had a high attendance at private sources (Tables 6A.18 and 6A.19). However, for all patients, irrespective of their socio-economic conditions, public MCs with inpatient facilities were the final source of treatment in the case of severe illness (Tables 6A.14 and 6A.15).

Moreover, from the patients' point of view, supply deficiencies, quality of care at private sources, familiarity with the treatment source etc., made a larger proportion of patients seek treatment from private sources. The importance of some conditional factors was also elucidated in this analysis. For instance, the need to avoid waiting time at a public MC was a reason to seek private treatment for 26.2 % of those patients (Table 6A.14); a reason for another 33.8 % of those patients was the more attention given by the government doctors for their private patients. In total, the need to get better treatment was the reason for 15 % of all patients to move into private sources for the first visit. On the other hand, unavailability of services at the closest public MC made another 20.8 % seek private care. In total, supply deficiencies including drug shortages made 18 % of all patients seek private care for the first visit. During field visits, one of the main complains made by the respondents, especially in Wilgamuwa HA, was drug shortages at the public MC. They made this reference to Hettipola PU.

Irregular supply of drugs was observed when examining drug distribution records. MCs with MICs always received priority in issuing drugs - which could be an indicator of endemicity. There was a mismatch between case load and usage of drugs in many MCs; irregular supply seemed to be one reason for this. For instance, while Dewahoowa CD used 86,000 and 67,000 chloroquine and primaquine tablets with 2,123 positive cases, respectively, these figures were 23,000 and 22,000 at Kimbissa CD with 1,173 positive cases, respectively. Both CDs had BT facilities. On the other hand, Nalanda PU used 20,000 chloroquine and 35,000 primaquine tablets with 1,676 cases;

Kongahawela PU with a huge case load of 3062 used 54,000 and 28,000 of those tablets, respectively. Another important observation was the provision of drugs with a very close expiry date to Dambulla DH, a leading MC in the district[12]. One simple consequence of irregular drug supply and utilization pattern could be the improper treatment for the malaria patients irrespective of the medical officer's intentions, in addition to move patients away from those MCs to others including private practitioners.

With this background, there was a noteworthy diversion among the patients towards the private sector from the virtually free public MCs. The percentage of visits made to private sources rose from 33.5 for the first visit to 77.8 for the fourth and fifth visits (Figure 6.1). In total, 36.8 % of all visits were made to private sources. This is indeed a good indicator of the divergence of patients towards the private sector. Two recent studies showed that about 50 % of all patient visits irrespective of the type of illness were made to private sources (Attanayake and Silva 1987 and 1992). But these studies were undertaken in a district close to the capital of Colombo with more access to private sources. Therefore, the reasons why nearly 40 % of malaria-like patients' visits in a rural district like Matale were to the private sector where virtually no BTF was available are likely to be the supply deficiencies in the AMC sponsored public treatment facilities.

In the examination of patients' cost of treatment, it was found that a PFRP spent Rs.36.79 as RC and Rs.38.28 as CC (Table 5.5). The CC figures were similar for all sources except inpatient care. For instance, it was Rs.35.84 for outpatient care at public fixed MCs and Rs.34.05 for private care. Relatively high figures of CC were reported for the combinations of inpatient care with other sources as well. However, the most noteworthy differences were found for the RC between public and private care. For instance, it was Rs.18.89 and Rs.8.48 for public inpatient and outpatient care, respectively, and Rs.86.13 for private care (Table 5.5). With respect to outpatient care, this gap tended to narrow if CPCT at public MCs (Rs.52.84) was added to RC values of public sources to give an approximate figure of RC from the social point of view (Table 4.12). As a more meaningful measure, if provider's AC per positive case[13] (Rs.96.47)

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[12] This was indicated by the medical officer in charge of the Dambulla DH in his drug usage report (dated 28.4.1993) to the DPDHS.

[13] This was the sum of cost of case detection and treatment per positive case (Table 4.12).

was added to the RC to get a proxy for the cost of treatment per outpatient at a public MC, it would be 34 % larger than the RC of private treatment. But the social cost per PFRP from outpatiant care at a public MC (Rs.277.86) was slightly lower than private care (Rs.280.82) (Table 7.3). For this seeming lower efficiency in the private sector, the unavailability of proper diagnostic facilities (i.e., BTF) for the majority of the private doctors could also be added. Therefore, this is an area to which the DAMC could focus in implementing its new policy of ACDT. For example, it could devise a mechanism to collaborate with the private sector in case detection and try to regulate its treatment procedures[14].

What was the response of the DAMC to this behaviour pattern of malaria-like patients ? Did the AMC have a proper understanding of the magnitude of the tendency towards private sources ? Had it ever made any attempt to examine the efficiency of its own curative care programme ? The DAMC has only expressed its dissatisfaction with the way private doctors treated malaria patients without proper diagnostic procedures (AMC 1989). By the time of the study, however, the DAMC's complaint on poor diagnostic procedures at private clinics had taken a more complex form with the escalation of private practice of public doctors even in the interior areas of the island.

In the DAMC's new policy statement of mid 1993 (DAMC 1993), there was no indication of the involvement of the private sector in treatment. Under ACDT, it simply stressed the need to alert "officers in medical institutions" to the importance of early detection and treatment, and ensuring adequate supplies of drugs in MCs (by making frequent visits to them and having buffer stocks of drugs). The third suggestion was once again the organization of MBCs in areas where MC facilities were scarce.

With this background, ignorance of the private sector by the DAMC could jeopardize its own control measures as well. This is due to the incompleteness of the incidence rates of AMC records. As mentioned, about 40 % of suspected malaria patient visits were made to private sources (Figure 6.1). If all the malaria-like patients were taken together, not more than 50 % and 11 % of them made visits to MCs with BTF and

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[14] The DAMC is not empowered to introduce any regulatory measures on the private sector. But the DAMC can take the initiative to move the policy makers at the MoH level in that direction. Some positive signes appeared recently in this respect by appointing a committee by the minister to examine the possibility to regulate private hospitals (see Chapter 8).

BFF, respectively. Thus, nearly half of the malaria-like cases in the district were not covered by the AMC records. Under such a situation and bypassing the closest MC by severely ill patients, can the AMC's assessments of outbreaks and epidemics at field level be treated as valid judgements ? Moreover, how far can the measures taken by the AMC on the basis of that incomplete data base be justified ?

All these observations suggest the DAMC should rethink its policies of ACDT and develop a community based control programme in this endeavour. This implies diversion from the existing policy of surveillance and treatment as in the case of RS, as discussed earlier. Thus the cost implications of getting away from MBCs by undertaking a crash programme leading to stationing trained MICs at the MCs with no MICs was examined in the policy analysis. The analysis also suggested the need to examine the use of MICs in the private sector; i.e., to work with GPDs as the initial step. However, one of the most important measures examined in policy analysis was the strengthening of existing the HIS with a view of extending it towards the private sector as well. Although it was found that within the present budget it was possible to introduce these changes, those cost estimates should be treated with caution as no reliable costing information was available for many of the items involved in the HIS.

Other AMAs

Other AMAs of the AMC were entomological investigations, larvicide spraying, FSs, MBSs, PRT, MNI, health education and the training and supervision of VHWs. Case studies were undertaken of all possible AMAs for which output data were available.

Only 6 FSs/MBSs were undertaken and the case study in Galewela HA, which was initiated by the DDHS, showed relatively better results in coverage. Although, its CPCD (Rs.140.50) and CPCT (Rs.63.00) were substantially higher than fixed MCs, it administered PRT for nearly 800 people with an AC of Rs.4.66. Administering PRT was observed in the case study of the SP in Kongahawela area as well. But no AC was measured due to the deficiency of data.

A good community response was received for the MNIP according to the two case studies and their provider's CPPP (i.e., Rs.24.31 and Rs.38.82 in the two case studies) was at least 60 % less than the PRSP. In the policy analysis, it was found that without increasing the current budget of the AMC, 105,600 and 146,420 people could be protected by the MNIP with the provider's CPPP at Rs.79.37 and Rs.63.12 in two consecutive years; social costs were Rs.114.16 ans Rs.108.13. These average figures

were higher than for the case studies due to the involvement of the annualized cost of nets which were assumed to be given with a 90 % subsidy for the deserving community members. But the DAMC still seemed to have a narrow perspective about the MNIP by just saying that "promotion of the use of insecticide impregnated bed nets (in appropriate locations) should be explored" (DAMC 1993).

No systematic health education programme was launched in the district. Galewela DDHS organized a few programmes with the participation of school teachers, school children and community organizations in addition to the RMOM organized programme in Laggala-Pallegama HA. Other details of the health education programme, including the cost figures of the above mentioned programmes, were not available in RMOM records. Health education was largely undertaken by the health workers of the district in an informal manner. Most of them indicated the proportion of their time spent on health education when filling in the time allocation questionnaire; this meant the advice given to community members, including patients, in their routine work. The community had, however, an appreciable understanding of the disease as discussed above. The roots of this interesting feature of the community go back a few decades because there was a continuous effort of public and private organizations to educate people with the island wide malaria epidemic in 1934-35.

VHW activities were largely organized and supervised by the health workers other than AMC employees. Almost all VHWs made complaints of drug shortages. Thus, in the policy analysis a travelling allowance was proposed for the VHWs to make regular visits to DDHSs offices to collect drugs. The possibility of getting their support for the implementation of MNIP was also examined. In general, the AMC had not made sufficient attempts to mobilise community support for the implementation of its control measures although a high willingness for voluntary work was observed during field observations especially among young people. The TDR sponsored present trials on source reduction in a remote area in the district are undertaken with the support of volunteers (pers. comm. with the RMO, Matale, September 1994). With these encouraging results, the AMC could attempt to devise methods to mobilize volunteers' support to move the control programme towards a community based one. This could indeed be extended to strengthen the previously proposed community based supervisory system for RS as well.

With this background, the DAMC seemed to have a very neutral approach in diversifying the existing control programme. By sticking to the PRSP, other AMAs

were given a lower priority and undertaken in an ad hoc manner. In this context, a mismatch was observed between the AMC approach and the community needs in controlling the disease. For instance, 23.6 % of respondents wanted to divert AMC attention towards controlling mosquito breeding places as a more effective control measure (Table 6A.47). Although the AMC employees sometimes poured crude oil on some breeding places during epidemics, such measures were not undertaken during the study period.

The obvious consequence of the seeming ineffectiveness of the PRSP and DAMC's neutral approach on other preventive measures, was that the community tended to engage in their own preventive measures. They ranged from burning leaves and husks through mosquito coils, MNs to prophylaxis. There was even one HH which practised spraying an insecticide purchased from a shop. Burning mosquito coils, and leaves and husks (and substitutes for them) were observed among 40.8 % and 31.4 % of HHs with higher percentages in high endemic HAs, respectively (Table 6A.30). Another 30.4 % of HHs used MNs as a preventive measure (Table 5.9).

As discussed, the HHs with low income and illiterate heads adhered to the AMC's PRSP with some reluctance and were burdened by the disease. As the main self preventive measure they burned leaves and husks, which were virtually freely available around the house (Table 6A.34). Other HHs tended to rely much on other self preventive measures. Using both mosquito coils and nets had a close and positive association with the literacy level of the HH head and HH income (Tables 6A.34, 6A.40 and 6A.41); unaffordability was the prime reason for lower usage of nets among low income brackets.

It is worth mentioning that all self preventive measures, except prophylaxis which was used by a few respondents, were largely considered as means of getting rid of mosquito nuisance. Only 22.7 % and 2.7 % of repellent and MN using HHs, respectively, expected to get rid of malaria by those measures (Tables 6A.32 and 6A.35). But when a respondent indicated the need to avoid mosquito nuisance it indirectly indicated need to avert the disease as well and visa versa. One respondent from Galewela HA illuminated this feature when he was asked whether he wanted to avoid only mosquito biting by using nets: his answer was "why do you say so...we do not want to avoid only mosquito biting. We know very well mosquitos bring malaria to us...". However, just as the immediate reaction, many respondents stated that they wanted to avoid mosquito nuisance by using self preventive measures. Thus, the need to avert

malaria infection seemed to be an objective of using repellents and nets and they can be treated as the community's substitute preventive measures to accepting residual spraying.

9.2 How far the study achieved its objectives?

The preceding section presented the main findings of the study. It also reached some conclusions on the cost-effectiveness and efficiency of AMAs from a societal point of view. Emphasis was placed on community response to the disease and community effectiveness was taken as the criterion in assessing economic worthiness of AMAs. This approach was rather different from all economic evaluations reviewed in chapter 2. Thus, this raises the need to reexamine the methods adopted in this study with a view to assessing their validity and applicability. This section critically looks at the methodological advances as well as limitations of the study along with the achievements within that framework. Each specific objective of the study will be examined separately.

a.Specific objective:1

The first specific objective of the study was to measure the cost and output of the provision of services of the AMC by activity level. The method adopted for the cost analysis was a combination of cost apportionment and direct estimation. As a requirement for the former, a time allocation study was undertaken among all employees of the public health sector of the district who had some involvement in AMAs. But apportioning the time across a wide range of activities was found to be a difficult task for those at the managerial level. The DPDHS was one example. His final conclusion was that, on average, he spent a whole working day in a week for AMAs. The other problem with the TAQ was related to RMOM employees. They provided the proportions of their time spent for each activity at district level, but were not able to decide what proportions of the time of each activity could be attributed to each HA.

For the first problem, assuming their contributions took the form of an overhead (Drummond et al 1987), it was divided among all activities according to their cost proportions after decomposing the total cost among activities at the first stage of analysis. The second problem was more difficult as RMOM employees had not worked in HAs according to an identifiable pattern. For instance, no SP was undertaken in Wilgamuwa HA; no MNIP was undertaken in HAs like Dambulla and Rattota. Therefore, the cost of small scale AMAs was not possible to estimate at HA level under the cost apportionment method. But the RMOM and DPDHS employees' involvement in the PRSP was distributed among HAs according to the coverage pattern of the PRSP across HAs. Similarly, their involvement in curative care at supervisory/advisory level was distributed

among MCs according to their case loads. Due to this limitation of the cost apportionment method, a set of case studies was carried out for the small scale activities for which RMOM employees were largely involved; and, the direct estimation method was used for them.

This was a limitation of the cost apportionment method, especially, in decomposing personal emolument on the basis of the responses of employees who were involved in a set of small scale multi-functions. Kaewsonthi (1988) attempted to test the consistency of two methods through a re-estimation exercise but her study was not involved with a wide range of small scale activities like this study. Given the small portions of total cost attributed to those small scale activities (Table 4.8) and the involvement of only a few employees in these activities (Table 4.1), the results of the cost apportionment exercise could be considered as reliable.

No measurement problems were encountered with respect to the outputs of AMAs. Coverage records of the PRSP were readily available at the RMOM at HA level. Records of case detection and treatment were also available in detail by MC and SP at the RMOM. Therefore, measurement of average cost indicators at activity level and also at means of provision of services (e.g., different types of MCs and surveillance) was straight forward. In achieving the specific objective, no methodological problems were encountered in expressing average cost figures in relation to outputs as they did not go beyond the intermediate level. But unlike Mills (1989), intermediate outputs were not considered as proxies for final health outcomes. Instead, based on the community responses, community effectiveness was measured at the intermediate level under the fourth specific objective, which will be discussed later.

With this background the study was able to measure both total cost, output as well as average cost by activity level at a satisfactory and consistent manner to achieve the first specific objective of the study. The study went further and measured even incremental cost for curative care at different means of treatment. But the IC measures did not provide an in-depth understanding about the scale of production because it was the case load rather than the scale which affected IC as well as AC measures.

b.Specific objective: 2

The second specific objective of the study was to measure the cost borne by the community for both preventive and curative care for malaria. A critical problem encountered in this issue was how to distinguish the expenses on anti-malaria activities from a HH budget ? Did the researcher have to depend on the responses alone or to

undertake any additional exercise to ascertain whether they indeed went into AMAs ? This problem was critical for curative care in ascertaining whether the malaria-like patients, who were not subjected to BT, were really malaria patients. Such a problem was not encountered by other authors (Mills 1989, 1992 and 1993, Kaewsonthi 1988 and Ettling et al 1991) as their study populations consisted of patients who were examined at a MC or in the field with BT facilities. Since this study focused on the whole community in the malarious zone, it was not possible to justify the representativeness of the sample if the patient sample was confined to those who attended public MCs with BTF. Also more than half of the public MCs in the district did not have BTF. Moreover, BTF was available for only one private doctor in the district. In this context, one critical problem posed was what would be the tool to handle the malaria-like patients who had perceivably fully recovered by the time of interview or were still taking treatment from sources with no BTF and who categorically stated they were infected by malaria during the recall period ?

This problem, indeed, arose due to the one month recall period of the HHS. If the study was focused only on suspected malaria patients at the time of investigation, the feasibility of adopting a BT procedure along with the HHS could have been explored. Such a method would certainly have made the economic evaluation less meaningful as it would not have led to obtaining cost data up to the point of the full recovery of the patient. This was somewhat similar to what Kaewsonthi (1988) did by estimating patient's cost only up to the point of taking treatment with BT. A better method would have been to, first, use a large research team to cover the sample within a short period with a BT component - in the present study the sample covered 54 GNDs. Secondly, the research team would make repeat visits to the selected HHs with patients until the patients are fully recovered. However, it was not possible to bear such a large cost for the present study[15].

Irrespective of these practical constraints, from the economics point of view one can argue that if a patient made a payment to receive treatment assuming he had malaria, even without a confirmed BT, it could be considered as an economic loss due to malaria; this statement was made on the basis of the well known assumption of price theory on perfect knowledge of the consumer. How far this assumption is valid for a

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[15] Alternatively, a serological study could have been undertaken without changing the sampling method if there was no resource constraint.

patient and, specially for a malaria patient in this study, is highly controversial (Arrow 1963 and McGuire et al 1988). But firstly, the study population had a good understanding of the symptoms of malaria through experience and a relatively high adult literacy rate (e.g., Table 6A.16); the island wide malaria control programme had been operating for over a half century. Secondly, the study observed a high sensitivity towards illness in the study population, irrespective of socio-economic status. Thus, with an appreciable validity, it was quite reasonable to make the cost estimate on the basis of self assessments of the patients on the type of illness, even if all of them were not confirmed by BT.

If such an assurance cannot be attributed to the study population, economic evaluations have to be confined to confirmed cases alone or to take steps to get all suspected patients confirmed through laboratory tests and interviewed in follow up visits as explained above. The first approach would certainly leave out a large proportion of patients, who did not appear for a BT, making the study less significant from a societal point of view. It was left for future researchers to look at the trade off between such a method and the dependence on community responses as was done in this study. Alternatively, the researcher could undertake a pilot survey with a diagnostic procedure to assess the level of the validity of self assessment of the type of illness, and then design the main study and its analytical framework on that basis.

With this background, based on community responses, direct and indirect costs of the community were estimated with an assumption that the upward bias of those estimates was minimal due to reasons given above on the characteristics of the study population. Estimation of direct cost was straightforward. But no attempt was made to estimate the economic cost of MNs for the current year. Even if the replacement cost approach would be the most suitable method, at the community level the life time of a MN could vary from one HH to another depending on the way it was consumed and will be consumed. Thus, without detailed information on the usage pattern of MNs at HH level, some doubts arose about the accuracy of the results gained by adopting the replacement cost approach. Therefore undertaking such a tedious and time consuming exercise for each net was assumed to be less worthwhile and a simple method was adopted by dividing the purchase value of a net by the sum of used and expected life years to get an average value for the current year; MN users' responses were used for this exercise. In the direct cost analysis, imputed market values were used for the items such as fruits (e.g., young coconut plucked from the home garden and used as self treatment) and special food. There was no need to make such adjustments for other direct

cost elements of the community .

In the presentation of direct cost on curative care, cost per patient was decomposed into two categories as RC and CC. The former referred to the cost of receiving services, which included travel cost, cost of drugs etc. But the latter had a very broad meaning although it was termed cost of compliance. It simply consisted of all additional direct costs borne by the patient after receiving treatment from a formal source up to the full recovery (except RC incorporated any more visits to treatment sources). Since this involved items other than prescribed drugs and vitamins to be purchased outside the clinic (e.g., special food), CC should be interpreted with caution.

The method adopted in this study in valuing time loss was different from many other studies. It used the output related approach (Goldschmidt-Clermont 1987) with an attempt to assess the losses at HH level rather than using general indicators such as average wage rate (Kaewsonthi 1988). Although Mills (1989) made an attempt to focus on output losses it was hindered by the data base. In this study, priority was always given to realized income and output losses. Due to seeming discrepancies in the data on expected losses they were excluded from the analysis. Labour substitution within the HH was valued subject to the realized output/income losses. Only for this purpose average wage rates were used. This was the only plausible method to value the time loss by HH members in sharing foregone work of the patient. For instance, in the case of a housewife who was not normally engaged in farming work but attended them due to her husband's illness, the average wage rate of the female casual workers in the corresponding HA was used as the opportunity cost, if the patient did not incur (realized) any output losses from farming due to illness.

There was no possibility to express indirect cost with respect to each source of treatment. A public MC was not the final source of treatment for many patients and they sought treatment from several sources. The problem that arose in this context was how to distinguish the indirect cost among multiple sources. In an occupation like casual labourer such a distinction could be possible. However, income/ output losses due to the inability to pluck the harvest in proper time (e.g., tobacco leaves), damage of the plants by wild animals, inability to spray pesticide in time etc. cannot be simply attributed to a particular source of treatment but for the whole episode of illness. Therefore patients were classified according to the combinations of treatment sources from which treatment was sought and perceivably recovered, and indirect cost was measured for them. But this does not mean that all patients sought treatment from more than one source and such

patients' indirect cost was measured for those single sources.

With these positive, as well as negative, adaptations of the costing methods, the study was able to undertake a more detailed and deeper analysis of community cost compared to many other studies. Specifically the approach adopted to measure indirect cost provides a basis for future researchers to develop methods to distinguish amongst multiple sources of treatment. This issue was not raised by any earlier study. Moreover, the community cost analysis shed light on the community willingness to pay for control measures as well as on the areas where the community faced unaffordability of involvement in control measures. The results were quite reliable as the analysis did not suffer from any significant methodological obstacles apart from what was elaborated above.

c.Specific objective: 3

The third specific objective of the study was to identify the factors underlying community behaviour in relation to preventive and curative care for malaria with special emphasis on socio-economic factors. Chapter 6 was entirely devoted to achieving this objective.

The scope of that chapter was somewhat similar to the studies focused on knowledge, attitudes and practices (KAP) of patients (Fungladda and Sornmani 1986, Ongore et al 1989, Hlaing and Maung 1990, and Kamunvi and Ferguson 1993). But the main difference was its special emphasis on economic factors, mainly living standards of HHs. Therefore, HH behaviour was examined in association with its income as well as entitlement to receive public income support. In the analysis, however, the conventional methods of scaling, scoring and odd ratios were not used (Hlaing and Maung 1990 and Fungladda and Sornmani 1986). Instead, the direct association of attitudes and knowledge of the study population with its behaviour pattern was examined using χ^2 teats and ANOVA. The identified associations were further examined and elaborated using frequency distributions, mean deviations and cross tabulations of relevant variables, and interviews and discussions held during field observations. In this way, more dynamism, liveliness and realism was brought into the findings of the community behaviour analysis.

To a certain extent, the methodology adopted for the community behaviour analysis was a synthesis of quantitative and qualitative methods. With no such studies available in recent literature, the method adopted for the analysis could be treated as an experiment rather than a direct application of a conventional methodology. The community behaviour analysis could also be considered as a basic exercise for further

research focusing on demand for anti-malaria services.

In the analysis, an attempt was made to devise an indicator to reflect socio-economic status of the HH as a unit. This was straight forward only for living standards, for which monthly income and the entitlement to income support of the HH were taken. The head's literacy level was taken as a proxy for the literacy level of the HH. But some problems arose with this method of categorization. It was observed, for instance, that if a child was at a university, had G.C.E. (A/L) qualifications, had a white collar job or was in the armed forces/police (a common feature in many villages), he/she had some influence on family decisions over the HH head who had a low educational attainment. This was common, especially for the decisions on health and education. But Caldwell et al (1989) found a leading role played by mothers in Sri Lanka in taking decisions on health matters. Although that study was not undertaken in a rural area like Matale, as observed in field investigations, this finding could have some validity to Matale district as well but for other illnesses rather than malaria due to the people's high acquaintance with the disease. Traditionally, in rural Sri Lanka, the family head always has a high influence over family decisions and it could still be observed in the district. Using this argument, therefore, only the HH heads literacy level was taken in explaining and elaborating associations. It is worth mentioning that the results obtained by adopting this view demonstrated strong plausible relationships between the head's literacy level and the examined behaviour patterns; thus, the study's view on HH decision making processes could reasonably be considered as valid.

By adopting the methodology explained above, the study was indeed able to make some contribution to fill the gap of knowledge of the community behaviour in response to the disease. To date no study has explored the relationship between socio-economic status of HHs and their behaviour in relation to curative and preventive care for malaria. In the context of Sri Lanka, although some authors (Caldwell et al 1989) examined health seeking behaviour, no focus was placed on malaria patients. On the other hand, the study of Silva (1991) was primarily focused on examining traditional practices of rural folk towards the diseases but that author himself considered them as obsolete practices. Studies undertaken either on KAP or socio-economic behavioural factors of endemic populations (e.g., Kamunvi and Ferguson 1993) also have not sufficiently brought up the associations between preventive and curative behaviour patterns, and underlying socio-economic factors. In this way, the study has opened up a hitherto unexplored area for further research. It is not only KAP but also socio-economic

variables of the endemic populations that should be considered in the form of a rather holistic approach for an in-depth understanding of the community response to the disease as well as the control programmes.

d.Specific objective: 4

The fourth specific objective of the study was to measure the cost-effectiveness of control of malaria with special emphasis on intermediate outcomes from a societal point of view. The methodology adopted for the CEA was rather different from the similar studies undertaken in other countries. This was primarily related to the assessment of effectiveness.

Many methodological problems were posed in assessing effectiveness from a societal point of view. But lack of effectiveness data was, however, a common problem for the researchers who evaluated ongoing programmes. Many authors confined their analysis to cost-descriptions due to deficiencies in effectiveness data (Sauerborn et al 1991 and Shepard et al 1991). Ettling et al (1991) also adopted a similar but much broader approach and went further by estimating "incremental cost-effectiveness" at different delivery points. But Kaewsonthi (1988) adopted a different method. From her point of view the study was largely focused on performance but seemed to have emphasised much process and some intermediate outputs. Mills (1992) handled this problem by treating intermediate outputs as reliable proxies for final output and undertaking a sensitivity analysis within a framework of with and without the control programme. One exception was Picard et al (1993) because they had control groups to make comparisons in assessing effectiveness.

In the present study the lack of effectiveness data arose due to two main reasons: the absence of a control area, which cannot be normally expected for an ongoing intervention; and the lack of data obtained from a randomised controlled trial, which is also rather unexpected for an ongoing and established programme. These difficulties became much greater since the study focused not only at the AMC but also at the community as a whole. Given the resource constraint and the need to assess community effectiveness within a short period of time (Vlassoff and Tanner 1992 and Tanner et al 1993), the study therefore attempted to evaluate effectiveness from the community point of view by largely relying on community responses.

In that way, for preventive measures, the study grouped the respondents according to their preventive care practices and compared them with their HLIRs to examine whether there were any statistical differences among the groups in infection of

the disease. This was indeed a very simple method but there was no other way to assess the effectiveness of preventive measures. Similarly patients' perceptions about recovery from illness were taken as given, as explained under the second specific objective, in assessing the outcome of curative care. Thus, probabilities were estimated for different means of treatment for the perceived recovery of illness. Once again this method was adopted on the seemingly justifiable assumption that the community responses were reliable proxies to assess the effectiveness of control measures in the absence of a direct data source on effectiveness.

One problem encountered in assessing the cost-effectiveness of AMAs was to find out a method to estimate community cost for the whole year. This was due to undertaking of the HHS with a one month recall period within a time span of three months; but the cost estimates had to be computed for a full calender year because provider's cost referred to the year 1992. This raised the need to extrapolate community cost figures for a whole year. First, it was found that the seasonal variations in climatic conditions, and hence the incidence of malaria and productive work (which was largely agricultural and based on rain water) were not similar across HAs. Secondly, the validity of undertaking HA level statistical manipulations in the form of an extrapolation exercises was challenged by the sampling method of the study. The adopted cluster sampling method generated a sample which represented the whole malarious zone as a unit rather than each HA as a stratification. With these limitations, even the undertaking of an HA level extrapolation was hindered. The need to make an extrapolation was required only for curative care and acceptance of residual spraying; for other AMAs, annual HH level costs were collected by the HHS. With these methodological problems, the analysis was undertaken assuming the cost averages based on the HHS reflected the community behaviour for the whole year. Due to the heterogeneity of climatic conditions across HAs at a given time, the HHS captured community response to the disease under different climatic conditions and agricultural seasons, and therefore this assumption seemed to have a practical validity.

Apart from the above problem, no other critical problems were encountered in the CEA. The method adopted for the CEA was relied on both the AMC as well as the HHS data. However, the community responses played the most critical role in determining effectiveness and, particularly, community effectiveness of AMAs. Although there was ample evidence from the study itself to make a reliable dependence on community responses, it would be an area for future researchers to undertake

confirmation tests to link perceived and actual malaria as suggested under the second specific objective. This approach however facilitated the researcher not only to assess the economic worthiness of publicly provided AMAs but also the curative care of the private sector and to reach some conclusions on efficiency. Self preventive measures could also be assessed with respect to their effectiveness. It also provided some indications of the affordability as well as willingness to pay for both curative and preventive care among various socio-economic strata. Further, the CEA along with the findings of the community behaviour analysis provided a strong basis to undertake the analysis of policy options.

e.Specific objective: 5

The fifth specific objective of the study was to estimate cost implications and potential effectiveness of a set of POs with a view of enhancing the economic viability of the malaria control programme. Thus, it meant how could the present policy of the DAMC be changed to achieve a more cost-effective control programme.

The POs were derived mainly on the basis of the findings of the study, the DAMC's recent policy statement (DAMC 1993), WHO's Global Plan of Action for Malaria Control (WHO 1993) and findings of contemporary studies on malaria control in other countries (Gandahusada et al 1984, Phillips and Mills 1991 and Picard et al 1993).

The policy analysis took the form of a sensitivity analysis. Based on the requirements of each policy measure, necessary changes were made in the relevant variables. Both recurrent and capital costs were taken into account. Expected outputs were measured by making a set of assumptions on them on the basis of the available information on similar measures. For instance, a slightly higher SPR was assumed for the MBCs on the assumption that they will be conducted in proper locations unlike the MBCs evaluated for this study as case studies. The sensitivity analysis was, however, largely confined to the SRSP, MBCs and MNIP. Due to the novelty of the HIS and the component of subsidised nets in the MNIP, the direct cost estimation method was used for them. But the cost of all nets was annualized assuming a five year life time.

All attempts were made to estimate the cost implications of POs as accurately as possible. But the suggestion to strengthen the HIS lacked that accuracy as it was an entirely new suggestion and even findings of similar attempts in developing countries were not available in the literature. This was because it was only very recently that the attention of researchers and donor agencies was drawn to the strengthening of

district level HIS (Waddington et al 1989 and WHO 1993). However, a margin was allowed for the probable estimation errors in allocating funds for it. Similarly, due to the novelty of the policy of the provision of subsidised MNs to the deserving community members for impregnation, a 10 % margin was allocated to cover unforseen expenditures. Moreover, a margin was given for any additional costs attributed to the provision of safety measures for the sprayers as the existing measures were found to be inadequate for the new insecticides.

For the cost analysis, however, community cost was not considered except for the MNIP. As this study showed, direct cost of the community in accepting spraying was negligible and the indirect cost, too, was a small amount. Nevertheless, the study showed a high willingness of the community to accept RS with a new insecticide. Therefore the ignorance of indirect cost would not invalidate the policy measures of SRSP. For MBCs it was not possible to measure community cost; the number of patients who reported attending them in the HHS was too small and therefore the statistical validity of making generalizations with that data would be low. Yet, field observations as well as the case studies indicated that the MBCs were a preference of the patients and therefore the possibility of receiving a poor response for them would be extremely low. On the other hand, since the MBCs were suggested just as a temporary measure for ACDT, no further attempt was made to project their community cost. For the MNIP, in addition to the estimation of the cost of MNs for the HHs which were already having them, a 10 % of the cost of subsidized MNs was assumed to be borne by the receivers. The 10 % payment of the community for subsidized MNs can be justified from the findings of this study. Unaffordability was a prime reason for not using MNs by many low income HHs. But given the income levels of the study population and the high community willingness to use them in many parts of the malarious zone, 10 % payment could be reasonably justified as affordable. But this is an area for further investigation as the present study did not directly examine the willingness to pay for nets.

In general, the policy analysis was dependent on a large number of assumptions which could be justified in many ways as explained above. Even if some of those assumptions have low validity, the exercise was able to provide at least some suggestions for policy makers to rethink existing policies in order to enhance the economic worthiness of AMAs.

9.3 Validity and reliability of data

Some specific problems associated with the validity and reliability of data

used for the study will be presented here in brief as most of them have already been discussed at relevant sections.

Among cost items related to the provider, one of the most complete and reliable data set was personnel emoluments. Although most of the other cost items were also collected by screening vouchers and issuing orders, it was not possible to collect expenditure figures of inpatient food bills for each MC. Another problem was the incompleteness of the records of SPs initiated at HA level. This was due to the irregularity among PHIs to send feedback reports to the RMO and therefore the case studies had to be confined to the SPs for which sufficient information was available. There was a noteworthy mismatch between the RMOM records and the HHS findings with respect to the PRSP coverage in two HAs. PRSP data of these two HA were substantially different from other HAs as well. No justification could be found for these differences. This raises some doubts about the reliability of the RMOM records on PRSP coverage. One former consultant entomologist with the WHO very recently raised the same issue as a doctoring of figures to conform to set standards due to resistance of the public to AMAs (Thevasagayam 1993). If other AMAs also suffered from similar data drawbacks, it further justifies the undertaking of a HHS for this study and urges to giving high weight to community responses. However, such a departure from official data sources would primarily depend on the reliability of community responses. Many evidences supporting the reliability of the dependence on community responses were repeatedly elucidated in the previous sections. Further evidence on the validity of the manner through which community data were collected will be explained below.

All attempts were made to collect accurate information from the HHS, and discussions and interviews with respondents. As explained in Chapter 3, this was done by making pre visits to the selected GNDs and developing a very close relationship with the GNs and some respondents. These visits seemed to have developed some understanding and a confidence among the respondents about the study. Supervision also played an important role in this endeavour. The investigator made very frequent visits to the field and assisted the field investigators. Although no formal repeat interviews were undertaken, the discussions held with the selected HHs after screening the filled questionnaires provided an opportunity to check the answers given at the interview.

The field investigators expressed their assessments about the responses by indicating that in general they were "very satisfied" with 39.8 % of interviews followed by "satisfied" with 57.1 % of interviews. They were not satisfied with only 2 HHs (0.2

%). With respect to specific questions, the field investigators were not satisfied with the responses for the questions on income at 10 HHs (1.0 %). At two HHs, heads were not available to provide reliable information on income and at the other HHs, respondents either overestimated or underestimated their income figures. With respect to illness, 4 HHs did not provide satisfactory information: the patient was not available at one place; and, information on the compliance with drugs was not reliable at the other three places. These are, indeed, the areas where there could be a less reliability in community data, as was revealed in the follow up discussions. In total, however, the assessments of the Field Investigators, the Investigator's personal experience and also the lack of any contradiction in the data analysis indicated that the data collected through the HHS seemed to be reasonably valid and reliable.

In concluding this chapter it is worth mentioning that to make a study based on community responses a successful one in terms of validity and reliability, in addition to the appropriateness of the analytical methods, the investigator has to make a strenuous effort to reach closer to the community. Although it needs high devotion, its gains would certainly overshadow the effort of such an attempt by producing energetic, trustworthy and valuable results of much greater value than the results of a study based on routine data sources.

Chapter 10. CONCLUSIONS

a.Encouraging changes in the control programme

Throughout this thesis the seeming policy rigidity of the AMC has been extensively challenged. However, following the DAMC policy statement in mid 1993, some significant changes have taken place in the control programme throughout the island[1]. In addition to the introduction of selective residual spraying, two new insecticides (i.e., Fenitrothion and Lambda-cyhalothrin) have already been introduced in three districts replacing malathion. The move from malathion into new insecticides and a selective residual spraying programme, however, coincided with the controversial dispute of the MoH with malathion suppliers. It was reported in national newspapers[2] that one of the potential malathion supplying firms was challenging the decision of the tender board, which selected some other supplier, and looking forward to seeking judicial justification for it. This seemed to have resulted in cancellation of the importation of malathion.

Along with the introduction of the DAMC's new policy, a series of MBCs was conducted in the district with the sponsorship of the World Bank. PRSP was confined to Galewela and Dambulla HAs under the SRSP. Thus, the released sprayers were used largely to intensify larvicide spraying. Mosquito net impregnation programme has also been geared up. According to the RMO, these measures have resulted in a substantial drop in the incidence rate in the district.

These changes, on the one hand, help to justify the findings and policy proposals of the present study. On the other hand, the need to draw the DAMC's attention to the economic dimensions of the control programme has been reconfirmed by these changes. A considerable potential still remains for assessing the cost-effectiveness of the newly introduced changes of the DAMC. The saving of some public funds due to the introduction of a SRSP does not necessarily mean that the DAMC has reached a more efficient and cost-effective regime and the DAMC still has to go a long way to make the AMC an efficient and community based control programme.

b.Assessment of methods and findings

This study was undertaken at a time when policy makers in endemic

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[1] Personal communication with the RMO, Matale (September 1994.)

[2] Daily News (February/March 1993).

countries as well as donors have encountered a challenge as to what are the most appropriate means through which more effective and efficient control could be achieved. This concern resulted in the publication of the guidelines of implementing the global malaria control strategy by the WHO in 1993 (WHO 1993). Researchers, who have attempted to assess cost-effectiveness of ongoing control programmes, are facing a series of methodological problems in achieving their goals: what could be considered as the more reliable proxies in assessing effectiveness of ongoing programmes in the absence of a control area or randomised control trial; what would be the plausible methods to incorporate acceptance of and compliance with control measures into the CEA framework in order to obtain more meaningful and useful findings for policy analysis. With this background it is important to assess the significance and strength of the methods and findings of the present study in this international context.

In this study, the attempt to widen the scope of CEA, in evaluating an ongoing programme in the absence of control areas or randomized controlled trials, took the form of assessing community effectiveness by incorporating a proxy for incidence and investigating acceptance and compliance only on the basis of community perceptions. The strongest support for adopting this method was provided by the appreciable understanding of the community members of the disease and control methods as illuminated in the study. The adoption of such a method and its findings could, however, be challenged by epidemiologists in particular. But the current requirement of policy makers in endemic countries to obtain an in depth understanding of community contributions to the achievement of effectiveness and efficiency of their control tools is nonetheless important. With the resource constraints for undertaking randomized control trials and the seeming reluctance of policy makers to undertake such trials for ongoing programmes, which are normally based on tools where efficacy has already been demonstrated, the feasibility to incorporate CEAs in those trials appears to be low. However, it is an immensely important area for epidemiologists and economists to work together on, particularly to assess the validity of community perceptions on illness prior to the undertaking of economic evaluations focusing on community effectiveness.

c.Policy options

The study has been able to investigate basically two policy issues both of which have taken higher priority recently in policy agendas: selection of more cost-effective control measures on the basis of local requirements and enhancing the role of the private sector. The former specially refers to the choice between residual spraying

and bednet impregnation. Both of these issues are given high emphasis in the WHO guidelines (WHO 1993).

On a set of assumptions on effectiveness and community participation, bednet impregnation was shown to be a feasible and seemingly more cost-effective method to replace residual spraying as a regular control measure leaving residual spraying to be undertaken only on a selective basis; i.e., during epidemics and outbreaks or only in highly endemic areas. In general, diversification of control measures over the existing dependence on one or two control measures was found to be an affordable task and this could be an area for policy makers in other endemic areas to focus on.

Given affordability, the community has a high preference to use the private sector for curative care specially in the case of mild illness. This is due to the presumption that only the public sector has the facilities to handle severely ill cases properly. This seems to be a common feature in many endemic areas. An important question arising in this context is what would be the appropriate measures to enhance case detection and treatment in the private sector which normally lacks proper diagnostic facilities. This indeed emphasises the need to examine the ways through which a collaboration could be established with the private sector for those purposes. One probable measure could be the development of a public and private mixture of the provision of services by allowing the private sector to use public diagnostic facilities for payment. Such an attempt could provide a better basis to establish a link with the private sector, and even to extend the public health information system towards the private sector.

Apart from these issues another important aspect on which emphasis is placed is the seeming willingness of the community to bear a large portion of the cost of control measures, particularly as direct cost. But the community payments for both curative and preventive care take a very haphazard form in that payments are made only when they become imperative either due to illness or higher mosquito nuisance. Yet given the notably high magnitudes of those payments, it is essential for the control programmes to take measures to divert those payments towards more effective means. Health education programmes may play an important role in this endeavour. This issue further brings up the high worthiness of undertaking studies on both stated and actual willingness to pay for control measures.

Finally this study could provide an encouragement for the economic evaluators of tropical diseases to widen the framework of CEA by incorporating

community dimensions of the disease control strategies and measures in future studies. It would further be an indication for policy makers to get away from their seemingly supply side biased approach and focus on the receivers as well in formulating future policies.

BIBLIOGRAPHY

Abyan A.M. and Osman A.A. (1993). Social and behavioural factors affecting malaria in Somalia. Social and Economic Research Project Reports No.11. Geneva: UNDP/WORLD BANK/WHO Special Programme for Research and Training in Tropical Diseases (TDR).

Aikins M.K., Pickering H., Alonso P.L., D'Alessandro U., Lindsay S.W., Todd J, and Greenwood B.M. (1993). Perceptions of the causes of malaria and of its treatment and prevention in the study area. Transactions of the Royal Society of Tropical Medicine and Hygiene 87 (Supplement 2), 25-30.

Aikins M.K., Pickering H. and Greenwood B.M. (1994). Attitudes to malaria, traditional practices and bednets (mosquito nets) as vector control measures: a comparative study in five West African countries. Journal of Tropical Medicine and Hygiene 97, 81-86.

Allen S.J., Snow R.W., Menon A. and Greenwood B.M. (1990). Compliance with malaria chemoprophylaxis over a five-year period among children in a rural area of The Gambia. Journal of Tropical Medicine and Hygiene 93, 313-322.

Alonso P.L., Lindsay S.W., Armstrong J.R.M., Conteh M., Hill A.G., David P.H., Fegan G., De Francisco A., Hall A.J., Shenton F.C., Cham K. and Greenwood B.M. (1991). The effect of insecticide-treated bed nets on mortality of Gambian children. The Lancet 337 (June 22), 1499-1502.

Amarasinghe F.P., Amarasinghe P.H., Peiris J.S.M. and Wirtz R.A. (1991). Anopheline ecology and malaria infection during the irrigation development of an area of the Mahaweli project, Sri Lanka. American Journal of Tropical Medicine and Hygiene 45 (2), 226-235.

Ansari M.A., Sharma V.P.,Razdan R.K. and Mittal P.K. (1990). Evaluation of certain mosquito repellents marketed in India. Indian Journal of Malariology 27 (June), 57-64.

Anti-Malaria Campaign. (1981-1991). Administration reports, 1981 to 1991. Colombo: Ministry of Health, Sri Lanka.

Arrow K.J.(1963). Uncertainty and the welfare economics of medical care. The American Economic Review LIII (5), 941-973.

Asinas C.Y., Alvarez A.B., Joson N.DC., del Rosario B.M., Ortega L.I.. and Awat J. (unpublished). The effectiveness of etofenprox 20 % WP (Trebon) insecticide compared to DDT 75 % WP against the primary vector in the Philippines. Unpublished document. Malaria Control Service, The Philippines.

Attanayake N. and Silva U.H.S.De. (1987). Health sector resource flows in Gampaha District of Sri Lanka. Geneva: World Health Organization.

Attanayake N. and Silva U.H.S.De. (1992). Utilization patterns of resources at peripheral level health care institutions in Gampaha District, Sri Lanka. Health Systems Research Project, National Institute of Health Science. Colombo: Ministry of Health, Sri Lanka.

Barlow R. (1967). The economic effects of malaria eradication. The American Economic Review LVII (2), 130-148.

Banguero H. (1984). Socioeconomic factors associated with malaria in Colombia. Social Science and Medicine 19 (10), 1099-1104.

Bennett S., Wood T., Liyanage W.M. and Smith D.L. (1991). A simplified general method for cluster sample surveys of health in developing countries. World Health Statistics Quarterly 44 (3), 98-106.

Berman P.A. (1982). Selective primary health care: is efficient sufficient?. Social Science and Medicine 16, 1054-1059.

Bernstein H., Crow B. and Johnson H. (1992). Rural livelihoods - crises and responses. New York: Oxford University Press in association with The Open University.

Bichmann W., Diesfield H., Agboton Y., Gbaguidi E.A. and Simshauser U. (1989). District health systems: users' preferences for services in Benin. Health Policy and Planning 6 (4), 361-370.

Bonilla E. and Rodrigauz A. (1993) Determining malaria effects in rural Colombia. Social Science and Medicine 37 (9), 1109-1114.

Brabin B.J., Ginny M., Alpers M., Brabin L., Eggelte T. and Van Der Kaay H.J. (1990). Failure of chloroquine prophylaxis for falciparum malaria in pregnant women in Madang, Papua New Guinea. Annals of Tropical Medicine and Parasitology 84 (1), 1-9.

Brown P.J. (1986). Socioeconomic and demographic effects of malaria eradication: a comparision of Sri Lanka and Sardinia. Social Science and Medicine 22 (8), 847-859.

Bruce-Chwatt L.J. (1987). Malaria and its control: present situation and future prospects. Annual Review of Public Health 8, 75-110.

Butraporn P., Sornmani S. and Hungsapruek T. (1986). Social, behavioral, housing factors and their interactive effects associated with malaria in east Thailand. Southeast Asian Journal of Tropical Medicine and Public Health 17 (3), 386-392.

Caldwell J., Gajanayake I., Caldwell P. and Peiris I.(1989). Sensitization to illness and the risk of death: an explanation for Sri Lanka's approach to good health for all. Social Science and Medicine 28 (4), 365-379.

Castilla R.E.F. and Sawyer D.O. (1993). Malaria rates and fate: a socioconomic study of malaria in Brazil. Social Science and Medicine 37 (9), 1137-1145.

Castro E.B. and Mokate K.M (1988). Malaria and its socioeconomic meanings: the study of Cunday in Colombia. In Herrin A.N. and Rosenfield P.L (eds.) Economics, health and tropical diseases. Quezon City: The University of the Philippines 159-189.

Central Bank of Sri Lanka. (1984). Consumer finances and socio - economic survey 1981/82. Colombo: Central Bank of Sri Lanka

Central Bank of Sri Lanka. (1991). Consumer finances and socio - economic survey 1987/88. Colombo: Central Bank of Sri Lanka

Chiang G.L., Tay S.L., Eng K.L. and Chan S.T. (1990). Effectiveness of repellent / insecticidal bars against malaria and filariasis vectors in Peninsular Malaysia. Southeast Asian Journal of Tropical Medicine and Public Health 21 (3), 412-417.

Coene J., Ngimbi N.P., Mulumba M.P. and Wery M. (1989). Ineffectiveness of mosquito coils in Kinshasa, Zaire. Transactions of the Royal Society of Tropical Medicine and Hygiene 83, 568-569.

Cohn E.J. (1973). Assessing the costs and benefits of anti-malaria programmes: the Indian experience. American Journal of Public Health 63, 1086-1096.

Creese A. and Parker D. (1991). Cost analysis in primary health care. Geneva: World Health Organization.

Curtis C.F. (1991). Comments on "Environmantal management in malaria control in India". In Targett G.A.T. (ed.) Waiting for the vaccine. Chichester: John Wiley & Sons Ltd.

Curtis C.F. (1994). Should DDT continue to be recommended for malaria control ? Medical and Veterinary Entomology 8, 107-112.

Lin B.U. (1991). Bednets treated with pyrethroids for malaria. In Waiting for the vaccine. Targett G.A.T. (ed.) Chichester: John Willy & Sons Ltd.

Dabis F., Breman J.B., Roisin A.J., Haba F. and the ICSI-CCCD team (1989). Monitoring selective components of primary health care: methodology and community assessment of vaccination, diarrhoea, and malaria practices in Conakry, Guinea. Bulletin of the World Health Organization 67 (6), 675-684.

Deming M.S., Gayibor A., Murphy K., Jones T.S. and Karsa T. (1989). Home treatment of febrile children with antimalarial drugs in Togo. Bulletin of the World Health Organization 67 (6), 695-700.

Dhillon H.S. and Kar S.B. (1961). Malaria eradication. an investigation of cultural patterns and beliefs among tribal population in India. International Journal of Health Education 8, 31-40.

Directorate of Anti-Malaria Campaign. (1993). Circular issued by the Director on 29.6.1993 to all RMOs. Colombo: Ministry of Health, Sri Lanka.

Drummond M.F., Stoddart G.L and Torrance G.W. (1987). Methods for the economic evaluation of health care programmes. Oxford: Oxford University Press.

Edirisinghe J.S., Balasuriya S. and Kumarasiri P.V.R. (1987). Changing patterns of clinical malaria: a field study. Ceylon Medical Journal 32, 35-42.

Ettling M.B. and Shepard D.S. (1991). Economic cost of malaria in Rwanda. Tropical Medical Parasitology 42, 214-218.

Ettling M.B., Thimasarn K., Shepard D.S. and Krachaiklin S.(1991). Economic analysis of several types of malaria clinics in Thailand. Bulletin of the World Health Organization 68 (4), 467-476.

Ettling M.B., Thimasarn K., Krachaiklin S. and Bualombai P. (1989a). Evaluation of malaria clinics in Maesot, Thailand: use of serology to assess coverage. Transactions of the Royal Society of Tropical Medicine and Hygiene 83, 325-331.

Ettling M.B., Thimasarn K., Krachaiklin S. and Bualombai P. (1989b). Malaria clinics in Mae Sot, Thailand: factors affecting clinical attendance. Southeast Asian Journal of Tropical Medicine and Public Health 20 (3), 331-340.

Ekeh H.E. and Adeniya J.D. (1986). Targeting school children for tropical diseases control: preliminary findings from a socio-behavioural research in Negeria. Journal of Tropical Medicine and Hygiene 89, 1-6.

Feinberg R. (1990). Spiritual and natural etiologies on a polynesian outlier in Papua New Guinea. Social Science and Medicine 30 (3), 311-323.

Fernandez R.E. and Sawyer D.O. (1988). Socioeconomic and environmental factors affecting malaria in an Amazon frontier area. In Herrin A.N. and Rosenfield P.L. (eds.) Economics, health and tropical diseases. Quezon City: The University of the Philippines.

Foster S.D. (1991). Pricing, distribution, and use of antimalarial drugs. Bulletin of the World Health Organization 69 (3), 349-363.

Fernando M.A. (1983). Social and economic aspects of tropical diseases and control. Southeast Asian Journal of tropical Medicine and Public Health 14 (1), 8-11.

Fungladda W. and Sornmani S. (1986). Health behaviour, treatment-seeking patterns, and cost of treatment for patients visiting malaria clinics in western Thailand. Southeast Asian Journal of Tropical Medicine and Public Health 17 (3), 379-385.

Fungladda W., Sornmani S., Klongkamnuankarn K.and Hungsapruek T. (1987). Socio -demographic and behavioural factors associated with hospital malaria patients in Kanchianaburi, Thailand. Journal of Tropical Medicine and Hygiene 90, 233-237.

Gamage-Mendis A.C., Carter R., Mendic C., De Zoysa A.P.K., Herath H.R.J. and Mendis K. (1991). Clustering of malaria infections within an endemic population: risk of malaria associated with the type of housing construction. American Journal of Tropical Medicine and Hygiene 45(1), 77-85.

Gandahusada S., Fleming G.A., Sukamota, Damar T., Suwarto, Sustriayu, Bang S., Arwati S. and Arif H. (1984) Malaria control with residual fenitrothion in Central Java, Indonesia: an operational-scale trial using both full and selective treatment. Bulletin of the World Health Organization 65 (5) 783-794.

Gardiner C., Biggar R.J., Collins W.E. and Nkrumah F.K. (1984). Malaria in urban and rural areas of southern Ghana: a survey of parasitaemia, antibodies, and antimalarial practices. Bulletin of the World Health Organization 62 (4), 607-613.

Garfield R.M. and Vermund S.H. (1986). health education and community participation in mass drug administration for malaria in Necaragua. Social Science and Medicine 22 (8), 869-877.

Goldschmidt-Clermont L. (1987). Economic evaluation of unpaid household work: Africa, Asia, Latin America and Oceania. Women, Work and Development, No.14. Geneva: International Labour Organization.

Government of Sri Lanka (1992). Government estimates 1992. Colombo: Government Press.

Glik D.C., Ward W.B., Gordon A. and Haba F. (1989). Malaria treatment practices among mothers in Guinea. Journal of Health and Social Behavior 30 (Dec), 421-435.

Goh K.T (1986). Social and economic aspects of malaria in Singapore. Southeast Asian Journal of Tropical Medicine and Public Health 17 (3), 346-352.

Gomes M. (1993). Economic and dempgraphic research on malaria: a review of the evidence 37 (9), 1093-1108.

Greenwood B.M. (1989). The microepidemiology of malaria and its importance to malaria control. Transactions of the Royal Society of Tropical Medical and Hygiene 83 (Suppl), 25-29.

Gray R.H. (1974). The decline of mortality on Ceylon and the demographic effects of malaria control. Population Studies 28 (2), 205-229.

Griffith M.E. (1961). Financial implications of surveillance in India and other countries. Bull. Nat. Soc. Ind. Mal. Mosq. Dis. 9 (5-6, Sept-Nov.), 385-411.

Gunatilleke G., Perera P.D.A., Fernando J. and Fernando E. (1988). Seasonality and health. a study of the socio-economic environment of ill-health in five locations. A study undertaken for the World Health Organization. Colombo: Marga Institute.

Hammer J.S. (1993). The control of malaria control. The World Bank Research Observer 8 (1), 1-22.

Harinasuta C. (1986). The need for health behaviour and socio-economic research in malaria control in Thailand. Southeast Asian Journal of Tropical Medicine and Public Health 17 (3), 475-478.

Hedman P., Borohult J., Forslund J., Sirleaf V. and Bengtsson E. (1979). A pocket of controlled malaria in a holoendemic region of West Africa. Journal of Tropical Medicine and Parasitology 73 (4), 317-325.

Helitzer-Allen D.L., McFarland D.A., Wirima J.J. and Macheso A.P. (1993). Mlalaria chemoprophylaxis compliance in pregnant women: a cost-effectoveness analysis of alternative interventions 36 (4), 403-407.

Heymann D.L., Steketee R.W., Wirima J.J., McFarland D.A., Khoromana C.O. and Campbell C.C. (1990). Antenatal chloroquine chemoprophylaxis in Malawi: chloroquine resistance, compliance, protective efficacy and cost. Transactions of the Royal Society of Tropical Medicine and Hygiene 84,
496-498.

Hiramani A.B. and Sharma N. (1987). Socio-economic aspects of malaria in India - a literature review. African Journal of Medical Science 15, 113-117.

Hirsch R.P. and Riegelman R.K. (1992). Statistical first aid: Interpretation of health research data. Boston: Blackwell Scientific Publications.

Hlaing T. and Maung T.M. (1990). A knowledge - perception - behaviour study on malaria in two island villages and two timber extraction camps in Tanintharyi Division. The Myanmar Health Sciences Research Journal 2 (1),
1-8.

Hongvivatana T. (1986). Human behavior and malaria. Southeast Asian Journal of Tropical Medicine and Public Health 17 (3), 353-359.

Hongvivatana T., Leerapan P. and Smithisampan M. (1982). An observational study of DDT house spraying in a rural area of Thailand. Journal of Tropical Medicine and Hygiene 85, 245-250.

Jackson L.C. (1985). Malaria in Liberian children and mothers: biocultural perceptions of illness vs clinical evidence of disease. Social Science and Medicine 20 (12), 1281-1287.

Jambulingam P., Gunasekharan K., Sahu S.S., Hota P.K., Tyogi B.K. and Kalyanasundaram M. (1989). Effect of permethrin impregnated bednets in reducing population of malaria vector Anopheles culicifacies in a tribal village of Orissa State (india). Indial Journal of Medical Research 89 (January), 48-51.

Jayawardana R. (1993). Illness perception: social cost and coping-strategies of malaria cases. Social Science and Medicine 37 (9), 1169-1176.

Jeffrey G. (1984). The role of chemotherapy in malaria control through primary health care: constraints and future prospects. Bulletin of the World Health Organization 62 (Supplement), 349-353.

Kaewsonthi S. and Harding A.G. (1984).Cost and performance of malaria surveillance in Thailand. Social Science and Medicine 19 (10), 1081-1097.

Kaewsonthi S.(1988).Internal and external cost of malaria surveillance in Thailand. II final report. TDR project no.850059. Geneva: World Health Organization.

Kalra N.L. (1978). National malaria eradication programme, India - its problems, management and research needs. Journal of Communical Diseases 10 (1), 1-20.

Kamolratanakul P., Dhanamun, Prasittisuk C. and Grisso J.A. (1993). Economic analysis of malaria control for migrant workers in eastern Thailand. Southeast Asian Journal of Tropical Medicine and Public Health 24 (2), 216-220.

Kamunvi F. and Ferguson A.G. (1993). Knowledge, attitudes and practices (KAP) of human intestinal helminths (worms) in two rural communities in Nyanza province, Western Kenya. East African Medical Journal 70 (8), 482-490.

Kere J.F. and Kere N.K. (1992). Bed-nets or spraying? Cost analysis of malaria control in the Solomon Islands. Health Policy and Planning 7 (4), 382-386.

Kaseje D.C.O., Sempebwa E.K.N. and Spencer H.C. (1987a). Malaria chemoprophylaxis to pregnant women by community health workers in Saradidi, Kenya, I Reasons for non-acceptance. Annals of Tropical Medicine and Parasitology 81 (Supplement 1), 77-82.

Kaseje D.C., Spencer H.C. and Sempebwa E.K. (1987b). Usage of community - based chloroquine treatment for malaria in Saradidi, Kenya. Annals of Tropical Medicine and Parasitology 81 (Supplement 1), 111-115.

Lennox R.W. 1991. Malaria in Africa: the need for economic analysis. Tropical Medical Parasitology 42,198.

Leake D.W. and Hii J.L.K. (1989). Giving bednets "fair" tests in field trials against malaria: a case from Sabah, East malaysia. Southeast Asian Journal of Tropical Medicine and Public Health 20 (3), 379-384.

Lin L.B. (1991). "Bednets treated with pyrethroide for malaria". In Target G. (ed.)Malaria - waiting for the vaccine. 67-81. John Wiley & Sons

Lariosa T.R. (1986). Culture, environment and people's perceptions: considerations in malaria control in the Philippines. Southeast Asian Journal of Tropical Medicine and Public Health 17 (3), 360-370.

Lipowsky R., Kroeger A. and Vazquez M.L. (1992). Sociomedical aspects of malaria control in Colombia. Social Science and Medicine 34 No.6, 625-637.

Little I.M.D. and Mirrlees J.A. (1974). Project appraisal and planning for developing countries. New York: Basic Books, Inc., Publishers.

MacCormack C.P. (1984). Human ecology and behaviour in malaria control in tropical Africa. Bulletin of the World Health Organization 62 (Supplement), 81-87.

MacCormack C.P. and Lwihula G. (1983). Failure to participate in a malaria chemosuppression programme: North Mara, Tanzania. Journal of Tropical Medicine and Hygiene 86, 99-107.

MacCormack C.P. and Snow R.W. (1986). Gambian cultural preferences in the use of insecticide-impregnated bed nets. Journal of Tropical Medicine and Hygiene 89, 295-302.

MacMcormack C.P., Snow R.W. and Greenwood B.M. (1989). Use of insecticide -impregnated bed nets in Gambian primary health care: economic aspects. Bulletin of the World Health Organization 67 (2), 209-214.

Mackintosh M. (1989). Gender, class and rural transition: agribusiness and food crisis in Senegal. London: Zed Books.

Magesa S.M., Wilkes T.J., Mnzava A.E.P., Njunwa K.J., Myamba J., Kivuyo M.D.P., Hill N., Lines J.D. and Curtis C.F. (1991). Trial of pyrethroid impregnated bednets in an area of Tanzania holoendemic for malaria Part 2. Effects on the malaria vector population. Acta Tropica 49, 97-108.

Matola Y.G. and Malle L.N. (1985). Factors affecting the compliance of malaria chemosuppression with chloroquine of some maternal and child health clinics in Tanga, Region, Tanzania. East African Medical Journal 62, 720-724.

Mburu F.M., Spencer H.C. and Kaseje D.O.C. (1987). Changes in sources of treatment occurring after inception of a community-based malaria control programme in Saradidi, Kenya. Annals of Tropical Medicine and Parasitology 81 (Supplement), 105-110.

McGuire A., Henderson J. and Mooney G. (1988). The economics of Health care. International Library of Economics. London:Routledge & Kegan Paul Ltd.

Mendis C., Gamage-Mendis C., De Zoysa A.P.K., Abeyawardana T.A., Carter R., Herath P.R.J. and Mendis K. (1990). characteristics of malaria transmission in Kataragama, Sri Lanka: a focus for immuno-epidemiological studies. American Journal of Tropical medicine and Hygiene 42 (4), 298-308.

Menon A., Snow R.W., Byass P., Greenwood B.B., Hayes R.J. and N'jie A.B.H. (1990). Sustained protection against mortality and morbidity from malaria in rural Gambian children by chemoprophylaxis given by village health workers. Transactions of the Royal Society of Tropical Medicine and Hygiene 84, 768-772.

Mills A. (1991). The economics of malaria control. In Targett G.A.T. (ed.) Waiting for the vaccine. Chichester: John Wiley & Sons Ltd.

Mills A. (1993a). Is malaria a priority? Evidence from Nepal. Health Economics 2, 333-347.

Mills A. (1985). Survey and examples of economic evaluation of health programmes in developing countries. World Health Statistic Quarterly 38, 402-434.

Mills A. (1989). The application of cost-effectiveness analysis to disease control programmes in developing countries, with special reference to malaria control in Nepal. PhD Thesis, London University.

Mills A. (1992). The economic evaluation of malaria control technologies : the case of Nepal. Social Science and Medicine 34(10),965-972.

Mills A. (1993b). The household cost of malaria in Nepal. Tropical Medical Parasitology 44, 9-13.

Mills A. (1993c). The impact of malaria control on the economic development of Nepal. In Mills A. and Lee K. (eds.) Health economics research in developing countries. New York: Oxford Medical Publications, Oxford University Press.

Ministry of Health. (1987). A survey on morbidity patterns and drug requirement at primary health care level. Colombo: Ministry of Health, Sri Lanka.

Ministry of Health. (1989). Annual Health Bulletin, 1989. Colombo: Ministry of Health, Sri Lanka.

Ministry of Health. (1992). Annual Health Bulletin, 1992. Colombo: Ministry of Health, Sri Lanka.

Mkawagile D.S.M. and Kihamia (1986). Relationship between clinical diagnosis malaria and parasitaemia in adult patients attending Mwananyamala dispensary, Dar es Salaam. The Central African Journal of Medicine 32 (1), 2-5.

Moir J.S., Tulloch J.L, Vrbova H., Jolley D.J., Heywood P.F. and Alpers M.P. (1985). The role of voluntary village aids in the control of malaria by presumptive treatment of fever. 2. Impact on village health. Papua New Guinea Medical Journal 28, 267-278.

Mwabu G.M. (1986). Health care decisions at household level: results of a rural health survey in Kenya. Social Science and Medicine 22 (3), 315-319.

Newman P. (1965). Malaria eradication and population growth, with special reference to Ceylon and British Guiana. Bureau of Public Health Economics, Reserch Series No.10. Ann Arbor: School of Public Health, The University of Michigan.

Njunwa K.J., Lines J.D., Magesa S.M., Mnzava A.E.P., Wilkes T.J., Alilio M., Kivumbi K. and Curtis C.F. (1991). Trial of pyrethroid impregnated bednets in an area of Tanzania holoendemic for malaria. Part 1. Operational methods and acceptability. Acta Tropica 49, 187-196.

Nur E.T.M. (1993). The impact of malaria on labour use and efficiency in the Sudan. Social Science and Medicine 37 (9), 1115-1119.

Onari E. and Grab B. (1980). Indicators for the forecasting of malaria epidemics. Bulletin of the World Health Organization 58 (1), 91-98.

Ongore D., Kamunvi F., Knight R.and Minawa A. (1989). A study of knowledge, attitudes and perceptions (KAP) of a rural community on malaria and the mosquito vector. East African Medical Journal 66 (2), 79-90.

Pampana E. (1963). A textbook of malaria eradication. London: Oxford University Press.

Parke A. (1988). Antimalarial drugs and pregnancy. The American Journal of Medicine 85 (Supplement 4A), 30-33.

Phillips M., Mills A. and Dye C. (1993). Guidelines for cost-effectiveness analysis of vector control. PEEM Guideline Series 3. Geneva: PEEM Secretariat, World Health Organization.

Phillips M.A. and Mills A. (1991). The operational costs of spraying residual insecticides: a case-study from Nepal. Journal of Tropical Medicine and Hygiene 94, 130-139.

Picard J and Mills A. (1992). The effect of malaria on work time: analysis of data from two Nepal districts. Journal of Tropical Medicine and Hygiene 95, 382-389.

Picard J., Aikins M., Alonso P.L., Schellenberg J.R.M.A., Greenwood B.M. and Mills A. (1993). Cost-effectiveness of bed net impregnation alone or combined with chemoprophylaxis in preventing mortality and morbidity from malaria in Gambian children. Transactions of the Royal Society of Tropical Medicine and Hygiene 87 (Supplement 2), 53-57.

Pribadi W., Muzaham F., Santoso T., Rasidi R., Rukmono B. and Soeharto (1986). The implementation of community participation in the control of malaria in rural Tanjung Pinang, Indonesia. Southeast Asian Journal of Tropical Medicine and Public Health 17 (3), 371-378.

Procacci P.G., Lamizana L., Kumlien S., Habluetzel A. and Rotigliano G.(1991). Permethrin-impregnated curtains in malaria control. Transactions of the Royal Society of Tropical Medicine and Hygiene 85, 181-185.

Ramaiah T.J. (1980). Cost benefit analysis of malaria control and eradication programmes in India. PSG Monograph 26. Ahamadabad: Public Systems Group, Indian Institute of Management.

Rajagopalan P.K., Jambulingam P., Sabesan S., Krishnamoorthy K., Rajendran S., Gunasekeran K. and Pradeep Kumar N. (1986). Population movement and malaria persistence in Rameswaram island. Social Science and Medicine 22 (8), 879-886.

Rosenfield P.L., Golladay F. and Davidson R.K. (1984). The economics of parasite diseases: research priorities. Social Science and Medicine 19 (10), 1117-1126.

Ruebush II T.K., Zeissig R., Godoy H.A. and Klien R.E. (1990). Use of illiterate volunteer workers for malaria case detection and treatment. Annals of Tropical Medicine and Parasitology 84 (2), 119-125.

Sauerborn R., Shepard D.S., Ettling M.B., Brinkmann U., Nougtara A. and Diesfeld H.J. (1991). Estimating the direct and indirect economic costs of malaria in a rural district of Burkina Faso. Tropical Medical Parasitology 42, 219-223.

Sawyer D.R. (1986). Malaria on the Amazon frontier: economic and social aspects of transmission and control. Southeast Asian Journal of Tropical Medicine and Public Health 17 (3), 342-345.

Sawyer D. (1993). Economic and social consequences of malaria in new colonization projects in Brazil. Social Science and Medicine 37 (9), 1131-1136.

Schwartz J.B., Akin J.S. and Popkin B.M. (Forthcoming) Economic determinants of demand for modern infant delivery in low income countries: the case of the Philippines. In Mills A. and Lee K. (eds.) Health economics research in developing countries. New York: Oxford Medical Publications: Oxford University Press.

Sevilla-Casas E. (1993). Human mobility and malaria risk in the Naya river basin on Colombia. Social Science and Medicine 37 (9), 1155-1167.

Sexton J.D., Ruebush II T.K., Brandling-Barnnett A.D., Breman J.G., Roberts J.M., Odera J.S. and Were J.B.O. (1990). Permethrin - impregnated curtains and bed-nets prevent malaria in western Kenya. American Journal of Tropical Medicine and Hygiene 43 (1), 11-18.

Sharma V.P and Sharma R.C (1986). Cost-effectiveness of the bio-environmental control of malaria in Kheda district,Gujarat. Indian Journal of Malariology 23, 141-145.

Sharma R.C, Malviya V.S.and Bhati P.G. (1990). Economic loss due to malaria in Kheda district, Gujarat. Indian Journal of Malariology 27, 149-155.

Sharma V.P., Ansari M.A. and Razdan K. (1993). Mosquito repellent action of neem (azadirachta indica) oil. Journal of the American Mosquito Control Association 9 (3), 359-360.

Shepard D.S., Ettling M.B., Brinkmann U. and Sauerborn R. (1991). The economic cost of malaria in Africa. Tropical Medical Parasitology 42, 199-203.

Silva K.T. (1991). Ayurveda, malaria and indigenous herbal tradition in Sri Lanka. Social Science and Medicine 33 (2), 153-160.

Singer B. and Sawyer D.O. (1992). Perceived malaria illness reports in mobile populations. Health Policy and Planning 7 (1), 40-45.

Singhanetra-Renard A. (1993). Malaria and morbidity in Thailand. Social Science and Medicine 37 (9), 1147-1154.

Singhanetra-Renard A. (1986). Population movement, socio-economic behavior and the transmission of malaria in northern thailand. Southeast Asian Journal of Tropical Medicine and Public Health 17 (3), 396-405.

Snow R.W., Rowan K.M., Lindsay S.W. and Greenwood B.M. (1988). Atrial of bed nets (mosquito nets) as a malaria control strategy in a rural area of The Gambia, west Africa. Transactions of the Royal Society of Tropical Medicine and Hygiene 82, 212-215.

Sornmani S. and Manderson L.(eds.) (1992) SEAMEO-TROPMED Technical Report on Social and behavioral aspects of malaria control Bangkok: SEAMEO Regional Tropical Medicine and Public Health Project.

Spencer H.C., Kaseje D.O.C., Roberts J.M. and Huong A.Y. (1987). Consumption of chloroquine phosphate provided for treatment of malaria by volunteer village health workers in Saradidi, Kenya. Annals of Tropical Medicine and Parasitology 81 (Supplement 1), 116-123.

Statistical Branch, Matale (1991). Statistical abstract, Matale District. Matale: District Secretariat.

Stein C.M., Gora N.P. and Macheka B.M. (1988). Self-medication with chloroquine for malaria prophylaxis in urban and rural Zimbabweans. Tropical and Geographical Medicine 40, 264-268.

Stephens C., Masamu E.T., Kiama M.G., Keto A.J. and Lines J. (1991). Urban mosquitoes, community participation, community control measures a baseline study of community knowledge, attitudes and practices towards urban mosquito vectors and their control in Dar es Salaam, tanzania. Urban Health Programme, Department of Public Health and Policy. London: London School of Hygiene and Tropical Medicine.

Subramanian S., Manoharan A., Sahu S., Jabmulingam P., Govardhini P., Mohapatra S.S.S. and Das P.K. (1991). Living conditions and occurrence of malaria in a rural community. Indian Journal of Malariology 28, 29-37.

Tanner M., Ch. Lengeler and Lorenz N. (1993). From the efficacy of disease control tools to community effectiveness - Case studies from the biomedical and health systems research activities of the Swiss Tropical Institute in Africa. Transactions of the Royal Society of Tropical Medicine and Hygiene 87, 518-523.

Tanner M. (1991). Comments on "Organization of control" by Teklehaimnot in Waiting for the vaccine. 169-182.

Taylor P. and Mutambu S.L. (1987). Compliance with malaria chemoprophylaxis programme in Zimbabwe. Acta Tropica 44, 423-431.

Trape J.F., Zoulani A. and Quinet M.C. (1987). Assessment of the incidence and prevalence of clinical malaria in semi-immune children exposed to intense and perennial transmission. American Journal of Epidemiology 126. No.2, 193-201.

Thevasagayam E.S. (1993). Malaria control - what went wrong. Daily News, March 23, 1993. Colombo: Lake House Publishers.

Uragoda C.G. (1987). A History of Medicine in Sri Lanka - from the earliest to 1948. Colombo: Sri Lanka Medical Association.

Vlassoff C. and Tanner M. (1992). The relevance of rapid assessment to health research and interventions. Health Policy and Planning 7 (1), 1-9.

Vosti S. (1990). Malaria among gold miners in Southern Para, Brazil: estimates of determinants and individual costs. Social Science and Medicine 30 (10), 1097-1105.

Waddington C.J. and Eniyimayew K.A. (1989). A price to pay; the impact of user charges in Ashanti-Akin district, Ghana. International Journal of Health Planning and Management 4, 17-47.

Walsh J.A. and Warren K.S. (1980). Selective primary health care: an interim strategy for disease control in developing countries. Social Science and Medicine 14C, 145-163.

Wang'ombe J.K. and Mwabu G.M. (1993). Agricultural land patterns and malaria conditions in Kenya. Social Science and Medicine 37 (9), 1121-1130.

World Health Organization, (1991). Community involvement in health development: challenging health services - Report of the WHO study group. Technical Report Series, 809. Geneva: World Health Organization.

Waddington C., Kello A.B., Wirakartakusumah D., Ganiarto E., Malik R., Aneno J., Thube C., Wangombe J., Attanayake N., Silva U. De. and Ndeki S. (1989). Financial information at district level: experience from five countries. Health Policy and Planning 4 (3), 207-218.

World Health Organization.(1993). Implementation of the global malaria control strategy - Report of the WHO study group on the implementation of the Global Plan of Action for Malaria Control 1993-2000. WHO Technical Report Series 839. Geneva: World Health Organization.

Yeneneh H., Gyorkos T.W., Joseph L., Pickering J. and Tedla S. (1993). Antimalarial drug utilization by women in Ethiopia: a knowledge-attitudes-practice study. Bulletin of the World Health Organization 71 (6) 763-772.

APPENDIX 1

Summary of economic evaluations of malaria control programmes

Author/s	Focus group/ Area/ Country, and Time	Aspects examined	Control method/s involved	Nature of economic evaluation and remarks if any
Griffith (1961)	Greece (1958)	Provider's cost per person	Surveillance	Partial cost-description
	Sarawak (1959 & 1960)	-do-	-do-	-do-
	Ethiopia, Awash Valley (1959-60)	-do-	Surveillance, spraying	Partial cost analysis
	Thailand (1960 and estimates for 1960-69)	Provider's cost per person and Provider's cost per contact	Surveillance, spraying, and surveillance and spraying	-do-
	Indonesia (1961)	Provider's per capita of control expenditure	Surveillance, spraying and spraying	-do-
	Ceylon-Sri Lanka (1960)	-do-	-do-	-do-
	Taiwan (1956 & 1960)	-do-	Spraying, Surveillance, Spraying and surveillance	-do-
	India (1961)	-do-	-do-	-do-
Bruce-Chwatt (1987)	Africa	Cost per person per year per chemotherapy	Chemotherapy	Partial cost-description

Cohn (1973)	India (1951/52-1970/71)	Total annual cost per malaria control unit in the control and eradication phases	Spraying, spraying and surveillance	Partial cost-outcome description Remarks: No attempt was made to quantify ceratin important cost and benefit items although they were identified
Gandahusada et al (1984)	Central Jawa, Indonesia (1980-82)	Provider's cost per capita per year for full coverage and selective coverage	Residual spraying of fanitrothion: full coverage and selective coverage with 2 different dosages	Partial cost analysis Remarks: Although indices on both cost and effectiveness were measured, no attempt was made to develop CE ratios
Jefffery (1984)	Not specified (1984 and a few years before)	Cost of chloroquine alone	Presumptive treatment	Partial cost description
Hedman et al (1979)	Yekepa mining town, Liberia (1975)	Provider's total annual cost and cost per person	Residual spraying (DDT), larviciding and chemotherapy	Partial cost- description Remarks: Full cost of provider was not measured - some items were excluded
Pampana (1963)	India, Pakistan and Burma (1939)	Total economic loss including some indirect costs	Non specific	Cost-description
	India (1939-60)	-do-	-do-	-do-

	Southern India (1942)	Patient's treatment cost per episode Patient's economic loss (including wages) per episode	Case detection and treatment -do-	Cost description -do- Remarks: Examined the savings generated through eradication
	Indonesia (?)	Provider's total cost	Non specific - but some emphasis on DDT spraying	Cost description
	The Philippines (1957)	Total and annual social cost per person	Case detection and treatment	Cost-outcome description Remarks: Cost borne by patients and value of life were examined
	Colombia (1959)	Cost of eradication and total cost of malaria per year	Non specific	Cost description
	Latina Province, Italy (1946-49)	-do-	-do-	-do-
	Togo (1958)	-do-	-do-	-do-
	Quandus Area, Afghanistan (1935-52)	Increase in land value under control	Non specific but spraying was mentioned (DDT)	Outcome description
	Chan Province, Cambodia (1955 & 60)	-do-	Non specific	-do-

	Mysore State, India (1952)	Net gain from irrigated land	Spraying (DDT)	Cost-outcome description Remarks: Cost of DDT spraying was compared with the increase in gains from land
Sauerborn et al (1991)	Solenzo District, Burkino Faso (1984/85)	Provider's cost, and direct and indirect cost of users	Case detection and treatment	Cost-description
Ettling and Shepard (1991)	Rwanda (1989)	-do-	-do-	-do-
Shepard et al (1991)	Rwanda (1989), Solenzo Chad, Burkino Faso (1987), Brazzqville district, Congo (1984) and all Sub-Saharan Africa (1978)	Direct and indirect cost per capita	-do-	-do-
Njunwa et al (1991)	Tanzania (1989)	Cost of implementation	Impregnated bed nets, spraying (DDT)	Cost-outcome description Remarks: A partial cost-outcome description
Phillips & Mills (1991)	Nepal (1985)	Operational cost - cost per structure, per spraying round	Residual spraying: Ficam, malathion and DDT	Cost analysis
Lin (1991)	Sichuan & Jiangsu Provinces in China (1986)	Per capita per year	Impregnated bed nets (deltamethrin and permethrin), Residual spraying (DDT)	Cost analysis

Fungladda & Sornmani (1986)	Sai yok district, Western Thailand (1984)	Cost of patients	Case detection and treatment	Cost description Remarks: A comparison was made between two groups: the control group consisted of patients who were not infected malaria during the past year
Castro & Mokate (1988)	Cunday, Colombia (1981-83)	Net benefits at household level	Non specific	Cost-outcome description Remarks: No comparison was made between alternatives. But attempted to make a partial CBA
Foster (1991)	Non specific	Cost of drugs	Non specific but more emphasis was on medication	Cost analysis
Ettling et al (1989)	Mae sot district, Thailand (1985-86)	Cost of patients	Case detection and treatment	-do-
Ettling (1991)	Mae sot district, Thailand (1985-86)	Institutional, community and social cost; cost per positive case (Institutional), cost per positive case (community), incremental institutional cost per extra case	-do-	-do- Remarks: Analysis was confined to intermediate effects
Heymann et al (1990)	Four sites in Malawi (1988)	Cost per case prevented	Chemotherapy	Cost-outcome description Remarks: Some cost elements were not included

MacCormack et al (1989)	The Gambia (1986,87)	Cost per person/ household, expenditure preferences	Impregnated bed nets and chemotherapy	Cost description Remarks: Examined outcomes from users' point of view
Sharma et al (1990)	Kheda District, India (1988)	Economic loss per case from patient's point of view	Bio-environmental control	Cost analysis
Sharma & Sharma (1986)	Kheda District, India (1985-86)	Provider's total cost	Bio-environmental control, insecticide spraying (DDT,HCH and malathion)	-do-
Vosti (1990)	Southern Para, Brazil (1984)	Cost borne by patient: medical expenses and loss of income	Non specific but emphasised DDT spraying and drug distribution	Cost description
Mills (1993c)	Nepal (up to mid 1980's)	Economic loss and benefit of control from macro perspectives	All control measures	CBA Remarks: Inability to express some costs and benefits in monetary terms was mentioned
Brown (1986)	Sri Lanka (1921-71) and Sardinia (1911-71)	Effect of control on economic development	-do-	Outcome description Remarks: No attempt was made to examine both costs and benefits in monetary terms
Barlow (1967)	Sri Lanka (1947-66) and projections for 1977	Economic effect of eradication - an assessment of macro impact	-do-	CBA
Stephens et al (1991)	Dar es Salaam, Tanzania (1991)	User's direct cost of domestic control methods per month/ item/ pit	Mosquito coils, insecticide spraying,bed nets, window gauze and beads	Cost analysis

Helitzer-Allen et al (1993)	Four antenatal clinics, Malawi (1988)	Total cost of four alternatives, compliance for each alternative	Antimalarial chemoprophylaxis among pregnant women	Partial cost analysis
Kamolratanakul et al (1993)	Bothong district, Thailand (1988)	Total and average cost to Malaria Division and workers, net saving of using a treated net	Mosquito net impregnation	Partial cost analysis
Kere and Kere (1992)	Solomon Islands(1986-1989)	Average cost and per capita of spraying/ bed net impregnation cycle	DDT spraying and bed net impregnation	Partial cost analysis
Picard et al (1993)	The Gambia (1989,90)	Cost per death/ case averted, cost per discounted healthy life year gained, cost per child year protected	Bed net impregnation, chemoprophylaxis	CEA
Walsh & Warren (1980)	Non specific	Cost per death averted, per capita cost	Mosquito control	CEA Remarks: Compared with other diseases
Kaewsonthi & Harding (1984)	Two zones, Thailand (1980-81)	Indictors related to cost and performance	Case detection and treatment	Cost analysis
a.Kaewsonthi (1988) b.Kaewsonthi & Harding (1986)	Two zones, Thailand (1985-86)	Provider's cost and cost borne by users, maydays prevents	Case detection, treatment and spraying	-do-

Mills (1989) Mills (1992) Mills (1993a)	National Malaria Eradication Organization and a sample of districts	Provider's per capita expenditure, cost per case/ unit, cost borne by patients and their families, cost per case/ death prevented, cost per day of health life gained, cost per discounted day of health life gained, net savings in curative/ preventive costs and net cost per case/ death prevented	Various methods of case detection and treatment, and residual spraying (DDT and malathion)	CEA

APPENDIX 2

Policy options: Costing methodology

In measuring cost of each policy option, necessary adjustments were made to the cost estimations of Chapter 4 under a set of assumptions. Those assumptions and the adopted costing methods are explained below for each activity. Residual spraying component of both policy options will be explained together. After describing the methods, relevant costing details for each activity will be presented.

1.Residual spraying

1.1 Initially 50 % and 25 % of the total expenditure on malathion in 1992 were allocated for the purchase of a new insecticide for the PO1 and PO2, respectively. For the PO1, it was assumed that only half of the targeted houses will be covered by the new insecticide, and it will be only 25 % for the PO2.

1.2 Estimation of required quantities and costs of the three new insecticides were made on three assumptions:

a.Average spraying area of a house would be 200 square meters

b.The new insecticide will be sprayed only in two cycles during a year

c.Total number of houses covered by the selective residual spraying programme would be 30,000 for the PO1 and 15,000 for the PO2

a.Based on field observations, it was assumed that length and width of an average house are 20 and 15 feet, respectively. It has a small living area, a large bed room and a small kitchen. Toilet is located outside the house. The hight of the house is between 9-12 feet where 12 is the tallest edge at the middle of the house. Thus, the wall and the lower indoor roof area of the house is around 200 square meters.

b.A review of the phamplets and unpublished reports of the firms which produce the three new insecticides clearly indicated that two cycles per year would be the standard application.

c.According to RMOM records, the total number of houses fully/ partially sprayed and refused in 1992 in four spraying cycles was 235,850. This means that the total number of houses in the malarious zone is about 60,000.

1.3 Particulars on active ingredient (ai) and presentation of the three insecticides were received from the DAMC and the Mitsui company: Sumithion 40 % WP (Fenitrothion) 1g ai/m^2, Icon 10 % WP (Lambda cyhalothrin) 0.03g ai/m^2 and Vectron 20 % WP (Etofenprox) 0.2g ai/m^2 [1]. By using the formula [(ai/m^2 X spraying space)/presentation of the insecticide], it was estimated that 500, 60 and 200 grams of the three insecticides were required to spray a house with 200 square meters of walls and ceiling (or lower part of the roof), respectively.

1.4 The required quantity of each insecticide was estimated by multiplying their requirements for a standard house size (above 1.3) by 30,000 X 2 for PO1 and 15,000 X 2 for PO2. The prices paid by DAMC per kg of Icon and Sumithion are $ 70.00 and $ 8.00, respectively. The f.o.b. price of Vectron per kg ($28.00) was directly received from the Mitsui company; the standard insurance rate of 0.14 % (Curtis 1994) was added to this price. The amount of $ 1.48 per kg for intercontinental see freight and land haulage used by Curtis 1994 was reduced to $1.00 just to get an approximate value for a shipments to Sri Lanka and it was also added to the f.o.b. price of Vectron; a further 10% was added to the landing value (i.e., ex-factory price + insurance + freight) for handling, storage and distribution charges of the DAMC. Exchange rate of the dollar was assumed to be equal to the current rate of Rs.48.00.

1.5 The number of RSTs required to cover the targeted houses was initially calculated in the following manner to carry out four spraying cycles during a year to provide basis for final calculations:

No. of RSTs = [(number of targeted houses X 4)/
(number of working days of a year)]/25

where 25 is the number of houses expected to be covered by a RST in one working day according to AMC standards (Chapter 4).

The required number of RSTs for each insecticide would be half of this number if spraying is confined to two cycles (above 1.2). However, it was assumed that the coverage rate of houses by a RST per day should be confined to a lesser number. Firstly, it will be a precautionary measure towards fulfilling an important suggestion made by the

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[1] For Vectron, the lowest possible dosage was taken as it seemed to be expensive compared to other insecticides.

community on a "proper spraying system" (Chapter 6). Secondly, during the study period, no RST covered more than 18 fully sprayed houses per day (Table 4.7). Thus, it was assumed that a RST, normally with two spraying machines, on average, would cover 12-13 houses per day. Therefore, the required number of RSTs, calculated by using the above formula, would be equal to number of RSTs required to undertake the PRSP with two cycles as well.

1.6 Direct manpower requirements for the number of RSTs (1.5) was calculated on the basis of current AMC practices. Thus depending on the number of targeted houses in each HA, the required number of FAs and SMOs were calculated for each HA. It was assumed that the excess SMOs in one HA will be transferred to the closest HA with a shortage of them. This problem did not arise to FAs as there was an excess of FAs in all HAs. It was also assumed that SSMOs will be recruited for the HAs which still had a shortage of SMOs. There will an excess of 9 and 19 FAs in implementing the PO1 and PO2, respectively. On the other hand, 28 SMOs can be released from PRSP with the implementation of PO2. For the PO1, the shortage of SMOs will be 12.

1.7 Initially, total value of salaries, wages, and travelling and subsistence of the required number of FAs, SMOs and SSMOs for the PRSP were estimated using their average earnings in 1992. This total was then multiplied by the proportion of time spent by them in 1992 for the PRSP. For the drivers who took part in the PRSP, 50 % and 25 % of their earnings in 1992 were taken for the PO1 and PO2, respectively. The supervisory level inputs coming from the RMO, DDHSs and PHIs and SFAs were also considered as half and quarter of their contributions in 1992 for the two options.

1.8 For the other inputs used for perennial residual spraying such as equipment, supplies and transport, only half and quarter of their 1992 values were taken for PO1 and PO2, respectively. It was assumed that the same office space of the RMOM, which is currently being used for the PRSP, will be used for the new insecticide as well. It was also assumed that the malathion store at the RMOM will be continuously used for the new insecticide as any spare space of it does not seem to be used for any other purpose at this stage. No adjustments were made for the small values of communication and electricity.

1.9 It was assumed that there will be no requirement of hiring small outlets to store the

new insecticide at regional level simply due to the extremely low storing capacity required for any new insecticide. It was calculated that although 136.47 tons of malathion was used during 1992, the maximum requirement of any new insecticide would not be more than 30 tons. For the Galewela HA, which had the highest number of houses, it would be little less than 10 tons. From Icon, only 4 tones will be required for the whole SRSP programme. Due to this reason and also as a precautionary measure for pilferage, it was assumed that DDHSs will take the responsibility to store the new insecticide at their offices; they will introduce a new method to distribute it among the RSTs periodically using AMC vehicles or their own vehicles when inspecting the SRSP. Alternatively, FAs of the SRSP can be given the responsibility to collect necessary quantities from the DDHS office. For instance only 3.6 kgs of Icon is required for a spraying team for five working days. In this respect, the highest amount is required from Sumithion which is 31.25 kgs.

2.Augmentation of case detection and treatment

2.1 It was assumed that during the first year, the RMO, a PHI at RMOM, four PHIs attached to Galewela, Dambulla, Naula and Matale DDHS Offices each will take part in 25 MBCs (i.e., 25 X 6 = 150) on supervisory capacity. The three SFAs at Galewela, Dambulla and Matale DDHS Offices and a PHI/SFA of the RMOM or the RMO was assumed to be the supervisor of the rest 100 MBCs. It was further assumed that FAs and MICs for each MBC will be taken from the respective administrative unit which organizes the MBC (i.e, DDHS office or the RMOM). Thus, service of the drivers and temporary labourers (i.e,SSMOs) will also be taken in the same manner. For the 50 MBCs in the second year a similar pattern of participation was assumed but each type of manpower explained above will take part in only 5 MBCs.

2.2 To estimate the cost of manpower, the number of clinics attended by each manpower category was multiplied by the sum of their average daily salary/wage and subsistence per day. For temporary labourers only daily payment was considered.

2.3 Other input items such as diesel, capital cost of vehicles and capital cost of microscopes were estimated similar to the two case studies of MBCs in Chapter 4 on per day/ per clinic basis. Similarly, findings of Chapter 4 was used to estimate the laboratory supplies for blood tests as well.

2.4 In estimating cost of drugs, two assumptions were made: on average, 100 patients will attend a MBC in each year; the SPR of the MBCs would be 20 for the first year and 15 for the second year. The attendance number taken for the first assumption is almost the same as the average attendance at the MBCs considered for the case studies (Chapter 4); but to make it a round figure for easy calculations it was equalled to 100. The average values of the SPR of those case studies were, however, below 15. It seemed that some of those MBCs were held at suitable locations (Chapter 4). Thus, a relatively high value of SPR could reasonably be assumed for the proposed MBCs for the first year given their location will be decided in a more realistic manner. In assuming a low SPR for the second year a decline in the incidence rate was expected as a result of the new policy measures. Just for illustrative purpose, however, the cost of the proposed 250 MBCs in the first year was calculated with the assumption SPR equals to 15 as well. But the difference between the two estimates were negligible. It was because those differences were attributed only to the cost of drugs; all other inputs were the same for both cases.

2.5 Following the case studies (Chapter 4) six types of drugs were assumed to be administered in MBCs. Chloroquine and primaquine were assumed to be given to all positive cases. Small proportions of Phenergen, Fansidar and Camoquine (similar to case studies) were added to the drug cost along with Paracetamol tablets.

2.6 In training 9 MICs, an allowance of Rs.2,500.00 was assumed to be given for them during the training period. This is little higher than the present practice of the public sector. But leaving some allowance for the increase in cost of living, this amount could be considered as a reasonable allowance for the trainees who will go through a crash training programme. A block sum of Rs.225,000 was allocated for the training programme assuming even a private sector firm would not expect more than Rs.25,000.00 to train one MIC. At present even a fee paid post-graduate course at the university level does not charge above this amount. With the completion of the training programme, the trained MICs were assumed to be given the normal salary of a joining MIC - about Rs.3000.00. The market price of a currently popular microscope among MICs (Rs.45,000) was used to estimate the cost of 9 microscopes. Since this cost has to be incurred at the beginning of the second year it was added without making any discounting. Similarly, existing monthly salary scales were used to cost the stationing of FAs to 9 MCs at the beginning of first year.

2.7 Assuming 250 VHWs will be recruited from 235 GNDs and each will make 6 visits to the attached DDHS office to collect drugs (and to seek advice) Rs.50.00 was allocated for each visit as travelling allowance.

3.Mosquito net impregnation

3.1 Ten FAs (out of 19) and 28 SMOs released from the curtailed PRSP of PO2 (above 1.6) were assumed to be sufficient to form 10 dipping teams for the first year of the MNIP. For the second year, however, with the provision of more nets to the community 12 SSMOs will be required to undertake dipping. It was assumed that in each year during the one and a half months prior to the initiating of dipping, the 10 FAs along with 10 SMOs will travel around the GNDs to meet the GNs, VHWs and village leaders to organize the MNIP. Since the impregnation will take only one and a half months, requirement of the service of FAs, SMOs and SSMOs will be as follows:

10 FAs - 3 months for each round of MNI (each year)

10 SMOs - 3 months for each round of MNI (each year)

18 SMOs - 1 1/2 months for each round of MNI (each year)

12 SSMOs - 1 1/2 months for each round of the MNI in the second year

PHIs, SFAs, DDHSs and the RMO were also assumed to assist the FAs to carry out the preparatory work at field level. While PHIs and SFAs were assumed to spend 30 % of their time in organizing and supervising the programme the time proportion of the RMO on the programme would be 25 %. DDHSs were also assumed to spend 25 % of their time (i.e., from the time spent on AMAs) for the impregnation programme. However, the 10 FAs are expected to play the role of immediate supervisor. Drivers were assumed to spend 30 % of their time for the programme.

3.2 Following the findings of the case studies (Chapter 4), it was assumed that 80 nets can be dipped in a day during the first year by a dipping team consisted of one FA and 2-3 SMOs[2]. With the recruiting of 12 SSMOs there would be 4 dippers in each unit during the second year. Therefore a dipping team was assumed to dip about 110 nets per day during the second year. As suggested in the text, the number of working days would be 66 (i.e., 22 days a month).

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[2] The previously used designations of FA, SMO, SSMO etc., were continuously used to avoid any confusion.

3.3 Annual average salaries including travelling and subsistence of all the manpower categories were taken as the basis to estimate the manpower cost of the MNIP.

3.4 Capital cost of vehicles and fuel were estimated assuming vehicles were used for 120 days for the MNIP. This means in each of the six months of the programme, a vehicle will be used in five HAs for 20 days for supervision, and transporting employees and materials. Following the case studies in Chapter 4, 30 litres of diesel were allocated per day.

3.5 In estimating cost of Permethrin the method adopted in Chapter 4 was followed: i.e., about 40 millilitres per net with a price of Rs.843.08 per litre.

3.6 After estimating the total cost of impregnation following above 3.1 to 3.5, a 10 % was added to recover any incidental expenses including storage cost and overheads.

3.7 Proposed payments for the VHWs to take part in the MNIP (with AMC employees) in encouraging community members and organizing village level impregnation sessions were estimated as Rs.100.00 per day. Payments were assumed to be made for 2 days for 250 VHWs in each round of impregnation; since a VHW is expected to recruit from each GND and there are 235 GNDs (large and small) 250 would be the reasonable number of VHWs recruited.

3.8 A fixed sum of Rs.200,000.00 was allocated for the MNI training sessions for SFAs, FAs and SMOs (PHIs have already received this training) for the first year. Similar amount was allocated to hold training sessions for VHWs. Since the training session at the beginning of the second year would be to review of the work of the previous year and to train the newly recruited SSMOs, a smaller amount of Rs.75,000.00 was allocated for it. Any additional expense in this activity can be covered by the 10 % allowance made under 3.6.

3.9 After estimating the cost of all the other activities of the PO2 and the cost of impregnation in the above manner (i.e., 3.1 to 3.7), the balance of the total funds was allocated to provide nets for deserving HHs. The value of a net was taken as Rs.600.00 which is the current market price of a fairly good mosquito net. Since the subsidy was

assumed to be 90 %, AMC's share of the cost of a net would be Rs.540.00. A 10 % was added to the purchasing price to recover incidental expenses, delivery cost etc., which can not be properly estimated at this stage. These estimates were used to measure financial implications of the cost of nets for the current AMC budget. In measuring CPPP, it was assumed that a MN would last for five years and annualized cost was used for each year. Similarly, in measuring community cost of MNs same method was used with the same assumption.

3.10 The cost estimation for the whole programme was finally carried out in a simultaneous manner using a spreadsheet with interconnected entries particularly for the second year. By that way, taking the total cost of the all other activities of the PO2 as granted, determinant variables such as total number of subsidised nets, cost of permethrin etc., were repeatedly changed (as in the case of a manual solution to a simultaneous equation system) and resulted cost implications were examined. Thus, the maximum number of nets which can be subsidized and impregnated with the available of funds were obtained.

3.11 In estimating cost per person protected it was assumed that, on average, each net will be used by two HH members. Firstly, as it was observed during field visits, it was not the practice of many HHs in rural Sri Lanka to have a single bed for each member. Normally mother and children, or mother and elder daughter/s share the same bed. Therefore it is quite reasonable to assume sharing a mosquito net between two members within the HH as the existing habit of the study area.

3.12 The required number of mosquito nets for the HHs in the malarious zone was also estimated on the above assumption (3.11). Community perceptions on mosquito net usage were also taken into account in this exercise. For instance, approximately 57.2 % of the HHs which did not use nets had a need of using them (Table 6.35). It can be inferred from Table 6.34 that only about 10 % of the members of the HHs, which had the practice of using nets, were not interested in using them. Using all those information, it was estimated that about 105,000 mosquito nets are required to fulfil the needs of community. At the same time using the net availability rate of the study population, total number of nets in use in the malarious zone was estimated as about 27,500.

4.Health information system

4.1 It was assumed that the Health Information Officer will be paid a salary of a middle level government technical officer (i.e., Rs.4000.00). HIO will also be paid a subsistence for his/her visits to DDHSs for inspections; subsistence rate was assumed to be equivalent to that of the RMO (Rs.180.00). A similar salary of a newly recruited graduate to the government service was taken in valuing the emoluments for HIAs. Their subsistence allowance rate was also taken as Rs.180.00. Contributions of the RMO and DDHSs on supervisory capacity to the HIS was estimated by assuming one quarter of the time they previously spent on PRSP will be allocated for the HIS.

4.2 In estimating travelling cost, assuming a vehicle of the AMC will be used to make inspections, salary and subsistence of the diver, cost of diesel and capital cost of the vehicle were calculated and added together; methods used in the case studies in Chapter 4 were adopted in making cost calculations. An average amount of 30 litres of diesel was assumed to be used in each inspection visit.

4.3 Based on the existing market prices of computers a fixed amount of Rs.100,000.00 was used to estimate the cost of a computer and a printer. 15 % of the cost of them was added for maintenance (including stationery) for a year. Due to unavailability of information, only a fixed amount of Rs.250,000.00 was allocated for the training of HIOs, purchasing computer packages and/or for the payment for a computer firm to develop a programme (if necessary). Similarly, to make a review of the HIS and to undertake any recommended improvements (on the basis of the review) a fixed amount of Rs.150,000.00 was allocated.

4.4 Since no information was available, once again a fixed amount of Rs.25,000.00 was allocated for each HA for the second year to expand the HIS towards private sector. HIO was assumed to design and implement a plan with the assistance of the RMO, DDHSs and the DPDHS to reach private practitioners. For instance this allocation could be used to organize a meeting of the private practitioners as the initial step of expanding the HIS. Also HIAs can be paid a travelling allowance to make visits to private clinics to collect information. This allocation could further be used to print necessary forms to collect data.

4.5 After estimating the total cost following above 4.1 to 4.4, 10 % was added for capital

cost (including buildings, furniture etc.), overheads and any other incidental expenses.

5.Other cost items

5.1 Fixed amounts of Rs.500,000.00 and 2,000,000.00 were allocated for the PO1 and PO2, respectively to review the implementation of them during the second year. The allocation for the PO2 is substantially large as it involves the review of the MNIP as well. Firstly, the review of the MNIP needs a large multi-disciplinary evaluation team. Secondly, it consumes more inputs as evaluation was assumed to be undertaken during the whole second year.

APPENDIX 3: Questionnaire of the Time Allocation Study

The TDR/WHO sponsored study on cost-effectiveness of anti-malaria activities in Matale district

The survey of activities of the officials/employees who had some involvement in anti-malaria activities in 1992

PART I

01.	Name:
02.	Position/s held in 1992: a.From ..... to ..... as ..... b.From ..... to ..... as ..... c.From ..... to ..... as .....
03.	Health areas to which attached in 1992: a.From ..... to ..... in ..... b.From ..... to ..... in ..... c.From ..... to ..... in .....
04.	According to your personal assessment what percentage of your time in 1992 was spent for anti-malaria activities? .....%

PART II

Please indicate what percentage of the total time, that you spent for anti-malaria activities in 1992, was spent for each of the following activities. (Please allocate your total time among the relevant activities making the total equal to 100. Please avoid the activates which are not relevant to you.)

01.	Examining/assisting to examine suspected malaria patients at medical centres/in field activities with blood testing facilities:	
	1.1 Government medical centres	
	1.2 AMC mobile clinics	
	1.3 Police mobile clinics	
	1.4 Other (Specify)	
02.	Treating/assisting to treat confirmed malaria patients at medical centres/in field activities with blood testing facilities:	
	2.1 Government medical centres	
	2.2 AMC mobile clinics	
	2.3 Police mobile clinics	
	2.4 Other (Specify)	

03.	Examining and treating/assisting to examine and treat suspected malaria patients at medical centres/in field activities with no blood testing facilities:	
	3.1 Government medical centres	
	3.2 Field activities (Specify)	
	a.	
	b.	
	c.	
04.	Other activities related to treatment	
	4.1 Distribution of drugs	
	4.2 ..... (Specify)	
05.	Prescribing prophylaxis treatment	
06.	Obtaining blood smears at:	
	6.1 Government medical centres	
	6.2 AMC mobile clinics	
	6.3 Fever surveys	
	6.4 Mass blood surveys	
	6.5 Police mobile clinics	
	6.6 Field activities (Specify)	
	6.7 Other (Specify)	
07.	Preparing slides to take blood smears	
08.	Obtaining blood smears	
09.	Perennial residual spraying	
10.	Organizing perennial residual spraying	
11.	Supervising perennial residual spraying	
12.	Engagement in activities to persuade people to accept perennial residual spraying: e.g. propaganda	
13.	Focal spraying	
14.	Seasonal spraying	
15.	Abate spraying	
16.	Organizing abate spraying	
17.	Supervising abate spraying	

18.	Engagement in other larvicide control activities	
	18.1 ..... (Specify)	
	18.2 ..... (Specify)	
19.	Entomological investigations	
20.	Health education on malaria control	
21.	Training voluntary health workers	
22.	Supervising voluntary health workers	
23.	Organizing activities of voluntary health workers	
24.	Impregnating insecticides to mosquito nets	
25.	Office work related to anti-malaria activities	
26.	Please indicate what percentage of your total time on anti-malaria was spent on inpatient care.	

APPENDIX 4: QUESTIONNAIRE OF THE HOUSEHOLD SURVEY

The TDR/WHO sponsored study on cost-effectiveness of anti-malaria activities in Matale district

HOUSEHOLD SURVEY

Name of the Field Investigator: .....

Date of the survey: .....

INSTRUCTIONS TO THE FIELD INVESTIGATOR:

1. FORM 1, FORM 3 and FORM 4 should be filled for all the selected households for the survey.

2. For the households members who report at least one episode of malaria for the past 30 days, please fill one form of FORM 2 for each episode of illness.

FORM 1

A. INTRODUCTION

Name of the household head: .....
Address: .....
.....
.....

1.1 Household number	:.....	(...)
1.2.1 Village	:.....	(...)
1.2.2 G.N.Division	:.....	(...)
1.2.3 A.G.A.Division	:.....	(...)
1.2.4 Health area	:.....	(...)
1.2.5 Electorate	:.....	(...)
1.2.6 Local Authority	:.....	(...)
1.2.7 Closest government western medical centre	:.....	(...)

B. BACKGROUND INFORMATION OF HOUSEHOLD MEMBERS

INSTRUCTIONS TO THE FIELD INVESTIGATOR:

1. Please leave the first column (1.3) of the following two tables blank.

2. Please enter the particulars of household head first with number 1 under column 1.4.

3. When completing the column 1.7, please indicate both the number of completed years and months for children under 6 years. For others, only the number of completed years is sufficient.

Serial No.	Individual No.	Name	Relationship to the household head (Code A)	Age		Sex (Code B)	Marital status (Code C)
				Years	Months		
1.3	1.4	1.5	1.6	1.7		1.8	1.9
.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....

Code A:

Household head	1
Wife	2
father	3
Mother	4
Son	5
Daughter	6
Relative son	7
Relative daughter	8
Grandfather	9
Grandmother	10
Brother	11
Sister	12
Other (specify)	13

Code B:

Male	1
Female	2

Code C:

Unmarried	1
Married	2
Widow/ Widower	3
Separated	4
Divorced	5

Serial No. (Ref. 1.3)	Individual No. (Ref.1.4)	Educational attainment (Code D)	Main Occupation	Subsidiary Occupation	Did you suffer from malaria during the past 30 days? If YES please go to 1.14. If NO please go to Form 3.	How many times? Now, please go to FORM 2.
		1.10	1.11	1.12	1.13	1.14
.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....

CODE D:

Primary	0
Secondary	1
Up to grade 10	2
Up to grade 12	3
Up to the university	4
Other (specify)	5
No schooling (but literate)	6
No schooling and illiterate	7

FORM 2

TREATMENT BEHAVIOUR

INSTRUCTIONS TO THE FIELD INVESTIGATER:

This form should be filled for each household member who believes he/she has had malaria during the past 30 days as indicated by stating YES for question H1.13. An episode could have begun even before the past 30 days and continued in that period. Such episodes should also be included in this form. A separate form should be filled for each person and each episode. For those who are below 16 years please ask the household head to answer the questions. Please allow the respondent to decide the number of episodes he/she has had during the period concerned. If the household head is not available, please ask a senior household member to answer the questions. If you are not satisfied with his/her answers (e.g. if the respondent is not able to answer some questions), please arrange a time with the respondent to meet the household head as early as possible.

1. Household number (Ref.1.1) :.....
2. Individual number (Ref.1.4):.....
3. Serial Number (Ref.1.3) :.....
   (Please leave this blank)
4. Individual number of the person who answers the questions (Ref. 1.4) :.....
5. Serial number of the person who answers the questions (Ref. 1.3) :.....
   (Please leave this blank)

EPISODE 1/2/3

2.1 Please tell us the date on which the symptoms of the illness appeared first.

2.2 What were the first symptoms of your illness?

1. Fever .....
2. Shivering .....
3. Head ache .....
4. Pains in limbs, back, joints of hands and legs .....
5. Other (specify) .....
6. .....
7. .....
8. .....

2.3 How do you assess the severity of your illness?

1. Mild .....
2. Moderate ....
3. Severe ....

2.4 Did you take self treatment **BEFORE** getting treatment from any other source?

1. Yes ....
2. No ..... Please go to Question 2.15
3. I completely ignored the illness ..... Please go to Questions 2.19-21 and then to 2.62

2.5 How many days after the onset of symptoms you decided to take self treatment?

1. On the same day .....
2. On the following day .....
3. Two days later ....
4. Three days later ....
5. Other (specify) .....

Questions 2.6 to 2.8:

Type of self treatment received		Who suggested you to take this treatment? (Code E)	From where you got the treatment/ drugs? (Code F)
2.6		2.7	2.8
Panadol	.....	.....	.....
Disprin/Asprin	.....	.....	.....
Coriander	.....	.....	.....
Anti-malaria tablets	.....	.....	.....
Paspanguwa	.....	.....	.....
(Ayurvedic mixture of	.....	.....	.....
five herbs)	.....	.....	.....
King coconut	.....	.....	.....
Young coconut	.....	.....	.....
Other(Specify).....	.....	.....	.....

Code E

By practice	1
Household head	2
Other (specify)	

Code F

Bought from a pharmacy	1	Bought from a shop	3
We had a stock at home	2	Other (specify)	4

Questions 2.9 to 2.12:
If you took anti-malaria tablets, Panadol or Disprin/ Asprin for self treatment, please tell us what were those tablets and, how many ?

Drug 2.9	Total no. of tablets per day 2.10	No. of days 2.11	Total no. of tablets 2.12
1. White one (Chloroquine)			
2. Brown one (Primaquine)			
3. A tablet which does not have a bitter taste, but very effective (Fansidar)			
4. Panadol			
5. Asprin/ Disprin			
6. Other (specify)			

2.13 Did you get full recovery after taking self treatment?
1. Yes .....
2. No .....

2.14 After self treatment did you take treatment from any other source?
1. Yes .....
2. No ..... Please go to Questions 2.19-21 and then to 2.52

FIRST FORMAL SOURCE OF TREATMENT AND SOME RELATED QUESTION

2.15 After self treatment (if any) from where did you get formal treatment first?

1. From a government western hospital as an inpatient .....
2. From a government western clinic .....
3. From a private western doctor .....
4. From a government Ayurvedic doctor .....
5. From a private Ayurvedic doctor .....

6. From a government western doctor in private capacity .....
7. From a Field Officer of the AMC .....
8. From a Public Health Worker .....
9. From a Volunteer of the AMC .....
10. Other (specify) .....

INSTRUCTIONS TO THE FIELD INVESTIGATOR: If the answer for the above question IS 1 or 2, please go to the following question. Otherwise skip to Question 2.18

2.16 What is the name of the government western clinic/hospital from where you took treatment? .....

2.17 Why did you decide to take treatment from that place first?

1. Because it has blood testing facilities. ....
2. Because it is the closest government western clinic/hospital. .....
3. Other (specify).....

Now please go to Question 2.19

INSTRUCTIONS TO THE FIELD INVESTIGATOR: If the answer for Question 2.15 is NOT 1 or 2, go to the following question.

2.18 Please tell us why did you decide to take treatment from this place instead of going to a government western clinic/ hospital.

1. Because I could not bear the travel cost ....
2. Because it is so crowded ....
3. Because it is too far ....
4. Because I was too ill to go there ....
5. Because I knew I had been infected malaria ....
6. Because the government doctor pays more attention when you take private treatment .....
7. Other (specify) .....

INSTRUCTIONS TO THE FIELD INVESTIGATOR: Please fill the last column of the following table after the interview.

QUESTIONS 2.19 to 2.21: Now, please tell us whether the following facilities are available at your nearest government western clinic and the time taken to get the report of a blood test at that place.

Item	Response	Remarks of the Interviewer
2.19 A person to take blood slides is available	1.Yes/No 2..Don't know	1.Correct/Wrong
2.20 A microscopist is available	1.Yes/No 2.Don't know	1.Correct/Wrong
2.21 No of minutes/days to receive the blood report	1.Minutes..... 2.Days ..... 3.Don't know 4.Not relevant	1.Correct/Wrong 2.Correct/Wrong

2.22 How many days after the onset of symptoms you took treatment from the this source?

2.23 Were you in the view that you had been infected malaria when you were making this visit ?
1. Yes ....
2. No ....
3. I wasn't sure ....

2.24 If your first source of treatment was inpatient care at a government western hospital, please tell us how many days you were in that place. .....

2.25 Did that doctor/health personnel ask you to take a blood test?
1. Yes .....
2. No .... Please go to Question 2.28

2.26 From where?
1. From the same place ....
2. From the nearest western government medical centre .....
3. Other (specify) .....

2.27 Did you have a blood test done?
1. Yes ....
2. No- there were no blood films. ....
3. Other (specify) .....

2.27.1
If your answer for the above question is "YES", when did you receive the report of the blood test?
a. On the same day ....
b. I havn't seen it yet ....
c. After ... days by post ....
d. After ... days I went there and collected it ....
e. Other (specify) .....

2.28 Did you take all the drugs prescribed by the doctor or the person whom you visited?
1. Yes .....
2. No. I took them only for two days .....
3. No. I did not take the brown tablet (Primaquine) .....
4. Until now I have taken as prescribed .....
5. Other (specify) .....

2.29 If your answer for the above question is NO (i.e.,2 or 3), please explain why?
1. Because I had to recover the work lost due to illness, I stopped them soon after the dissspearnace of symptoms .....
2. Because the brown tablet brings up pains .....
3. Other (specify) .....

2.30 Were you recovered after treatment?
1. Yes .....
2. No .... Please go to question 2.32

2.31 How many days after beginning to take treatment from this place? .....
Now please go to question 2.33

2.32 Are you still taking treatment?
1. Yes .....
2. No .....
3. I am still taking the same drugs ....

2.33 Are you satisfied with the way you were treated at this place?
1. Very satisfied ....
2. Satisfied ....
3. Not satisfied ....
4. Other (Specify) .....

SECOND/THIRD/FOURTH/FIFTH VISITS FOR FORMAL SOURCES OF TREATMENT

Question	2nd visit	3rd visit	4th visit	5th visit
2.34 From where did you get treatment second/ third/ fourth/ fifth? 1. From a government western hospital as an inpatient				
2. From a government western clinic				
3. From a private western doctor				
4. From a government Ayurvedic doctor				
5. From a private Ayurvedic doctor				
6. From a government western doctor in private capacity				
7. From a Field Officer of the AMC				
8. From a Public Health Worker				
9. From a Volunteer of the AMC				
10.Other (specify)				
11.Not relevant				

Question	2nd visit	3rd visit	4th visit	5th visit
If the answer for the above question IS 1 or 2, please go to the following question. Otherwise skip to Question 2.36. 2.35 Why did you decide to take treatment from this place? Please go to Question 2.37. 1.It has blood testing facilities 2.It is the closest government western clinic/ hospital				
2.36 Please tell us why did you decide to take treatment from this source instead of going to a government western medical centre. 1.Because I could not bear the travel cost 2.Because it is so crowded 3.Because it is too far 4.Because I was too ill to go there 5.Because I new I had been infected malaria 6.Because government doctor pays more attention when you take private treatment 7.Other (specify)				
2.37 How many days after the onset of symptoms you took treatment from this source?				
2.38 Were you in the view that you had been infected malaria when you were making this visit ? (CODE YES=1,NO=0, NOT SURE=3)				

Question	2nd visit	3rd visit	4th visit	5th visit
2.39 If your second/ third/ fourth source of treatment was inpatient care at a government western hospital, please tell us how many days you were in that place.				
2.40 Did that doctor/ health personnel ask you take a blood test? (CODE YES=1, NO=0) If No Please go to Question 2.43				
2.41 From where? 1.From the same place 2.From the nearest government medical centre 3.Other (specify)				
2.42 Did you have a blood test done? 1.Yes 2.No-there were no blood films 3.Other (specify)				
2.42.1 If your answer for the above question is "YES", when did you receive the report the report of the blood test? a. On the same day .... b. I havn't seen it yet .... c. After ... days by post .... d. After ... days I went there and received .... e. Other (specify)				

Question	2nd visit	3rd visit	4th visit	5th visit
2.43 Did you take all the drugs prescribed by the doctor or the person whom you visited? 1. Yes 2. No. I took them only for two days 3. No. I did not take the brown tablet (Primaquine) 4. Until now I have taken them as prescribes 5. Other (specify)				
2.44 If your answer for the above question is NO (i.e.,2 or 3), please explain why? 1. Because I had to recover the work lost due to illness, I stopped them soon after the disappearance of symptoms 2. Because the brown tablet brings up pains 3. Other (specify)				
2.45 Were you fully recovered after treatment? (CODE YES=1, NO=0) If No Please go to Question 2.47				
2.46 How many days after beginning to take taking treatment from this place? Please go to 2.48				
2.47 Did you take treatment from the same or another source of treatment? 1. Yes 2. No 3. I'm still taking the same drugs				
2.48 Are you satisfied with the way you were treated at this place? 1. Very satisfied 2. Satisfied 3. Not satisfied 4. Other (Specify)				

2.49 How was it confirmed that you had been infected with malaria?

1. After taking a blood test at a government clinic .....
2. After taking a blood test at a private clinic ....
3. The consulted private western doctor told me .....
4. I know that it was malaria because I am familiar with the disease .....
5. Because I was recovered from anti-malaria drugs .....
6. It was not confirmed .....
7. Any other (specify).....

2.50 Did you take any self treatment at the same time as any prescribed treatment?

1. Yes. I continued taking self treatment which I started before seen a doctor .....
2. Yes. I continued taking some of self treatment which I started before seen a doctor .....
3. Only after seen a doctor I took some self treatment .....
4. Yes. I took self treatment which was not taken before seen the doctor .....
5. No .... Please go to Question 2.52

2.51 What type/s of self treatment did you take at the same time as prescribed treatment?

1. Panadol .....
2. Disprin/Asprin.....
3. Coriander.....
4. *Paspanguwa*.....
5. King coconut .....
6. Young coconut .....
7. Other (specify) .....

2.52 Did you take any ritual treatment for this illness?

1. Yes, while I was getting treatment from the source/s indicated above .....
2. Yes, after I was not recovered by taking treatment from the source/s indicated above .....
3. Any other (specify) .....
4. None. Please go to Question 2.54

2.53 What type/s of ritual treatment you have received.

1. .....
2. .....

INSTRUCTIONS TO THE FIELD INVESTIGATOR :

1. If the patient has made more than one visit, please fill a separate column for each visit FOLLOWING THE SAME SEQUENCE GIVEN IN THE ANSWERS TO THE PREVIOUS QUESTIONS.
2. Please draw a line through the box for irrelevant questions.
3. For questions 2.55 and 56, if the person/s referred is/are family member/s, please go back to Question 1.4 and indicate the respective INDIVIDUAL NUMBER/S under respective columns. If he/she/they, is a/are non-family member/s, please indicate it under the respective column by stating the relationship, e.g., friend/s, a friend and a relative, 1 or 2 relative/s etc.

Source of treatment / Question\ Item	Self treatment 1	Self treatment 2	Ritual treatment	1st formal visit	2nd formal vist	3rd formal visit	4th formal visit	5th formal visit
2.54 Distance to the treatment place/pharmacy (including self treatment) in miles/km								
2.55 Who went to the pharmacy / shop to purchase drugs,. items for ritual treatment etc., (for self treatment only)				N.R.	N.R.	N.R.	N.R.	N.R.
2.56 Who accompanied you to go to the treatment place?	N.R.	N.R.						
2.57 Travel time: (in hours and minutes) a. To go to the place of teatment/pharmacy/ shop								
b. From the place of treatment/pharmacy/shop								
c. Normal time								

N.R.= Not relevant

Source of treatment / Question\ Item	Self treatment 1	Self treatment 2	Ritual treatment	1st formal visit	2nd formal vist	3rd formal visit	4th formal visit	5th formal visit
2.58 Waiting time (Mins.): a.Before seeing the doctor	N.R.	N.R.	N.R.					
b.At the doctor								
c.To get a blood slide								
d.To receive the report of the blood test (in days for (a) public clinics where microscopists are not available and b) private clinics which take blood slides and send them to a private laboratory)								
e.At the pharmacy of the clinic								
f.At the private pharmacy								
2.59 Travel cost (Rs.): a.For the patient	N.R.	N.R.	N.R.					
b.For the accompanying person/s								
c.For the person who went to the pharmacy								

N.R.= Not relevant

Source of treatment / Question\ Item	Self treatment 1	Self treatment 2	Ritual treatment	1st formal visit	2nd formal vist	3rd formal visit	4th formal visit	5th formal visit
2.60 Cost of treatment (Rs.): a. Consultation fee	N.R.	N.R.	N.R.					
b. Prescribed drugs								
c. Consultation fee and drugs (for private doctors)								
d. Medical tests								
e. Above c and d								
2.61 How much did you spend for the following? a. Ritual treatment				N.R.	N.R.	N.R.	N.R.	N.R.
b. Self treatment								
c. Any other spending related to treatment:								
- Vitamins								
- Nutritional food								
- Special food								
- Other (specify)								

N.R.= Not relevant

INSTRUCTIONS TO THE FIELD INVESTIGATOR: Following questions are related to the episode of malaria reported in the preceding pages.

2.62 Do you feel completely well now?
1. Yes .....
2. No ....

2.63 How many days were you completely disabled due to illness? (Completely disabled means your inability to engage in any of your normal activities.) .....

2.64 How many days were you partly disabled due to illness? (Partly disabled means your inability to engage in some of your normal activities.) .....

2.65 How did you spend your time while you were completely disabled? .....

2.66 How did you spend your time while you were partly disabled? .....

INSTRUCTIONS TO THE FIELD INVESTIGATOR: For children, who normally do not help parents in their economic activities (i.e.,income earning activities), please select "not applicable" in answering the following question.

2.67 How did your family recover the work lost due to your illness?
1. By hiring people
2. Relatives and/or friends helped - Please go to Question 2.70
3. A welfare/farmers' society in the village helped Please go to Question 2.70
4. Above 1 and 2
5. Above 1 and 3
6. We could not hire any person Please go to Question 2.72
7. Not applicable .... Please go to Question 2.72
8. Other (specify)

2.68 How many persons were hired and for how many days?
1.No. of days:.....X....days = ...

2.69 How much did your family pay for them?

2.70 Did your family provide food and/or any other incentives for them?
1. Yes
2. No Please go to Question 2.72

2.71 How much did they cost?

2.72 In addition to hiring people to recover the work lost (IF ANY) did you and your family members suffer any income/ output loss due to your illness?
1.Yes
2.No

2.73 If your answer for the above question is YES, please assess it by filling the following block?

Serial no.	Individual no.	How income lost?	Approximate amount (Rs.)
Example	4	Could not go to work for two days	Rs.150

2.74 Do you think your disability due to illness would have some adverse effect on your next harvest?

1. Yes
2. No Please go to Form 3
3. Not applicable Please go to Form 3

2.75 Please explain how.

Now please go to Form 3

FORM 4

INSTRUCTIONS TO THE FIELD INVESTIGATOR:

In filling this form please do not ask the questions directly from the household members as it was explained in the training programme. Please follow the instructions given to you in the training programme and try to get the most appropriate answer for each item. Please take down notes in your notebook and fill the form after the interview. (Please leave the Serial no. blank).

Individual number (Ref. 1.4)						
Serial number (Ref.1.3)						
SOURCE OF INCOME						
4.1 a. As a permanent salary earning employee b. As a temporary employee (last month)						
4.2 Agricultural income						
a. Paddy (last year)						
Total product (Bushels)						
Self consumption (Bushels)						
Gross income (Rs.)						
Less expenditure (Rs.)						
Net income (Rs.)						
Average income per month (Rs.)						
b. Type..... Total annual income (last year)						
Less expenditure						
Net income						
Average income per month						
c. Type..... Total annual income (last year)						
Less expenditure						
Net income						
Average income per month						

d. Type..... Total annual income (last year)						
Less expenditure						
Net income						
Average income per month						
Average agricultural income per month						
4.3 Business income						
a. Type..... Total net income per month/year (last month/year)						
b. Type..... Total net income per month/year (last month/year)						
c. Type..... Total net income per month/year (last month/year)						
d. Type..... Total net income per month/year (last month/year)						
Average business income per month						
4.4 TOTAL EARNINGS						
4.5 Non monetary income (average per month)						
4.6 Transfer income a. Private* b. Government** c. Transfer payment (-)						
4.7 TOTAL INCOME PER MONTH						

* including remittances of the family members/ friends work aborad (e.g., those who work in the Middle East)

** Food stamps, Janasaviya (payments of the poverty alleviation programme)

FORM 3

KNOWLEDGE, ATTITUDES, PERCEPTIONS AND PREVENTIVE CARE

3.1 How frequently do the AMC workers come to your area to for spraying?
1. Once in three months 2. .....

3.2 When did they visit your house/ area last? .....

3.3 Did they spray your house at that time?
1. No ..... Please go to BLOCK A
2. Partially ..... Please go to BLOCK B
3. Completely ..... Please go to BLOCK C

BLOCK A: REFUSALS

3.4 Why was your house not sprayed?
1. We asked them not to spray ....
2. We avoided them by closing down the house and going out ....
3. We were not at home, they had gone without spraying ...
4. Other (specify) ...

3.5 Was this the first time you refused/ missed spraying?
1. Yes ....
2. No. We allow them to spray only one time in a year. That is the mosquito season. .....
3. No. We allow them to spray only one time in a year. That is the malaria season. .....
4. We allow them to spray only in the off harvest season. ....
5. Other (specify) .....

3.6 Why did you refuse or avoid/ miss spraying at this time?
1. Because it does not reduce malaria
2. Because it does not reduce mosquitos
3. .....
4. .....

Please go to Question 3.17

BLOCK B: PARTIAL ACCEPTANCE

3.7 Is that the normal practice of your family to allow for partial spraying?
1. Yes. .....
2. No. We allow them to do so in the off malaria season. .....
3. No. We allow them to do so in the off mosquito season. .....
4. We allow them to do so in the harvest season. .....
5. Other (specify) .....

3.8 Why did you allow them to spray your house partially at this time?
1. Because it was announced by the AMC that those who refuse spraying would be prosecuted
2. Because malaria had not been spread at that time
3. Other (specify)

3.9 What are the benefits of partial spraying?
1. No apparent benefits 2. .....
3. ..... 4. .....

3.10 Did any of your family members have to spend any time to facilitate spraying?
1. Yes. To close down windows, doors etc. .....
2. Yes. To cover furniture etc. .....
3. Yes. To cover food. .....
4. Other (specify) .....
5. No. .....

Now please go to Question 3.15

BLOCK C: COMPLETE ACCEPTANCE

3.11 Is that the normal practice of your family to allow for complete spraying?
1. Yes. ....
2. No. We allow them to do so only in the malaria season. ....
3. No. We allow them to do so only in the mosquito season. ....
4. We allow them to do it only in the off harvest season. ....
5. Other (specify). .....

3.12 Why did you allow them to spray your house completely at this time?
1. Because this is the malaria season. .....
2. Because this is the mosquito season. .....
3. Because this is the off harvest season. .....
4. Because it was announced by the AMC that those who refuse spraying would be prosecuted. .....
5. Because the sprayers explained the benefits of spraying. ....
6. Because we know it will reduce mosquitos. ....
7. Other (specify. .....

3.13 What are the benefits of complete spraying?
1. It reduces mosquitoes. .....
2. It reduces other insects. .....
3. Although we allow them to spray, it does not help much to reduce malaria. .....
4. Other (specify). .....

3.14 Did any of your family members have to spend any time to facilitate spraying?
1. Yes. To close food items. ....
2. Yes. To remove furniture. ....
3. Other (specify). .....
4. No. ....

Questions 3.15 and 3.16:
Please answer the following two questions related to your answer for the previous question (either 3.10 or 3.14).

Serial no.	Individual no.	How long did it take to facilitate spraying (partially or completely)? 3.15	If the sprayers had not come on that day, what would he/ she/ they probably have been doing? 3.16
....	....	....	....

3.16 Did you rub off the residuals ?
1. Yes. Only door and windows were cleaned. ....
2. No. .....
3. Other (specify). .....

3.17 When did you rub them off ? .....

BURNING LEAVES / HUSKS

3.17 Do you have the practice of burning leaves/ husks?
1. Yes. ....
2. No. ..... Please go to Question 3.22

3.18 Why do you burn them?
1. To get rid of mosquitos nuisance. ....
2. To get rid of malaria. ....
3. To avoid biting insects. ....
4. To reduce insects. ....
5. Other (specify). .....

3.19 What type/kind are they?
1. Maduruthala leaves (*Ocimum sanitum*). ....
2. Kohomba leaves. (*Azadirachta indica*). ....
3. Tyres. ....
4. Coconut husks. ....
5. Other (specify). .....

3.20 How frequently you used them during the last year?
1. At some evenings in the mosquito season. ....
2. Once a week in the malaria season. ....
3. Everyday in the malaria season. ....
4. Everyday in the mosquito season. ....
5. Other (specify). .....

3.21 How much did you spend for them during the last year? .....

REPELLENTS

3.22 Do you have the practice of using repellents?
1. Yes .....
2. No ..... Please go to Question 3.27.

3.23 What type/kind are they?
1. Mosquito coils. .... 2. Body lotion. ....
3. Other (specify) .....

3.24 Why do you use repellents?
1. To get rid of mosquitos nuisance. ....
2. To get rid of malaria. ....
3. To avoid biting insects. ....
4. To reduce insects. ....
5. Other (specify). .....

3.25 How frequently you used them during the last year?
1. At some evenings in the mosquito season. ....
2. Once a week in the malaria season. ....
3. Everyday in the malaria season. ....
4. Everyday in the mosquito season. ....
5. Other (specify). .....

3.26 How much did you spend for them during the last year ? .....

PROPHYLAXIS

3.27 Do you know about prophylaxis (*Sathi peththa*)?
1. Yes ..... 2. No ..... Please go to Question 3.34

3.28 Does any member in your household have a practice of taking prophylaxis?
1. Yes. ....
2. No. ..... Please go to Question 3.34

3.29 Particulars of the household members who used prophylaxis		How was it taken ? 3.30	Who suggested/ prescribed to take it ? 3.31	From where it was obtained? 3.32	How much spent for it during the last year ? 3.33
Serial No.	Individual No.				
....	....	....	....	....	....

MOSQUITO NETS

3.34 Do your household members have the practice of using mosquito nets?
1. Yes .... Please go to Question 3.36.
2. No .....

3.35 Why don't you use mosquito nets in your house?
1. Cannot afford. .....
2. Since they are useful only in the mosquito season
3. Other (specify) .....

Now please go to Question 3.45.

3.36 How many mosquito nets are used in your house?

3.37 Who use them regularly ?
1. Children only. 2. Other (specify) .....

INSTRUCTIONS TO THE FIELD INVESTIGATOR: If the number of mosquito nets in the house does not seem to be sufficient for all the household members, as indicated in the answers to Question 3.36 and 3.37, please ask the following question.

3.38 Please explain why do some members of your household appear to be not using mosquito nets ?
1. We can manage by sharing it/them among ourselves. ....
2. Can not afford them for all family members. ....
3. Other (specify) .....

3.39 How frequently your family members use them?
1. Every day. .....
2. Every day in the malaria season. .....
3. Every day in the mosquito season. .....
4. Other (specify) .....

3.40 Who slept inside a mosquito net during the last night?
Please indicate Individual numbers.

3.41 Please explain why do you use mosquito nets?
1. ..... 2. .....
3. .....

3.42 When did you buy each of your mosquito nets?

1.	2.	3.	4.	5.
6.	7.	8.	9.	10.

3.43 How much did you pay for each of them?

1.	2.	3.	4.	5.
6.	7.	8.	9.	10.

3.44 How long could each mosquito net be used?

1.	2.	3.	4.	5.
6.	7.	8.	9.	10.

3.45 Do any of your family members have the practice to sleep outside the house?
1. Yes ....
2. No ..... Please go to the Question 3.47

3.46 Who are they?
Please indicate Individual numbers.

3.46 According to your experience what would be the most effective malaria control measures for your area? Please order them.

1. ..... 2. .....
3. ..... 4. .....
5. .....

APPENDIX 5 : Sampling method

Based on the information provided by the AMC, Matale district was initially divided into two zones as malarious and non-malarious. Table 5AP.1 shows the number and percentage of population in each HA in the malarious zone[1]. Instead of selecting a separate sample for each HA, which makes the sampling procedure a stratified sampling, the number of clusters for the sample was selected by treating the malarious zone as a whole. One purpose of using this method was to avoid complications in analysing the data produced by stratified sampling. Some practical difficulties were also taken into consideration in deciding the sampling method; a stratified sampling method would lead the selection of a relatively large number of GNDs from the two low endemic HAs (i.e., Matale and Rattota) than the number of GNDs selected by using a non-stratified method[2]. On the one hand, time and resource constraints did not allow to cover such a vast area for the study. On the other hand, undertaking the data analysis at each HA level was not a prime concern of the study; thus, the sampling method was selected to get only a representative sample of the total population of the malarious zone with a sufficient level of precision. In deciding the number of clusters it was assumed that 100 persons would be interviewed from each GND making the number of HH units interviewed in each cluster equal to 20. The underlying assumption was that each HH unit, on the average, had five members. The reported national family size was 4.81. According to a recent study (Gunathilake et al 1988), it was 5.32 in Matale district. But selection of the sample for that study was purposively done by giving high a weight for poor families. That study found that the family size of poorer sections was higher than others. Having considered all these facts it was decided that five would be the most appropriate assumption on family size for the study area.

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[1] Until 1991, AMC figures for the district were presented with respect to four HAs. By the time of undertaking the household survey, the district had been divided into 11 HAs but it was still in the transition process; no DDHSs had been appointed to some HAs such as Hettipola and Ambanganga Korale.

[2] This problem comes up due to the need to attain a proper representativeness in each HA and, hence, a significant level of precision in relation to the standard error.

Table 5AP.1: Population and the API of the HAs in the malarious zone in Matale district, 1991

Health Area*	Population in the malarious zone**	API***
1. Matale	38,838 (21.38)	91.66 (19.60)
2. Dambulla	89,424 (82.91)	283.65 (235.16)
3. Naula	63,466 (99.39)	133.25 (132.44)
4. Rattota	18,197 (25.05)	41.44 (10.46)
Total	209,926 (49.28)	181.69 (89.54)

* Matale is the administrative capital of Matale district. The area around the city of Matale is considered as a separate HA called Matale. Other HAs are also named by the leading town in each HA.

** Within parentheses are percentages of the total population of the respective HA.

*** API was measured by taking the population in the malarious zone alone in each HA as the denominator. Within parentheses are the APIs calculated by taking the total population in each HA as the denominator (Table 3A.3).

Source:DAMC

It was also assumed that the variability of API between clusters was low compared to the variations within clusters. Thus the parameter *roh* of the sample formulae, which determined *the design effect* (please see below) was made equal to 0.02. In deciding the size of *roh*, instead of endemicity, socio-economic characteristics of the sample population were taken into consideration since the HHS had multiple objectives. Further, in calculating the sample size, the API for the malarious zone for 1991 was calculated by taking the population in the malarious zone alone as the denominator. The resulting API for the malarious zone was 181.69 and 89.54 for the whole district (Table 5AP.1).

In making the sample size, it was essential to make a reasonable assumption on P or the proportion of malaria cases in the study population. P can simply be computed from the API; but, the API was related to the cases detected by the AMC alone. In that way, the value of P derived directly from the API could be an underestimation because it did not account fôr the cases which were not detected through AMC channels. Therefor, some wight should have been given to the non-reported cases in deriving the value of P from the API figure in Table 5AP.1. On the other hand, the non-malarious zone is not entirely free of the disease (personal communication with the RMO of the district); cases were reported from that zone as well, but at a low level.

The general presumption is that about 50 percent of all outpatient visits in the island are made to sources other than public MCs. In the case of malaria, however, this percentage could be different due to the non-availability of laboratory facilities (for blood testing) for private practitioners in many rural areas. But there was no evidence available as what percentage of malaria patients stake treatment from sources other than public MCs. Moreover, some public MCs in malarious zone also do not have even blood filming facilities. Therefore, without making any adjustment, the API in Table 5AP.1 was taken as the P in deciding the sample size with the probable implication of that even if the real API was higher than this number, the calculated sample size would be larger than the required size; but not the other way round. Thus, an issue of under representation of the sample would certainly not arise.

The following formulae was used to estimate the number of clusters for the sample:

$$C = P\,(1-P)D \,/\, s^2 b$$

where C = number of clusters selected

b = number of responses from each cluster (100)

P = proportion of malaria cases in the malarious zone (0.18169)

s = standard error (5% of P), and

D = design effect.

Design effect was calculated by using the formula:

$$D = 1+(b-1)\ roh$$

The resulting number of clusters was 54 which made the sample size equal to 1080 HH units and about 5500 respondents. The 54 clusters were distributed among the GNDs in the malarious zone by using the *probability proportional to size (PPS)* method (Bennett et al 1991). It was expected that the clusters would be distributed among the four HAs giving high weight to the two highly malarious HAs because of their relatively high population shares.

APPENDIX TABLES

Table 1A.1: Incidence of Malaria in Sri Lanka, 1960-1992

Year	No.of Blood films examined	Total Positive
1960	n.a.	422
1963	n.a.	17
1965	n.a.	308
1970	1,541,570	468,197
1972	1,545,699	132,604
1974	1,423,010	315,448
1976	1,400,416	301,946
1978	968,327	69,685
1980	803,692	47,383
1981	892,143	38,566
1982	1,127,605	127,264
1983	1,055,626	149,470
1984	859,178	149,470
1985	1,165,698	117,816
1986	1,496,737	412,521
1987*	1,952,739	676,769
1988	1.332,846	383,294
1989	1,124,400	258,727
1990	1,175,123	279,172
1991	1,398,002	400,263
1992	1,558,600	399,349

* Excludes Northern and Eastern provinces.
Source: Anti-Malaria Campaign

Table 1A.2: LEADING CAUSES OF HOSPITALIZATION BY DISTRICTS - 1992

Disease and ICD Code Numbers / District and Rank Order		SRI LANKA	Colombo	Gampaha	Kalutara	Kandy	Matale	Nuwara Eliya	Galle	Matara	Hambantota	Jaffna	Mannar, Vavuniya Mullaitivu	Batticaloa	Ampara	Trincomalee	Kurunegala	Puttalam	Anuradhapura	Polonnaruwa	Badulla	Moneragala	Ratnapura	Kegalle
Diseases of the respiratory system excluding diseases of the upper respiratory tract, pneumonia, bronchopneumonia and influenza.	(446, 490-519)	1	2	2	2	1	2	1	1	1	1	2	2	1	2	1	1	2	2	1	1	2	1	3
Traumatic injuries	(800-904, 930-939, 950-957)	2	3	1	1	3	1	2	2	2	2	1	3	2	3	2	3	4	3	2	2	4	2	1
Signs, symptoms and ill-defined conditions	(780-799)	3	1	3	4	2	3	4	3	3	3	3	5	7	4	3	5	5	4	3	4	3	3	2
Intestinal infectious diseases	(001-009)	4	4	5	5	4	5	3	4	4	4	4	4	6	1	5	4	1	5	6	3	5	4	4
Malaria	(084)	5					4				7	5	1	3	6	4	2	3	1	4	9	1	5	5
Diseases of the musculoskeletal system	(710-739)	6	9	4	6	8	9	5	6	6	5	9	9	4		6	9	8	6	7	5	8	6	7
Viral diseases	(045-079)	7	10	8	8	5	6	6	5	8	6	8	7		9	7	6	7		9	6	6	7	6
Diseases of the gastro-intestinal tract	(530-579)	8	6	7	7	6	10	7	9	9		7	8	5	8	8	8	10	8	5	7		8	8
Diseases of skin and subcutaneous tissue	(680-709)	9	7	9	3	7		9	7		8	6	6		10	9	10	9		8	8			
Other injuries and early complications of trauma	(910-925, 958-959, 990-995)	10		6	10			8	8	5						10	7	6	9					10
Diseases of the urinary system	(580-599)			10	9				10					9	7				10		10	10	9	
Diseases of the female genital organs	(610-629)		5																					
Anaemias	(280-285)					9																9		
Direct and indirect obstetric causes	(640-648, 651-676)		8			10	8			10		10		10										
Diseases of the upper respiratory tract	(460-465, 470-478)						7	10			10		10		5				7	10		7		9
Abortions	(630-639)									7	9													
Diseases of the eye and adnexa	(360-379)													8										
Influenza	(487)																						10	

Excludes normal delivery and those admitted and discharged before delivery.

Source: Medical Statistics Unit.

Table 1A.3: LEADING CAUSES OF HOSPITAL DEATHS BY DISTRICTS 1992

Disease and ICD Code Numbers / District and Rank Order	SRI LANKA	Colombo	Gampaha	Kalutara	Kandy	Matale	N'Eliya	Galle	Matara	Hambantota	Jaffna	Mannar, Vavuniya, Mullaitivu	Batticaloa	Ampara	Trincomalee	Kurunegala	Puttalam	Anuradhapura	Polonnaruwa	Badulla	Moneragala	Ratnapura	Kegalle
Ischaemic heart disease (410-414)	1	2	1	1	2	2	4	1	5	4	2	2	4	1	1	1	2	2	2	4	2	2	2
Cerebrovascular disease (430-438)	2	1	2	2	3	3	3	2	1	2	10			6		3	3	4	9	3		3	1
Diseases of the pulmonary circulation and other forms of heart disease (415-429)	3	3	4	3	6	4	2	4	10	5	4	5	3		4	5	10			8	4	5	
Pesticide Poisoning (989.2-989.4)	4		5	5		1	1	5		1		1		2	2	2	4	1	1	1	1	1	
Diseases of the gastro-intestinal tract (530-579)	5	4	3	8	6						6	3	5	6		5	6			7			7
Diseases of the respiratory system excluding the diseases of upper respiratory tract pneumonia bronchopneumonia and influenza (466, 490-519)	6	6	7	10	4	5	5	7	6	7	7	6	7		3			9	10	5	3	6	
Other bacterial diseases (020-041)	7	7	6	4		9	7	10	9		1				7	9	9	5		2		10	9
Traumatic injuries (800-904, 930-939, 950-957)	8	5	9						3		3	6	1	3					5	10	5		
Pneumonia and bronchopneumonia (480-486)	9	9	9	6	9	6	8							3	7	10	7	6	4	6	7		6
Signs, symptoms and ill-defined conditions (780-799)	10				5		10		4	8		10	8					3	7		10	4	3
Malignant neoplasms (140-208, 230-234)		8			1	6		6						3									
Slow fetal growth, fetal malnutrition and immaturity (764-765)			8				6	8	7		4	6	6		5	4	1	10	5			7	8
Diseases of the urinary system (589-599)		10																	8				
Other conditions originating in the perinatal period (760-783, 766-779)				7			9	8	8			4				7	5	7					10
Poisoning and toxic effects other than pesticide poisoning (960-979 989.5-989.9, 980-989.1)				9					2	3			2	6		8					6	8	4
Hypertensive disease (401-405)					8			3					9		6			8	3		10	9	
Diseases of the nervous system (320-359)					10						8				9					9	10		
Tuberculosis (010-018)						8				9												10	
Intestinal infectious diseases (001-009)						9				6	9	6					7				9		5
Snake bites (E.905.0)										9				6									
Anaemias (280-285)													10								10		
Nutritional deficiencies (260-269)														6									
Diabetis mellitus (250)															9								
Malaria (084)																					7		

Source: Medical Statistics Unit

Table 1A.4: Malaria morbidity in Sri Lanka in 1991 by district

District	Population	Total blood films examined	Total positives	SPR	API	ABER
Matale	426,000	114,633	38,142	33.27	89.54	26.91
Colombo	1,960,000	50,382	1,913	3.80	0.98	2.57
Gampaha	1,548,000	21,944	4,132	18.83	2.67	1.42
Kaluthara	950,000	661	125	18.91	0.13	0.07
Kandy	1,110,000	35,941	4,011	11.16	3.61	3.24
Nuwaraeliya	725,000	5,367	421	7.84	0.58	0.74
Anuradhapura	706,000	158,154	47,857	30.26	67.79	22.40
Polonnaruwa	314,000	71,356	20,462	28.68	65.17	22.72
Galle	936,000	4,771	398	8.34	0.43	0.51
Matara	769,000	10,667	1,747	16.38	2.27	1.39
Hambanthota	512,000	66,076	10,761	16.29	21.02	12.91
Jaffna	982,000	73,964	18,040	24.39	18.37	7.53
Vauniya	338,000	n.a.	n.a.	n.a.	n.a.	n.a.
Batticaloa	412,000	58,753	10,737	18.27	26.06	14.26
Ampara	476,000	54,984	9,240	16.80	19.41	11.55
Trincomalee	312,000	22,616	9,939	43.95	31.86	7.25
Kurunegala	1,426,000	307,681	106,433	34.59	74.64	21.58
Puttalam	596,000	114,758	49,391	43.04	82.87	19.25
Badulla	724,000	34,396	3,715	10.80	5.13	4.75
Monaragala	356,000	72,917	25,652	35.18	72.06	20.48
Ratnapura	936,000	74,613	24,396	32.70	26.06	7.97
Kegalle	762,000	43,368	12,751	29.40	16.73	5.69
Total	17,276,000	1,398,002	400,263	28.63	23.17	8.09

Source:DAMC

Table 3A.1: The seven highly malarious districts in Sri Lanka,1989,1990 and 1991

District	1989 API	1989 Rank	1990 API	1990 Rank	1991 API	1991 Rank
1. Matale	45.50	5	67.10	1	89.54	1
2. Puttalam	25.90	7	61.60	3	82.87	2
3. Kurunegala	33.70	6	52.59	5	74.63	3
4. Monaragala	74.10	1	58.11	4	72.06	4
5. Anuradhapura	61.70	2	65.56	2	67.79	5
6. Polonnaruwa	64.20	3	45.90	6	65.17	6
7. Trincomalee	7.20	7<	1.10	7<	31.86	7
8. Hambantota	59.90	4	17.80	7	21.02	7<

Source: DAMC

Table 3A.2: The ten highly malarious health areas in Sri Lanka by district,1989,1990 and 1991

Health Area	1989 API	1989 Rank	1990 API	1990 Rank	1991 API	1991 Rank	District
1. Dambulla	94.50	4	165.02	1	235.16	1	Matale
2. Maho	45.40	10<	135.60	2	174.34	2	Kurunegala
3. Puttalam	53.90	9	123.50	3	138.94	3	Puttalam
4. Naula	79.70	7	76.40	8	132.44	4	Matale
5. Gokarella	46.60	10<	73.10	10	115.91	5	Kurunegala
6. Kilinochchi	19.10	10<	25.50	10<	111.48	6	Jaffna
7. Nikeweratiya	27.80	10<	79.80	7	110.86	7	Kurunegala
8. Galgamuwa	56.40	8	123.10	4	95.84	8	Kurunegala
9. Monaragala	122.00	1	73.80	9	86.16	9	Monaragala
10. Kakirawa	50.90	10<	109.70	6	85.58	10	Anuradhapura
11. Polonnaruwa	112.80	2	58.70	10<	61.68	10<	Polonnaruwa
12. Hambantota	111.70	3	6.70	10<	10.50	10<	Hambanatota
13. Anuradhapura	89.90	5	113.70	5	46.00	10<	Anuradhapura
14. Mahiyanganaya	82.30	6	43.70	10<	15.26	10<	Badulla
15. Walasmulla	51.50	10	15.70	10<	29.08	10<	Hambanatota
16. Tissamaharama*		10<	47.07	10<	46.40	10<	Hambanatota

Note: 10 < indicates that the rank of these HAs were above 10 in the respective year

* In 1989 this HA area was under Hambantota Health Area

Source: DAMC

Table 3A.3: Basic morbidity figures of highly malarious districts in Sri Lanka, 1989,1990 and 1991

District/Health Area	Population 1991	Number of blood films examined			Slide positivity rate			Annual parasite incidence rate		
		1989	1990	1991	1989	1990	1991	1989	1990	1991
1.MATALE										
Matale	181,647	11,152	8,836	15,228	12.40	14.00	23.38	8.40	7.50	19.60
Dambulla	107,863	51,244	60,932	73,109	24.40	35.83	34.69	94.50	165.02	235.16
Rattota	72,633	2,836	3,349	3,127	8.40	10.99	24.30	3.90	6.02	10.46
Naula	63,857	19,432	16,272	23,169	25.90	29.66	36.50	79.70	76.40	132.44
District Total	426,000	84,664	89,389	114,633	22.60	31.62	33.27	45.50	67.10	89.54
2.PUTTALAM										
Puttalam	223,977	44,562	65,061	69,952	28.60	41.84	44.49	53.90	123.50	138.94
Maravila	103,346	8,949	9,428	9,878	6.80	18.02	34.64	5.40	16.60	33.11
Chilaw	151,265	11,689	18,114	26,562	22.90	31.59	42.91	16.50	36.10	75.34
Dankotuwa	117,412	3,793	6,045	8,366	10.50	27.01	41.51	3.10	14.10	29.58
District Total	596,000	68,993	98,648	114,758	23.10	36.77	43.04	25.90	61.60	82.87
3.KURUNEGALA										
Kurunegala	141,317	23,632	24,647	36,940	25.04	18.97	29.09	41.70	32.90	76.05
Kuliyapitiya	110,658	10,912	12,040	15,692	14.90	14.67	26.51	14.70	16.03	37.59
Maho	73,582	11,107	23,466	28,589	29.90	42.23	44.87	45.40	135.60	174.34
Wariyapola	99,820	7,929	10,486	8,142	18.40	25.41	33.49	15.20	27.70	27.32
Gokarella	176,682	45,471	53,573	61,600	20.20	26.92	33.25	46.60	73.10	115.91
Polgahawela	106,522	26,540	28,365	22,491	20.60	14.21	20.97	51.40	38.10	44.28
Bingiriya	98,964	8,751	13,689	14,162	23.80	31.40	47.25	21.00	43.40	67.62
Pannala	109,659	10,348	13,159	17,113	18.10	17.94	30.12	17.30	21.80	47.00
Panduwasnuwara	84,704	7,019	14,005	17,583	11.80	17.74	31.90	10.10	30.10	66.25
Mawathagama	136,986	19,277	22,031	23,180	26.90	21.75	39.48	46.70	43.10	66.81
Narammala	75,435	7,276	9,060	8,135	24.30	17.76	27.92	23.40	21.40	30.11
Galgamuwa	105,381	24,355	38,612	30,224	23.90	33.21	33.42	56.40	123.10	95.84
Nikaweratiya	106,380	7,936	19,575	23,820	36.40	42.46	49.51	27.80	79.80	110.86
District Total	1,426,090	210,553	282,708	307,681	22.50	26.23	34.59	33.70	52.59	74.63
4.MONARAGALA										
Monaragala	146,316	47,168	34,302	37,423	47.20	31.06	33.69	82.30	73.80	86.16
Bibile	63,368	5,788	6,016	7,479	34.70	25.05	25.22	122.00	23.90	29.76
Wellawaya	146,316	17,744	26,948	28,015	36.40	30.78	39.83	31.90	57.40	76.27
District Total	356,000	70,700	67,266	72,917	36.80	30.41	35.18	74.10	58.11	72.06
5.POLONNARUWA										
Polonnruwa	138,474	39,329	29,129	32,520	38.40	27.09	26.28	112.80	58.70	61.72
Hingurakgoda	175,526	22,607	22,815	38,836	27.10	27.71	30.68	27.10	36.04	67.88
District Total	314,000	61,936	51,944	71,356	32.10	27.37	28.68	64.20	45.90	65.17
6.ANURADHAPURA										
Kahatagasdigiliya	134,140	22,509	13,323	14,252	28.20	17.33	29.29	47.80	27.80	31.12
Kekirawa	186,384	56,545	57,607	42,680	32.40	35.10	37.37	50.90	109.70	85.58
Anuradhapura	385,476	81,913	87,570	101,222	22.40	26.53	27.40	89.90	113.70	71.94
District Total	706,000	160,967	158,500	158,154	26.70	28.87	30.26	61.70	65.56	67.79
7.HAMBANTOTA										
Hambantota	128,973	73,149	12,476	12,252	31.30	11.07	11.05	111.70	6.70	10.50
Walasmulla	81,664	11,806	5,652	9,522	35.30	22.59	24.94	51.50	15.70	29.08
Tangalle	108,749	12,850	10,804	11,891	14.50	5.69	7.81	21.90	1.10	8.54
Katuwana	63,795	1,707	4,999	6,920	47.00	34.23	36.36	10.40	22.20	39.44
Tissamaharama*	70,451	n.a.	22,544	22,038	n.a.	14.71	14.83	n.a.	47.07	46.40
Beliatta	58,368	1,835	3,683	3,453	27.30	16.94	9.21	8.80	10.90	5.45
District Total	512,000	101,347	60,158	66,076	29.80	14.83	16.29	59.90	17.80	21.02

* In 1989 this health area was coming under Hambantota Health Area

n.a.= not available

Source: DAMC

Table 3A.4: Proportions of P.vivax. P.falciparum and mixed cases in Sri Lanka in 1991 by district

	District	p.v	p.f	mixed
1.	Trincomalee	98.75	1.24	0.01
2.	Kegalle	93.68	6.04	0.28
3.	Kaluthara	93.60	6.40	0.00
4.	Batticaloa	93.52	4.15	2.33
5.	Jaffna	91.11	8.84	0.05
6.	Polonnaruwa*	90.26	9.68	0.06
7.	Ampara	88.38	11.32	0.30
8.	Matara	89.01	10.99	0.00
9.	Gampaha	95.62	4.26	0.12
10.	Monaragala*	89.09	10.80	0.11
11.	Nuwaraeliya	84.56	15.44	0.00
12.	Colombo	84.00	14.27	1.73
13.	Kandy	82.05	17.70	0.25
14.	Badulla	81.57	18.38	0.05
15.	Galle	80.15	19.35	0.50
16.	Puttalam*	79.79	20.06	0.15
17.	Anuradhapura*	79.74	19.61	0.65
18.	Kurunegala*	76.59	23.23	0.18
19.	Ratnapura	75.12	24.70	0.18
20	Matale*	72.41	27.31	0.28
21	Hambantota*	62.55	37.29	0.16
	ISLAND	80.88	18.83	0.29

* These districts were coming under the first seven highly malarious districts in 1989, 1990 and 1991; exceptions were Trincomalee and Hambantota. For details see Table 3A.3

Source: DAMC

Table 3A.5: Distribution of medical facilities in Matale district by health area, 1991*

Health Area	Western government MCs	Western private doctors	Ayurvedic government doctors	Ayurvedic private doctors	Total no. of MCs	As a % from total MCs
Galewela	5	4 (11.11)	1 (5.26)	5 (11.36)	15	11.54
Dambulla	4	1 (2.78)	1 (5.26)	5 (11.36)	11	8.46
Laggala-Pallegama	3	0 (0.00)	0 (0.00)	1 (2.27)	4	3.08
Naula	3	0 (0.00)	1 (5.26)	2 (4.55)	6	4.62
Wilgamuwa	3	2 (5.56)	0 (0.00)	4 (9.09)	9	6.92
Ambanganga Korale	2	1 (2.78)	0 (0.00)	0 (0.00)	3	2.31
Yatawatta	2	3 (8.33)	0 (0.00)	3 (6.82)	8	6.15
Pallepola	1	3 (8.33)	8 (42.11)	2 (4.55)	14	10.77
Rattota	2	7 (19.44)	2 (10.53)	6 (13.64)	17	13.08
Matale	2	14 (38.89)	5 (26.32)	15 (34.09)	36	27.69
Ukuwela	4	1 (2.78)	1 (5.26)	1 (2.27)	7	5.38
District	31	36	19	44	130	100.00

* Within parentheses are percentages from district total

Source: Statistical Abstract, Matale District,1991, Statistical Branch, District Secretariat, Matale

Table 4A.1: Total expenditure through decentralized budget on health care services in Matale District in 1992 by project/programme

	Programme/Project	Personnel emoluments	Travelling	Supplies	Repair & maintenance	Transport & other	Total	Percentage
	RECURRENT EXPENDITURE							
1.	Central and regional administration	2,324,391	646,202	429,837	214,222	270,164	3,884,816	4.88
2.	Patient Care Services							
a.	Maintenance of Base Hospitals	19,125,538	150,445	5,599,839	29,196	3,998,007	28,903,024	36.34
b.	Maintenance of District Hospitals	7,162,419	153,066	3,597,960	91,763	719,271	11,724,479	14.74
c.	Peripheral Units and Rural Hospitals	6,601,040	139,873	2,488,653	17,700	269,857	9,517,123	11.96
d.	Central Dispensaries/ Maternity Homes	2,347,152	132,260	349,197	3,702	120,061	2,952,372	3.71
e.	Chest Clinics/ Special Hospitals	202,366	13,745	646	0	0	216,757	0.27
f.	Laboratory Services	838,531	0	0	0	0	838,531	1.05
3.	Community Health Services							
a.	Environmental and Public Health	2,193,497	421,510	484,101	139,496	91,236	3,329,840	4.19
b.	Health Education	65,767	23,226	10,251	28,880	757	128,881	0.18
c.	School and Dental Health	605,370	111,747	200	0	5,436	722,753	0.91
d.	Malaria Control	8,807,322	2,754,955	520,870	207,005	73,567	12,363,718	15.54
e.	Maternal and Child Health	4,446,431	358,592	155,893	0	0	4,960,917	6.24
	Total recurrent expenditure	54,719,824	4,905,621	13,637,448	731,763	5,548,355	79,543,011	100.00
	Recurrent expenditure as a % of total expenditure							93.48
	Expenditure of Malaria project as a % of expenditure on community health services							57.49
	CAPITAL EXPENDITURE							
a.	Rehabilitation and improvements of capital assets						2,245,474	40.48
b.	Construction of permanent improvements						84,111	1.52
c.	Acquisition of equipment						2,906,942	52.40
d.	Environmental sanitation facilities						310,911	5.60
	Total capital expenditure						5,547,438	100.00
	Capital expenditure as a % of total expenditure							6.52
	Total expenditure						85,090,448	100.00

Source: Accounts Branch of the office of DPDHS, Matale

Table 4A.2: A comparison of the expenditure incurred under the malaria project of the DHB with the estimates

	Expenditure item	Financial statements of DPDHS	Estimates made for the study	% of difference between two columns
1.RECURRENT EXPENDITURE				
1.1	PERSONNEL EMOLUMENTS			
	Wages and salaries	8,807,322	7,982,078	9.37
1.2	TRAVELLING AND SUBSISTENCE	2,754,955	2,666,229	3.22
1.3	SUPPLIES			
	Stationary & office equip.	20,000	18,452	7.74
	Fuel	321,240	184,561	42.55
	Consumables	27,547	10,170	32.87
	- Laboratory		1,324	N.A.
	- Permethrin		6,998	N.A.
	- Drugs		5,932	N.A.
	Uniforms	99,873	99,873	0.00
	Tyres and tubes	52,210	128,660	-146.43
	Sub-total	520,870	455,968	12.46
1.4	REPAIR AND MAINTENANCE			
	Vehicles	189,137	139,247	26.38
	Buildings	17,869	17,869	0.00
	Sub-total	207,005	157,116	24.10
1.5	TRANSPORT & OTHER			
	Postal, telephone etc.	22,232	22,232	0.00
	Water supply, electricity and fuel (except diesel)	25,335	25,335	0.00
	Sub-total	47,567	47,567	0.00
	TOTAL RECURRENT EXPENDITURE	12,337,718	11,308,958	8.34
2.CAPITAL EXPENDITURE*				
2.1	BUILDINGS	26,000	75,000	-188.46
	TOTAL CAPITAL EXPENDITURE	26,000	75,000	-188.46
	TOTAL EXPENDITURE	12,363,718	11,383,958	7.92

* All other capital expenditure items are coming under provisions from the District Health Budget and Anti-Malaria Campaign. For details please see Table 4.2

Source: RMOM and DDHS Office, Matale

Table 4A.3: Distribution of case detection in Matale district in 1992 by means of surveillance

Means of surveillance	Blood films examined		Positive cases		Slide Positivity Rate
	No.	%	No.	%	
A. ACTIVATED PASSIVE CASE DETECTION					
I. Surveillance sources with BT facilities					
a. MCs	68,696	79.2	18,322	82.5	26.6
b. MBCs	3,641	4.2	663	3.0	18.2
c. PMCs	267	0.3	6	0.0	2.3
d. SPs	428	0.5	185	0.8	43.2
e. RMOMC	2,091	2.4	586	2.6	28.0
	75,123	86.2	19,762	89.0	26.3
II. Surveillance sources with only BF facilities					
a. MCs	6,176	7.1	1,614	7.3	26.1
b. SPs	153	0.2	18	0.1	11.8
SUB TOTAL	81,725	93.8	21,394	96.4	26.2
B. ACTIVE CASE DETECTION					
Fever surveys	4,224	4.9	624	2.8	14.8
SUB TOTAL	4,224	4.9	624	2.8	14.8
C. PASSIVE CASE DETECTION					
a. VUs	294	0.3	34	0.2	11.6
b. PSTs	840	1.0	146	0.7	17.4
c. PHSs	24	0.1	4	0.0	16.7
SUB TOTAL	1,158	1.3	184	0.8	15.9
TOTAL	87,107	100.0	22,202	100.0	25.5

Note: Details across HAs are given in table 4A.4
Source: RMOM, Laboratory Form 3

Table 4A.4: Case detection across health areas by means of surveillance

Means of case serveillance	Galewela			Dambulla			Naula			Rattota			Matale			TOTAL		
	No.	+Cases	SPR	No.	+Cases	SPR	No.	+Cases	SPR	No.	+Cases	SPR	No.	+Cases	SPR	No.	+Cases	SPR
A.ACTIVATED PASSIVE CASE DETECTION																		
I. Treatment sources with blood testing facilities																		
a. Public medical centres	26,957	7,102	26.35	15,492	3,870	24.98	16,769	5,376	32.06	0	0	N.A.	9,751	1,974	20.24	68,969	18,322	26.57
b. Mobile clinics	1,651	231	13.99	647	225	34.78	1,071	170	15.87	272	37	13.60	0	0	N.A.	3,641	663	18.21
c. Police mobile clinics	152	4	2.63	0	0	N.A.	43	1	2.33	0	0	N.A.	72	1	1.39	267	6	2.25
d. Special programmes	0	0	N.A.	428	185	43.22	0	0	N.A.	0	0	N.A.	0	0	N.A.	428	185	43.22
e. Clinic at the RMOM	160	37	23.13	53	11	20.75	306	89	29.08	394	123	31.22	1,178	326	27.67	2,091	586	28.02
II. Treatment sources with only blood filming facilities																		
a. Public medical centres	711	162	22.78	171	101	59.06	1,944	754	38.79	1,749	390	22.30	1,601	207	12.93	6,176	1,614	26.13
b. Special programmes	65	9	13.85	88	9	10.23	0	0	N.A.	0	0	N.A.	0	0	N.A.	153	18	11.76
B.ACTIVE CASE DETECTION																		
Fever surveys	2,338	327	13.99	896	194	21.65	973	99	10.17	0	0	N.A.	17	4	23.53	4,224	624	14.77
C.PASSIVE CASE DETECTION																		
a. Vigilance units	101	6	5.94	146	23	15.75	0	0	N.A.	0	0	N.A.	47	5	10.64	294	34	11.56
b. Spraying teams	221	47	21.27	172	55	31.98	100	14	14.00	338	27	7.99	9	3	33.33	840	146	17.38
c. Public health supervisors	4	0	0.00	16	3	18.75	2	0	0.00	0	0	N.A.	2	1	50.00	24	4	16.67
TOTAL	32,360	7,925	24.49	18,109	4,676	25.82	21,208	6,503	30.66	2,753	577	20.96	12,677	2,521	19.89	87,107	22,202	25.49

N.A. = not applicable
Source: RMOM

Table 4A.5: Output of the first mosquito net impregnation programmes by Health Area

Health Area & date	No. of bed nets	Use of permethrin (mls.)	No.of people using impr-egnated mosquito nets	
			5 > Years	5 ≤ Years
1.Galewela				
a.04.12.92	42	1,540	9	61
b.11.12.92	60	2,000	21	107
c.20.12.92	57	2,300	10	105
Sub total	159	5,800	40	273
2. Naula*				
a.03.12.92	12	460	N.A.	N.A.
b.22.12.92	61	2,000	N.A.	N.A.
Sub total	73	2,460	N.A.	N.A.
TOTAL	232	8,300	N.A.	N.A.

* These programmes were conducted in the newly created Laggala- Pallegama HA which was previously coming under Naula HA.

Source: RMOM, Feedback reports of MNIPs

Table 5A.1: Total and average direct cost for the first visit to a public means of treatment (Rs.)

Means of treatment	No. of Patients	Travel Cost for the patient	Travel Cost for accompanying	Cost of Drugs	Cost of Vitamins	Cost of Nutritional food	Cost of Special food	Total Cost
1.TOTAL COST								
INPATIENT CARE WITH BTF								
Galewela DH	3	18.00	18.00	0.00	0.00	0.00	55.00	91.00
Dambulla DH	4	10.00	9.00	0.00	0.00	50.00	255.00	324.00
Nalanda PU	1	13.00	13.00	0.00	0.00	0.00	20.00	46.00
Kongahawela PU	4	35.50	46.50	0.00	0.00	70.00	122.00	274.00
Laggala-Pallegama DH	1	0.00	0.00	0.00	0.00	0.00	18.00	18.00
Madipola PU	6	179.00	4.00	0.00	0.00	0.00	327.00	510.00
Yatawatta RH	1	0.00	4.00	0.00	0.00	60.00	0.00	64.00
Matale BH	2	7.00	14.00	0.00	0.00	0.00	17.80	38.80
Out of the district	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	23	262.50	108.50	0.00	0.00	180.00	814.80	1365.80
OUTPATIENT CARE WITH BTF								
Galewela DH	13	63.00	102.00	0.00	0.00	58.00	343.50	566.50
Dewahoowa CD	8	4.00	4.00	0.00	0.00	0.00	203.50	211.50
Dambulla DH	16	57.00	75.00	0.00	165.00	82.00	473.85	852.85
Nalanda PU	9	88.50	61.00	0.00	0.00	0.00	235.80	385.30
Kimbissa CD	30	32.00	40.00	0.00	0.00	234.00	538.50	844.50
Kongahawela PU	25	117.00	128.25	0.00	0.00	124.50	421.00	790.75
Laggala-Pallegama DH	14	79.00	45.00	60.00	0.00	197.00	309.80	690.80
Madipola PU	11	8.00	8.00	10.00	0.00	0.00	370.60	396.60
Yatawatta RH	4	14.00	4.00	0.00	0.00	0.00	42.00	60.00
Matale BH	2	19.50	12.00	0.00	0.00	0.00	25.00	56.50
SUB TOTAL	132	482.00	479.25	70.00	165.00	695.50	2963.55	4855.30
OTHER CLINICS								
Mobile Clinic (AMC)	6	16.00	20.00	0.00	0.00	3.50	137.90	177.40
Clinic at RMOM	5	102.00	91.00	0.00	0.00	0.00	332.50	525.50
Outpatient care at MCs with BFF	39	169.00	160.00	0.00	0.00	229.00	811.35	1369.35
Outpatient care at MCs with NO BFF	39	27.00	65.00	0.00	0.00	241.00	640.50	973.50
Field Assistant (AMC)	4	0.00	0.00	0.00	0.00	0.00	55.00	55.00
Public Health Worker	3	0.00	0.00	0.00	0.00	0.00	39.00	39.00
Voluntary Health Workers	8	0.00	0.00	0.00	0.00	52.00	107.00	159.00
Mobile Clinic (other)	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL - ALL VISITS	260	1058.50	923.75	70.00	165.00	1401.00	5901.60	9519.85
2. AVERAGE COST PER VISIT								
WITH BTF:								
Inpatient care at public MCs	23	11.41	4.72	0.00	0.00	7.83	35.43	59.38
Outpatient care at public MCs	132	3.65	3.63	0.53	1.25	5.27	22.45	36.78
Mobile Clinic (AMC)	6	2.67	3.33	0.00	0.00	0.58	22.98	29.57
Clinic at RMOM	5	20.40	18.20	0.00	0.00	0.00	66.50	105.10
WITH BFF:								
Outpateint care at public MCs	39	4.33	4.10	0.00	0.00	5.87	20.80	35.11
Field Assistants	4	0.00	0.00	0.00	0.00	0.00	13.75	13.75
WITH NO BFF:								
Outpateint care at publci MCs	39	0.69	1.67	0.00	0.00	6.18	16.42	24.96
Public Health Workers	3	0.00	0.00	0.00	0.00	0.00	13.00	13.00
Voluntary Health Workers	8	0.00	0.00	0.00	0.00	6.50	13.38	19.88
Mobile Clinic (other)	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL - ALL VISITS	260	4.07	3.55	0.27	0.63	5.39	22.70	36.61

* BT indicates the availability of blood testing facilities

Table 5A.2: Total direct cost of treatment for all visits to public medical centres

Type of treatment	No.of visits	Travel cost for the patient	Travel cost for accompanying	Cost of drugs	Cost of vitamins	Cost of nutritional food	Cost of special food	Total Cost
A.PUBLIC FIXED MCs								
Inpatient care with BTF	34	363.83	211.16	0.00	0.00	210.00	1,044.40	1,829.39
Inpatient care with BFF	3	23.00	30.00	0.00	0.00	50.00	65.00	168.00
Inpatient care with NO BFF	1	0.00	0.00	0.00	0.00	0.00	23.75	23.75
Outpatient care with BTF*	173	671.50	657.25	70.00	177.00	745.50	3,378.80	5,700.05
Outpatient care with BFF	43	199.00	182.00	0.00	0.00	239.00	826.35	1,446.35
Outpateint care with NO BFF	46	47.00	85.00	0.00	0.00	278.00	696.50	1,106.50
B.OTHERS								
Field Assistants (AMC)	5	0.00	0.00	0.00	0.00	0.00	107.00	107.00
Public Health Worker	3	0.00	0.00	0.00	0.00	0.00	39.00	39.00
Voluntary Health Workers	10	0.00	0.00	0.00	0.00	52.00	167.00	219.00
Mobile Clinics (AMC)	10	16.00	20.00	0.00	0.00	3.50	170.40	209.90
Clinic at RMOM	8	148.00	124.00	0.00	0.00	0.00	427.50	699.50
Mobile Clinic (other)	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL - ALL VISITS	337	1,468.33	1,309.41	70.00	177.00	1,578.00	6,945.70	11,548.44

BTF = Blood testing facilities
BFF = Blood filming facilities

Table 5A.3: Impact of the illness on patient's output/income by occupation

Occupation	No.of unaffected patients	No. of affected patients	Loss of wage income	Loss of business income	Cost of hired labour	Loss of output	Total loss to fully recovered	Total loss to partly recovered	TOTAL LOSS FOR ALL PATIENTS
Farming	74	20	0.00	0.00	7,955.00	14,900.00	22,855.00	0.00	45,710.00
Mason	0	1	0.00	0.00	0.00	0.00	0.00	1,050.00	1,050.00
House work	83	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
School going	107	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pre-school	38	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Job seeking	9	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Elderly	7	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Casual labourer	1	19	5,900.00	0.00	0.00	6,000.00	11,900.00	1,225.00	25,025.00
Garment worker	0	5	1,360.00	0.00	0.00	0.00	1,360.00	1,850.00	4,570.00
Retail trade (small scale)	1	2	0.00	450.00	0.00	0.00	450.00	0.00	900.00
Carpenter	0	6	3,710.00	0.00	0.00	0.00	3,710.00	0.00	7,420.00
Tailor	1	1	0.00	0.00	0.00	0.00	0.00	160.00	160.00
Driver	0	3	1,380.00	0.00	0.00	0.00	1,380.00	0.00	2,760.00
Security service	0	1	500.00	0.00	0.00	0.00	500.00	0.00	1,000.00
Pensioner	1	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Estate Labourer	0	1	0.00	0.00	0.00	0.00	0.00	630.00	630.00
Skilled worker	0	2	1,150.00	0.00	0.00	0.00	1,150.00	0.00	2,300.00
Fish trade	0	1	0.00	0.00	0.00	0.00	0.00	500.00	500.00
Gemming	2	0	600.00	0.00	0.00	0.00	600.00	0.00	1,200.00
Graphite/gem labourer	1	1	150.00	0.00	0.00	0.00	150.00	0.00	300.00
Retail trade (large scale)	2	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Handicraft maker	1	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Permanent labourer	0	2	0.00	0.00	0.00	0.00	0.00	1,100.00	1,100.00
Field Officer	0	1	1,000.00	0.00	0.00	0.00	1,000.00	0.00	2,000.00
Vegetable trade	0	2	0.00	2,100.00	0.00	0.00	2,100.00	0.00	4,200.00
Fruits trade	1	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Administrative Assistant	0	1	500.00	0.00	0.00	0.00	500.00	0.00	1,000.00
Timber cutting	0	1	800.00	0.00	0.00	0.00	800.00	0.00	1,600.00
Disabled	2	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	331	70	17,050.00	2,550.00	7,955.00	20,900.00	48,455.00	6,515.00	103,425.00

Table 5A.4: Effect of the engagement in arranging house for spraying on household/productive activities by health area

Item	Galewela	Dambulla	Laggala-Pallegama	Naula	Wilgamuwa	Yatawatta	Ambangang Korale	Pallepola	Rattota	Matale	TOTAL	% from Total
1. Acceptance of spraying												
1. Fully sprayed	153	129	36	55	76	25	32	15	16	22	559	53.9
2. Partially sprayed	20	29	7	25	17	11	11	9	2	8	139	13.4
3. Not sprayed	95	73	31	33	24	22	17	15	22	8	340	32.8
TOTAL	268	231	74	113	117	58	60	39	40	38	1038	100.0
2. For fully and partially sprayed houses, house was arranged for spraying by:												
1. Family members alone	168	146	41	73	84	32	41	21	17	28	651	93.3
2. Family members and a son/daughter lives outside the family	1	0	0	1	0	0	0	0	0	0	2	0.3
3. Family members and relative/s	0	0	1	3	0	0	0	0	0	0	4	0.6
4. Family members and neighbours	0	1	0	0	0	0	0	0	0	0	1	0.1
5. Family members and the spraying team	1			1	3		2	1			8	1.1
6. Relative/s alone	1	4	1	1	1	0	0	0	1	0	9	1.3
7. Spraying team alone	1	2	0	0	0	0	0	0	0	0	3	0.4
8. None - not arranged	1	5	0	1	5	4	0	2	0	2	20	2.9
TOTAL	173	158	43	80	93	36	43	24	18	30	698	100.0
3. Effect of engagement in house arrangements on household/productive activities of those family members: (no. of family members)												
1. On main occupation	37	36	18	19	20	5	13	4	2	2	156	17.1
2. On secondary occupation	13	14	1	3	2	1	1	1	0	2	38	4.2
3. On household work	121	101	26	51	61	24	28	16	8	23	459	50.2
4. No effect (for children, elderly etc.)	14	12	2	13	17	3	8	1	1	2	73	8.0
5. On the opportunity to help the main occupation of household head	3	9	0	0	2	0	0	0	0	0	14	1.5
6. On the time for resting	39	28	11	19	23	11	16	6	11	3	167	18.3
7. On household work and secondary occupation	0	2	0	1							3	0.3
8. On household work and main occupation	1	0	0	0	0	0	0	0	0	0	1	0.1
9. On a pre-arranged family/ social work	0	3	0	0	0	0	0	0	0	0	3	0.3
TOTAL	228	205	58	106	125	44	66	28	22	32	914	100.0

Table 5A.5: Some indicators of the quality of mosquito nets used by health area

	Health Area	No. of mosquito nets	Year of purchased/received (no. of mosquito nets)*			Expected years of use		
			Before 1983	Between 1983-87	After 1988	Up to 1 year	1 to 3 years	More than 3 years
1.	Galewela	163	2	35	126	28	80	55
2.	Dambulla	198	14	37	147	57	83	58
3.	Laggala-Pallegama	18	2	0	15	6	7	5
4.	Naula	22	2	7	13	7	8	7
5.	Wilgamuwa	50	0	7	43	4	28	18
6.	Ambanganga Korale	6	0	1	5	4	2	0
7.	Yatawatta	11	0	6	4	2	5	4
8.	Pallopola	11	0	2	9	0	4	7
9.	Rattota	2	0	1	1	1	0	1
10.	Matale	1	0	0	1	0	1	0
	Total	482	20	96	364	109	218	155
	As a % of total mosquito nets		4.15	19.92	75.52	22.61	45.23	32.16

* Totals of two Health Areas are slightly different from total number of nets as two respondents were unable remember the date of purchase.

Table 6A.1: First symptoms of malaria patients by their perceptions about illness

	Symptom	Those who believed to be of having malaria before taking formal treatment		Those who were not ceratin of having malaria before taking formal treatment		All responses	
		No. of responses	As a % of patients	No. of responses	% of patients	No.	As a % of total no. of patients
1.	Shivering	190	70.1	82	68.3	272	69.6
2.	Pains in joints of hands and legs	204	75.3	89	74.2	293	74.9
3.	Pains in back	65	24.0	25	20.8	90	23.0
4.	Nausea/vomiting	53	19.6	17	14.2	70	17.9
5.	Loss of appetite	9	3.3	8	6.7	17	4.3
6.	Headache	233	86.0	97	80.8	330	84.4
7.	Giddiness	9	3.3	2	1.7	11	2.8
8.	Fever	208	76.8	98	81.7	306	78.3
9.	Chillness	109	40.2	45	37.5	154	39.4
10.	Abdominal colic	5	1.8	5	4.2	10	2.6
11.	Other	23	8.5	15	12.5	38	9.7
	Total responses	1108	---	483	---	1591	---
	No.of patients	271	---	120	---	391	---
	Chi-square between two groups P value						8.4845 0.5816

Table 6A.2: Time gap between onset of symptoms and taking self treatment

Time gap in days	No. of patients	%
1.Same day	341	85.0
2.Following day	4	1.0
3.Two days later	4	1.0
4.Three days later	1	.2
5.Irrelevant - no self treatment	51	12.7
Total	401	100.0

Table 6A.3:Time gap between onset of symptoms and taking formal treatment*

Time gap in days	No. of patients who took self treatment	No. of patients who did not take self treatment	All patients
1. Same day	8 (02.3)	9 (17.6)	17 (04.2)
2. Following day	132 (37.7)	27 (52.9)	159 (39.7)
3. Two days later	117 (33.4)	12 (23.5)	129 (32.2)
4. Three days later	50 (14.3)	2 (03.9)	52 (13.0)
5. More than three days later	33 (09.4)	1 (02.0)	34 (08.4)
6. Irrelevant - no formal treatment	10 (02.9)	0 (00.0)	10 (02.5)
Total	350 (100.0)	51 (100.0)	401 (100.0)

* percentages in parentheses

Table 6A.4: Patient's behaviour in seeking care from formal sources by source of treatment

Source of treatment	Ist visit		2nd visit		3rd visit		4th & 5th visits		All visits	
	No. of visits	%	No. of visits	%	No. of visits	%	No. of visits	%	No. of visits	%
1. PUBLIC (FIXED CENTRES)										
a.Inpatient care	23	5.9	12	11.3	3	11.1	0	0.0	38	7.1
b.Outpatient care at MCs	210	53.7	42	39.6	8	29.6	2	22.2	262	49.2
c.Outpatient clinic at RMOM	5	1.3	2	1.9	1	3.7	0	0.0	8	1.5
Sub total	238	60.9	56	52.8	12	44.4	2	22.2	308	57.8
2. PUBLIC (FIELD)										
a.Mobile clinics of RMOM	6	1.5	4	3.8	0	0.0	0	0.0	10	1.9
b.Field Officers (AMC)	4	1.0	1	0.9	0	0.0	0	0.0	5	0.9
c.Public Health Workers	3	0.8	0	0.0	0	0.0	0	0.0	3	0.6
d.Voluntary Health Workers	8	2.0	2	1.9	0	0.0	0	0.0	10	1.9
e.Mobile clinics (other)	1	0.3	0	0.0	0	0.0	0	0.0	1	0.2
Sub total	22	5.6	7	6.6	0	0.0	0	0.0	29	5.4
PUBLIC TOTAL	260	66.5	63	59.4	12	44.4	2	22.2	337	63.2
3.PRIVATE										
a.Private Western (Govt.)+	74	18.9	29	27.4	11	40.7	4	44.4	118	22.1
b.Private Western	54	13.8	12	11.3	3	11.1	3	33.3	72	13.5
c.Employer's clinic	2	0.5	2	1.9	1	3.7	0	0.0	5	0.9
d.Ayurvedic	1	0.3	0	0.0	0	0.0	0	0.0	1	0.2
PRIVATE TOTAL	131	33.5	43	40.6	15	55.6	7	77.8	196	36.8
4.LEVEL OF RECOVERY										
a.Fully recovered	246	62.9	67	63.2	19	70.4	7	77.8	339	63.6
b.Partially recovered	33	8.4	8	7.5	0	0.0	2	22.2	43	8.1
c.Not recovered	112	28.6	31	29.2	8	29.6	0	0.0	151	28.3
TOTAL VISITS	391	100.0	106	100.0	27	100.0	9	100.0	533	100.0
As a % from total no. of patients	97.5	—	26.4	—	6.7	—	2.2	—	132.9	—

+ Receiving treatment from a Government (Western) doctor in private capacity for payment

Table 6A.5: Some conditional factors related to the location of source of treatment: time spent to reach, normal time to reach, and

Source of treatment	No. of visits	Time spent to reach the source of treatment (in minutes)		Time to reach the source of treatment (in minutes)		Distance to the source of treatment (in miles)	
		Average time	Standard deviation	Average time	Standard deviation	Average distance	Standard deviation
1. PUBLIC (FIXED)							
a.Inpatient care	38	60.9	45.9	39.4	37.7	4.2	3.9
b.Outpatient care at MCs	262	50.9	40.9	31.3	22.7	3.5	2.7
c.Outpatient clinic at RMOM	8	105.0	39.3	69.4	45.3	14.9	9.4
Sub total	308	53.5	42.4	33.3	26.5	3.9	3.7
2. PUBLIC (FIELD)							
a.Mobile clinics of RMOM	10	20.9	10.9	23.0	15.5	1.9	2.1
b.Field Officers (AMC)	5	6.0	8.2	7.6	12.7	0.3	0.4
c.Public Health Workers	3	21.7	7.6	8.3	2.9	0.3	0.0
d.Voluntary Health Workers	10	10.7	5.9	8.3	3.7	0.9	1.5
e.Mobile clinics (other)	1	1.0	0.0	1.0	0.0	0.1	0.0
Sub total	29	14.2	10.4	13.0	12.7	1.0	1.6
PUBLIC TOTAL	337	50.1	42.1	31.5	26.2	3.7	3.6
3.PRIVATE							
a.Private Western (Govt.)+	118	55.4	51.5	38.2	36.8	11.0	40.7
b.Private Western	72	43.6	33.9	32.5	25.3	3.0	11.1
c.Employer's clinic	5	12.0	10.9	10.0	3.5	1.0	3.7
d.Ayurvedic	1	25.0	0.0	15.0	0.0	0.1	0.0
PRIVATE TOTAL	196	49.8	45.7	35.3	32.8	5.1	6.4
TOTAL	533	50.0	43.4	32.9	28.8	4.2	4.9

+ Receiving treatment from a Government (Western) doctor in private capacity for payment

Table 6A.6: Some conditional factors related to the provision of services at the source of traetment: waiting time, time spent with doctor and time spent at the pharmacy

Source of treatment	No. of visits	Waiting time before consultation (in minutes)		Time spent with the doctor, FA, vHW, PHW etc., (in minutes)		Time spent to collect prescribed drugs (in minutes)	
		Average time	Standard deviation	Average time	Standard deviation	Average time	Standard deviation
1. PUBLIC (FIXED)							
a.Inpatient care	38	18.0	22.9	5.8	5.4	0.2	0.9
b.Outpatient care at MCs	262	31.4	35.6	3.1	1.2	11.7	14.7
c.Outpatient clinic at RMOM	8	2.3	2.1	1.4	0.5	1.6	1.2
Sub total	308	29.0	34.3	3.4	2.6	10.0	14.1
2. PUBLIC (FIELD)							
a.Mobile clinics of RMOM	10	26.5	29.1	3.3	1.3	4.4	1.4
b.Field Officers (AMC)	5	2.8	4.4	4.0	1.4	3.2	3.8
c.Public Health Workers	3	1.0	1.0	2.3	0.6	4.0	5.2
d.Voluntary Health Workers	10	2.7	4.7	2.7	2.3	1.9	1.2
e.Mobile clinics (other)	1	2.3	2.1	1.0	0.0	2.0	0.0
Sub total	29	11.2	20.4	3.0	1.7	3.2	2.5
PUBLIC TOTAL	337	27.4	33.7	3.3	2.5	9.4	13.6
3.PRIVATE							
a.Private Western (Govt.)+	118	15.6	29.2	3.7	2.3	4.8	5.8
b.Private Western	72	18.4	31.5	4.3	2.6	5.8	6.2
c.Employer's clinic	5	4.6	6.1	4.8	5.8	2.6	1.8
d.Ayurvedic	1	2.0	0.0	15.0	0.0	5.0	0.0
PRIVATE TOTAL	196	16.2	29.7	4.0	2.7	5.1	5.9
TOTAL	533	23.3	32.7	3.6	2.6	7.8	11.6

+ Receiving treatment from a Government (Western) doctor in private capacity for payment

Table 6A.7: Statistical validity of the differences of some conditional factors across sources of treatment

Conditional variable	F value for between group variations*	R^2
a.Location		
1.Distance	7.2847	.0081
2.Normal time to reach	3.7267	.0001
3.Time spent to reach	4.1916	.0041
b.Provision of services		
1.Waiting time	3.6615	.0384
2.Time spent with the doctor, FA,VHW, PHW etc.,	7.3663	.0015
3.Time spent to collect prescribed drugs	6.3734	.0358

N=533

* Since 12 sources of treatment were considered for the one- way ANOVA, degrees of freedom is 11. The 12 sources are the same as presented in Table 6A.5. For mean values and standard deviations of each conditional variable for each source of treatment please see Table 6A.5 and Table 6A.6.

Note: Statistical significance of all variables are less than .05.

Table 6A.8: Differences of factors related to the location and provision of services at public and private sources for outpatient care

Source of treatment	No. of visits	Location			Provision of services		
		Time spent to reach the source of treatment (in minutes)	Normal time to reach the source of treatment (in minutes)	Distance to the source of treatment (in miles)	Waiting time before consultation (in minutes)	Time spent with the doctor, FA, VHW, PHW etc., (in minutes)	Time spent to collect prescribed drugs (in minutes)
		Average time	Average time	Average distance	Average time	Average time	Average time
A. AVERAGE VALUES							
1. Public FOPC	270	52.5	32.4	3.9	30.5	3.0	11.4
2. GPD	118	55.4	38.2	5.5	15.6	3.7	4.8
3. DP	77	41.6	31.0	4.6	17.5	4.3	5.6
4. GPD+PD	195	49.9	35.3	5.2	16.3	4.0	5.1
B. BETWEEN GROUP DIFFERENCES	Degrees of freedom						
1. Public FOPC vs. GPD	386						
- t value		-0.590	-1.810	-3.070	4.030	-3.490	4.710
- P value		0.558	0.070	0.002	0.000	0.001	0.000
2. Public FOPC vs. PD	345						
- t value		2.100	0.440	-1.430	2.940	-4.990	3.400
- P value		0.037	0.662	0.152	0.004	0.000	0.001
3. Public FOPC vs. GPD+PD	463						
- t value		0.620	-1.110	-2.800	4.570	-4.840	5.650
- P value		0.535	0.269	0.005	0.000	0.000	0.000
4. GPD vs. PD	193						
- t value		-2.080	-1.490	-1.000	0.440	1.490	0.880
- P value		0.039	0.137	0.320	0.661	0.138	0.383

Public FOPC = Fixed outpatient clinics at public medical centres including outpatient clinic at RMOM
GPD = Government doctors engaged in private practice
PD = Private doctors (except GPDs) but this includes the visits made to the employer's clinic

Table 6A.9: Relationship between attitude about illness before seeking care and the first choice of formal treatment

Self assessment about type/level of sickness	Public	Private	P value	χ^2
Total no. of responses	260	131		
1. Type of sickness Response: I thought I was having malaria - No. of responses as a % of all visits to the source of treatment	69.23	69.47	.9621	0.022
2. Level of illness Response: I was severely ill - No. of responses as a % of all visits to the source of treatment	13.46	09.16	.2170	1.524

Table 6A.10: Patients' knowledge about availability of blood filming facilities at the closest public medical centre by source of treatment for the first visit

Knowledge about the availability of blood filming facilities	Public	Private	P value	χ^2
Total no. of responses	260	131		
Response: Yes they are available at that place - No. of correct responses as a % of all visits made to the source of treatment	85.77	85.50	.9420	0.005

Table 6A.11: Attitude towards level of illness before seeking care from a source of western medicine

Source of treatment	Total no. of patients	% of severely ill patients
1. Inpatient care	23	39.10
2. Outpatient care*	215	10.70
3. Private Western	56	14.40
4. Private Western (Govt.)	74	19.00
5.Fi Field treatment**	22	5.60
Total visits	390	12.10
P value		0.0009
Chi square		18.7047

* Including outpatient clinic at RMOM

** All field treatment sources coming under Table 6.3: PHWs, FAs, MBCs and VHWs

Table 6A.12: Bypassing the closest public fixed MC for the first visit by type and level of MC

Type and level of the MC	No. of visits made to the closest MC	No. of patients bypassed	% of bypassed patients
A.WITH BT FACILITIES			
1.District Hospitals			
Galewela	4	0	0.0
Dambulla	14	1	6.7
Laggala-Pallegama	12	0	0.0
Sub total	30	1	3.2
2.Peripheral Units			
Nalanda	6	1	14.3
Kongahawela	29	3	9.4
Madipola	15	1	6.3
Sub total	50	5	9.1
3.Rural Hospitals			
Yatawatta	5	0	0.0
4.Central Dispensaries			
Kimbissa	30	7	18.9
Dewahuwa	8	1	11.1
Sub total	38	8	17.4
SUB TOTA MCs WITH BF FACILITIES	123	14	10.2
B.WITH BF FACILITIES			
Rattota DH	5	0	0.0
Hettipola PU	8	0	0.0
Aluwihare CD	4	0	0.0
Aluthwewa CD	17	7	29.2
SUB TOTA MCs WITH BT FACILITIES	34	7	17.1
C.WITH NO BF FACILITIES			
Handungamuwa RH	8	1	11.1
Maraka CD	1	2	66.7
Aluthgama CD	17	1	5.6
Wahakotte CD	2	6	75.0
Gurubabila CD	1	3	75.0
Lenadora CD	2	5	71.4
Hattotaamuna CD	3	3	50.0
SUB TOTA MCs WITH NO FACILITIES	34	21	38.2
TOTAL	191	42	18.0

Table 6A.13: Type and level of the bypassed and attended fixed public MC for the first visit

Type and level of the MC bypassed	Type and level of the MC attended				Total
	BH/DH with BTF	PU with BTF	DH/PU with BFF	Other*	
A.WITH BT FACILITIES					
District Hospitals	1	0	0	0	1
Peripheral Units	1	3	0	1	5
Central Dispensaries	5	0	0	3	8
Sub total	7	3	0	4	14
As a % from the total bypassed patients	50.0	21.4	0.0	28.6	100.0
B.WITH BF FACILITIES					
Central Dispensaries	6	0	0	1	7
As a % from the total bypassed patients	85.7	0.0	0.0	14.3	100.0
C.WITH NO BFFACILITIES					
Rural Hospitals	0	0	1	0	1
Central Dispensaries	12	3	4	1	20
Sub total	12	3	5	1	21
As a % from total bypassed patients	57.1	14.3	23.8	4.8	100.0
TOTAL	25	6	5	6	42
As a % from total bypassed patients	59.5	14.3	11.9	14.3	100.0

* includes five visits made to MCs outside the district and one visit made to an MC within the district with no BF facilities.

Table 6A.14: Reasons for making first visit to a private western doctor

Reason	Patients who took treatment from a PD		Patients who took treatment from a GPD		Patients who took treatment from a PD/GPD	
	No.of responses	As a % of patients	No.of responses	As a % of patients	No.of responses	As a % of patients
A.SUPPLY DEFICIENCIES AT PUBLIC MCs						
1.To avoid waiting time and inconvenience at public MC	17	30.4	17	23.0	34	26.2
2.No service at the closest public MC	12	21.4	15	20.3	27	20.8
3.Not satisfied with the service at closest public MC	1	1.8	6	8.1	7	5.4
4.No drugs at closest public MC	1	1.8	3	4.1	4	3.1
SUB TOTAL	31	55.4	41	55.4	72	55.4
B.QUALITY OF CARE AT PRIVATE SOURCE						
1.Government doctor pays more attention in private treatment	0	0.0	44	59.5	44	33.8
2.Private doctor treats better than public doctors	17	30.4	0	0.0	17	13.1
SUB TOTAL	17	30.4	44	59.5	61	46.9
C.OTHER						
1.It is the familiar place	11	19.6	8	10.8	19	14.6
2.Too ill to wait atthe public MC	7	12.5	0	0.0	7	5.4
3.Other	5	8.9	2	2.7	7	5.4
NO.OF PATIENTS	56	---	74	---	130	---

Table 6A.15: Some features of the changes in source of treatment for the second visit

1. Patients shifted from public to private

a. As a % of the total no. of patients who made their first visit to public and not fully recovered: 27.4

b. Self assessment of the 1st source of treatment:
- Satisfied 2 (11.8 %) - Not satisfied 15 (88.2 %)

c. No. and % of patients shifted to:
- PDs 4 (23.5 %)
- GPDs 12 (70.6 %)
- Employer's clinic 1 (5.9 %)

d. Main reasons for the shift:
- Government doctor pays more attention in private treatment 11 (64.7 %)
- No service at the closest public MC 02 (11.8 %)

e. No. and % of patients fully recovered from the 2nd source of treatment: 12 (70.6 %)

f. Self assessment of the 2nd source of treatment:
- Fully satisfied 5 (29.4 %)
- Satisfied 8 (47.1 %)
- Not satisfied 4 (23.5 %)

2. Patients shifted from private to public

a. As a % of the total no. of patients not fully recovered from the 1st source of treatment: 38 %

b. Self assessment of the 1st source of treatment:
- Satisfied 5 (26.3 %) - Not satisfied 14 (73.7 %)

c. No. and % of patients shifted to:
- Public inpatient care 5 (26.3 %)
- Public outpatient care 12 (63.2 %)
- Other (RMOMC and MBC) 2 (10.6 %)

d. Main reasons for the shift:
- Since it is the closest public MC 9 (52.6 %)
- Since it has blood testing facilities 7 (36.8 %)
- That is the final source of treatment for serious illness 2 (10.6 %)

e. No. and % of patients fully recovered from the 2nd source of treatment: 13 (68.4 %)

f. Self assessment of the 2nd source of treatment:
- Fully satisfied 10 (52.6 %)
- Satisfied 7 (36.8 %)
- Not satisfied 2 (10.5 %)

Table 6A.16: Literacy level of household head and the source of treatment for the first visit

Literacy level	No. of visits made to public sources	% of visits made to public sources	No. of visits made to private sources	% of visits made to private sources
1.Illiterate	15	68.2	7	31.8
2.Primary education	119	67.2	58	32.8
3.Secondary education	79	68.1	37	31.9
4.Up to G.C.E. (O/L)	41	64.1	23	35.9
5.On or above G.C.E. (A/L)	6	50.0	6	50.0
Total	260	66.5	131	33.5
χ^2				1.8414
P value				.7649

Table 6A.17: Age structure of the patients by source of treatment for the first visit

Age group (in years)	No. of visits made to public sources	% of visits made to public sources	No. of visits made to private sources	% of visits made to private sources
1. ≤ 5	29	70.7	12	29.3
2. 5 < and ≤ 10	31	73.8	11	26.2
3. 10 < and ≤ 15	33	80.5	8	19.5
4. 15 < and ≤ 20	35	72.9	13	27.1
5. 20 < and ≤ 30	47	53.4	41	46.6
6. 30 < and ≤ 45	54	60.0	36	40.0
7. 45 < and ≤ 60	23	79.3	6	20.7
8. 60 <	8	66.7	4	33.3
Total	260	66.5	131	33.5
χ^2				16.4368
P value				.0214

Table 6A.18: Level of poverty of the households with patients by source of treatment for the first visit

Level of poverty	No. of visits made to public sources	% of visits made to public sources	No. of visits made to private sources	% of visits made to private sources
1. Receiving Janasaviya/ Food stamps	217	67.8	103	32.2
2. Not receiving income support from government	43	60.6	28	39.4
Total	260	66.5	131	33.5
χ^2				1.3706
P value				.2417

Table 6A.19: Income structure of the households with patients by source of treatment for the first visit

Monthly income (in Rupees)	No. of visits made to public sources	% of visits made to public sources	No. of visits made to private sources	% of visits made to private sources
1. First quartile: ≤ 1,782.33	75	75.8	24	24.2
2. Second quartile: 1,782.33 < and ≤ 3,048.33	70	71.4	28	28.6
3. Third quartile: 3,048.33 < and ≤ 5,016.67	55	56.7	42	43.3
4. Fourth quartile: 5,016.67 <	60	61.9	37	38.1
Total	260	66.5	131	33.5
χ^2				9.9966
P value				.0186

Table 6A.20: Compliance for drugs and reasons for noncompliance

Response of the patient	No. of patient visits	as a % of total visits (533)
Compliance for drugs		
1.I took all drugs as prescribed	433	81.3
2.Up to now I have taken as prescribed	41	7.7
3.I took them only for two days	38	7.1
4.I did not take them as prescribed	21	3.9
		As a % of total no. of non compliance cases (38+21=59)
Reasons for noncompliance		
1.Since I was recovered	17	28.8
2.Since there was no improvement	16	27.1
3.Since there were some side effects	12	20.2
4.Since illness aggravated	8	13.6
5.Other reasons	7	11.9

Table 6A.21: General behaviour in accepting residual spraying by level of acceptance*

Is this your general response for spraying?	Full spraying	Partial spraying	Refusing**
a. Yes	525 (93.9)	40 (28.8)	26 (09.0)
b. No	34 (06.1)	99 (71.2)	264 (91.0)
Total	559	139	290

* percentages in parentheses
** Excluding 50 houses refused by sprayers 28.8 % and 9.0 % of

Table 6A.22: Reasons for accepting full spraying for those who did not have a general practice of full acceptance

Reason	No. of responses	%*
1.Since sprayers came during the malaria season	9	26.5
2.Due to the announcement of prosecuting refused houses	7	20.6
3.Since sprayers came during the off harvest season	5	14.7
4.Since we all were at home on that day	4	11.8
5.Since sprayers explained benefits of spraying	3	8.8
6.Since it reduces insects	3	8.8
7.Since AMC officers forced us to do so	2	5.9
8.Since it reduces mosquitos	2	5.9
9.Since we were informed the spraying day in advance	2	5.9
10.Since one family member was infected malaria	1	2.9
11.Since sprayers came during the mosquito season	1	2.9
Total no. of respondents	34	

* Percentages from the total no. of respondents

Table 6A.23: Reasons for accepting partial spraying for those who did not have a general practice of partial acceptance

Reason	No. of responses	%*
1.Since we were unable to arrange the house	26	26.3
2.Sprayers had done so at a time when no one was at home	15	15.2
3.Since we had to attend some other important work	8	8.1
4.Since the house was under renovation	7	7.1
5.Since we were cooking/eating	7	7.1
6.Since it was a rainy day	6	6.1
7.Due to the announcement of prosecuting refused houses	5	5.1
8.Since AMC officers forced us to do so	5	5.1
9.Since there was a patient at home	4	4.0
10.Since we were engaged in work	4	4.0
11.Other reasons	14	14.1
Total no. of respondents	99	

* Percentages from the total no. of respondents

Table 6A.24: Reasons for refusing spraying for those who did not have a general practice of refusing

Reason	No. of responses	%*
1.Since we had to go for work	102	38.6
2.Since we had to go out	52	19.7
3.Since we were not informed the spraying day	27	10.2
4.Since there was no one to arrange the house	13	4.9
5.Since harvest was on the floor	12	4.5
6.Since there was an infant	11	4.2
7.Since there was a patient	11	4.2
8.Since there was a special occasion at home	10	3.8
9.Since it was a rainy day	7	2.7
10.Since some guests were at home	3	1.1
11.Other reasons	16	6.1
Total no. of respondents	264	

* Percentages from the total no. of respondents

Table 6A.25: Community perceptions about benefits from residual spraying by level of acceptance

Benefits	% of responses	
	Full acceptance	Partial acceptance
1.Reduces other insects	82.3	52.5
2.Reduces mosquitoes	55.5	15.1
3.Controls malaria infection	6.1	5.0
4.Reduces snakes	3.4	3.6
5.Reduces mosquitoes for a short period	2.9	2.9
6.Even full spraying does not reduce malaria infection	9.5	0.1
7.No benefit at all	0.0	40.0
Total no. of respondents	559	139

Table 6A.26: Literacy level of household head and the level of accepting residual spraying

Literacy level	N	% of full acceptance	% of partial acceptance	% of refusals
1.Illiterate	56	66.1	8.9	25.0
2.Primary education	464	59.7	12.7	27.5
3.Secondary education	264	58.7	12.1	29.2
4.Up to G.C.E (O/L)	151	51.0	13.9	35.1
5.On or above G.C.E (A/L)	38	34.2	18.4	47.4
Total	973	56.6	14.1	29.4
χ^2				14.3048
P value				.0742

Table 6A.27: Income structure of the households by the level of accepting residual spraying

Monthly income (in Rupees)	N	% of full acceptance	% of partial acceptance	% of refusals
1.First quartile: ≤ 1,933.17	241	57.3	10.0	32.8
2.Second quartile: 1,933.17 < and ≤ 3,166.67	244	59.4	11.5	29.1
3.Third quartile: 3,166.67 < and ≤ 5,040.83	248	61.7	12.5	25.8
4.Fourth quartile: 5,040.83 <	240	51.3	17.1	31.7
Total	973	57.5	12.7	29.8
χ^2				10.2496
P value				.1145

Table 6A.28: Compliance for residual spraying by type of items rubbed off and level of acceptance

Items rubbed	% of responses	
	Full acceptance	Partial acceptance
1. Windows and doors	41.5	34.5
2. Windows, doors and all furniture	8.6	6.5
3. All furniture	3.9	6.5
4. Windows, doors and chairs	3.2	3.6
5. Windows, doors and walls	2.0	1.4
6. Furniture and lower parts of walls	1.1	0.7
7. Rubbed/washed the floor	0.9	0.0
8. Windows, doors and lower parts of walls	0.9	1.4
9. Only chairs	0.5	2.2
10. Combinations of above	4.0	1.5
11. Not rubbed	33.4	41.7
Total no. of respondents	559	139

Table 6A.29: Time gap between spraying and rubbing off the residuals by level of acceptance

Time gap in hours/days/weeks	% of responses	
	Full acceptance	Partial acceptance
1. ≤ 1 hour	13.2	12.2
2. 1 hour < and ≤ 2 hours	12.2	12.2
3. 2 hours < and ≤ 3 hours	11.1	6.5
4. 3 hours < and ≤ 5 hours	6.8	5.0
5. 5 hours < and ≤ 10 hours	2.5	2.2
6. Same day*	3.8	4.3
7. Following day	7.7	6.5
8. Two days later	4.5	5.8
9. 2 days < and ≤ 7 days	4.5	3.6
10. 1 week < and ≤ 4 weeks	0.4	0.0
11. Not rubbed	33.4	41.7
Total no. of respondents	559	139

* No. of hours not specified

Table 6A.30: Use of mosquito coils, leaves and husks, and mosquito nets by health area

Health Area	No. and % of households using mosquito coils		No. and % of households using leaves and/or husks		No. and % of households using mosquito nets	
	No.	%	No.	%	No.	%
1. Galewela	113	42.2	78	29.1	108	40.3
2. Dambulla	131	56.7	79	34.2	112	48.5
3. Laggala-Pallegama	30	40.5	26	35.1	17	23.0
4. Naula	32	28.3	52	46.0	21	18.6
5. Wilgamuwa	73	62.4	37	31.6	29	24.8
6. Yatawatta	11	19.0	6	10.3	6	10.3
7. Ambanganga Korale	8	13.3	20	33.3	10	16.7
8. Pallepola	14	35.9	14	35.9	10	25.6
9. Rattota	5	12.5	8	20.0	2	5.0
10. Matale	6	15.8	6	15.8	1	2.6
Total	423	40.8	326	31.4	316	30.4
Chi square		108.0113		32.3031		102.0004
P value		<.05		0.0001		<.05

Table 6A.31: Use of leaves and husks as repellents by type

Item		No. of households used	As a % of households using leaves and/or husks
1.	Maduruthala leaves Ocimum sanitum	203	62.27
2.	Kohomba leaves	164	50.31
3.	Kohomba seeds Azadirachta indica	2	0.61
4.	Mee Muruwata Maduca longifolia	35	10.74
5.	Pawatta leaves Adhatoda vascica	1	0.31
6.	Ginisiriya leaves Albesia Sancata	1	0.31
7.	Nika leaves Vitex negundo	1	0.31
8.	Gandapana leaves Lantana Comara	1	0.31
9.	Makulu gedi Hydnocarpus Venenata	1	0.31
10.	Burutha Chlaroxylon Swietenia	1	0.31
11.	Terpentine leaves	1	0.31
12.	Coconut husks	131	40.18
13.	Cashew nut husks	13	3.99
14.	Fire wood	6	1.84
15.	Paddy husks	15	4.60
16.	Rubber sleepers	7	2.15
17.	Malathion	1	0.31
18.	Tyres	27	8.28
19.	Elephant dung	1	0.31
	Total no. of users	326	

Table 6A.32: Reasons for using repellents by type

Reasons	% of responses	
	Mosquito coils	Leaves and/or husks
1.To get rid from mosquito nuisance	94.1	96.3
2.To get rid from malaria	22.9	22.7
3.To avoid biting insects	8.5	7.4
4.To have an undisturbed sleep	0.7	0.0
5.To reduce insects	0.2	0.6
Total no. of users	423	326

Table 6A.33: Practice of using repellents by type

Frequency of using repellents	% of responses	
	Mosquito coils	Leaves and/or husks
1.Some evenings during mosquito season	68.1	53.1
2.Every evening during mosquito season	27.7	36.8
3.Once a week during mosquito season	1.9	3.4
4.Three times a week during mosquito season	0.7	1.2
5.Every evening during malaria season	1.2	0.6
6.Once a week during malaria season	0.5	0.9
7.Other	0.9	4.0
Total no. of users	423	326

Table 6A.34: Literacy level and income of the households using repellents by type

Indicator	N	% of using households	
		Mosquito coils	Leaves and/or husks
A.Literacy level of the household head			
1.Illiterate	60	31.7	33.3
2.Primary education	489	38.0	34.8
3.Secondary education	283	43.5	31.4
4.Up to G.C.E (O/L)	161	47.2	26.1
5.On or above G.C.E (A/L)	45	42.2	11.1
χ^2		7.2226	13.3826
P value		.1249	.0095
B.Monthly household income (Rs.)			
1.First quartile: ≤ 1,933.17	260	34.2	34.2
2.Second quartile: 1,933.17 < and ≤ 3,166.67	260	39.2	36.2
3.Third quartile: 3,166.67 < and ≤ 5,040.83	259	40.2	25.1
4.Fourth quartile: 5,040.83 <	259	49.4	30.1
χ^2		12.9282	8.6698
P value		.0048	.0340

Table 6A.35: Reasons for using mosquito nets

Reason	% of households
1.To get rid from mosquito nuisance	58.5
2.To have an undisturbed sleep	28.5
3.To get rid of mosquitos and insects	6.0
4.To get rid from malaria	2.8
5.Other reasons	4.2
Total no. of mosquito net using households	316

Table 6A.36: Practice of using mosquito nets

Frequency	% of households
1.Every day during mosquito season	62.0
2.Every day	30.4
3.Every day during malaria season	3.5
4.Some days during mosquito season	3.2
5.Rainy season	.9
Total no. of mosquito net using households	326

Table 6A.37: Age structure of regular mosquito net users*

Age group (in years)	Regular users		Those who used them last during night	
	No.	%	No.	%
1. ≤ 5	208	40.78	172	33.73
2. 5 < and ≤ 10	173	26.57	122	18.74
3. 10 < and ≤ 15	114	17.14	82	12.33
4. 15 < and ≤ 20	63	9.78	51	7.92
5. 20 < and ≤ 30	183	18.21	140	13.93
6. 30 < and ≤ 45	174	16.90	144	13.98
7. 45 < and ≤ 60	47	9.43	40	8.03
8. 60 <	20	9.17	15	6.88
Total	982	27.10	766	20.60

* Percentages are from the total number of respondents in each age group.

Table 6A.38: Reasons for the seeming inadequacy of the number of mosquito nets to be used by all regular users

Reason	% of households
1.No, they are adequate - we all use them by sharing	35.4
2.We can not afford for all members	30.7
3.Other members are not interested	20.2
4.They do not sleep in the house (i.e., shop, field etc.,)	4.4
5.They use mosquito coils	1.9
6.No enough space to use more mosquito nets	1.9
7.Other reasons	2.0
8.Not relevant - each member has a mosquito net	3.5
Total no. of mosquito net using households	316

Table 6A.39: Reasons for not using mosquito nets by some households

Reason	% of households
1.Unaffordability	45.0
2.Not required	19.1
3.Since we need them only for the mosquito season	12.5
4.Since we can not buy them for all the family members	12.2
5.Not interested	5.8
6.No enough space/mosquitos to use them	2.6
7.Since we use other methods for mosquito nuisance	1.2
8.Other reasons	1.6
Total no. of mosquito net using households	722

Table 6A.40: Practice of using mosquito nets by literacy level of household head

Literacy level	N	% of households using mosquito nets
1.Illiterate	60	16.7
2.Primary education	489	22.7
3.Secondary education	283	33.9
4.Up to G.C.E (O/L)	161	43.5
5.On or above G.C.E (A/L)	45	64.4
Total	1038	30.4
χ^2		58.3304
P value		<.05

Table 6A.41: Practice of using mosquito nets by level of household income

Monthly income (in Rupees)	N	% of households using mosquito nets
1.First quartile: ≤ 1,933.17	260	17.7
2.Second quartile: 1,933.17 < and ≤ 3,166.67	260	26.9
3.Third quartile: 3,166.67 < and ≤ 5,040.83	259	29.0
4.Fourth quartile: 5,040.83 <	259	48.3
Total	1038	30.4
χ^2		60.5921
P value		<.05

Table 6A.42: Knowledge and use of prophylaxis by Health Area

Health Area	% of households aware of prophylaxis	No. of prophylaxis users during the previous year*
1.Galewela	56.0	29 (30.9)
2.Dambulla	53.7	17 (18.1)
3.Laggala-Pallegama	50.0	10 (10.6)
4.Naula	61.9	26 (27.7)
5.Wilgamuwa	12.8	2 (02.1)
6.Yatawatta	13.8	6 (06.4)
7.Ambanganga Korale	21.7	1 (01.1)
8.Pallepola	33.3	2 (02.1)
9.Rattota	20.0	1 (01.1)
10.Matale	10.5	0 (00.0)
Total	42.6	94 (100.0)

* percentages in parentheses

Table 6A.43: Practice of using prophylaxis

Duration	% of users
1.12 weeks	34.0
2. 4 weeks	17.0
3. 8 weeks	12.8
4. 3 weeks	5.3
5. 6 weeks	4.3
6.10 weeks	4.3
7.24 weeks	3.2
8.Other	6.3
9.Still taking at the time of investigation	12.8
Total no. of prophylaxis users	94

Table 6A.44: Age and sex of prophylaxis users

Age (Years)	Male		Female		Total	
	No.	%	No.	%	No.	%
1. Less than or equal to 5	1	1.8	0	0.0	1	1.1
2. 5 < and LE 10	5	9.1	10	25.6	15	16.0
3. 10 < and LE 15	6	10.9	4	10.3	10	10.6
4. 15 < and LE 20	4	7.3	3	7.7	7	7.4
5. 20 < and LE 30	16	29.1	4	10.3	20	21.3
6. 30 < and LE 45	18	32.7	16	41.0	34	36.2
7. 45 < and LE 60	3	5.5	1	2.6	4	4.3
8. Above 60	2	3.6	1	2.6	3	3.2
Total	55	100.0	39	100.0	94	100.0

LE=Less than or equal to

Table 6A.45: Prescriber of prophylactic treatment

Prescriber	No. of users	% of users
1. Private doctor	40	42.6
2. Government doctor	32	34.0
3. Government doctor in private practice	11	11.7
4. AMC officer	7	7.4
5. Other	4	4.3
Total	94	100.0

Table 6A.46: Place from where prophylaxis was obtained

Place	No. of users	% of users
1. Private pharmacy	32	34.0
2. Government medical centre	29	30.9
3. Private doctor	21	22.3
4. Mobile clinic of AMC	8	8.5
5. Other	4	4.3
Total	94	100.0

Table 6A.47: Community perceptions on control measures

Suggestions to control the disease more effectively	No. of responses	As a % of total respondents
1. By spraying malathion properly	248	23.9
2. By controlling mosquito breeding places	245	23.6
3. By changing the insecticide into a better one	90	8.7
4. By keeping inside/outside the houses clean	55	5.3
5. By using mosquito nets	35	3.4
6. Through health education programmes	34	3.3
7. By introducing a vaccine	24	2.3
8. By bringing up treatment facilities to village level	19	1.8
9. By taking prophylactic treatment	15	1.4
10. By taking proper treatment	12	1.2
11. By improving treatment facilities at medical centres	8	0.8
12. By impregnation of mosquito nets	6	0.6
13. Can not make any suggestion	387	37.3
Total no. of responses	1178	
Total no. of respondents	1038	

Table 7A.1: Monthly parasite incidence rates in 1992 by Health Area

IHA/HA*	Month												
	January	February	March	April	May	June	July	August	September	October	November	December	Total
1.Galewela IHA	19.97	11.50	5.90	3.39	5.56	11.24	11.49	9.44	6.61	6.17	5.38	11.60	108.27
a.Galewela HA	22.41	12.91	6.53	3.80	4.87	11.45	12.40	10.46	7.30	6.88	6.01	13.00	118.03
b.Pallepola HA	0.00	0.00	0.75	0.00	11.17	9.54	4.02	1.13	1.00	0.38	0.25	0.13	28.36
2.Dambulla IHA/HA	20.99	10.13	3.99	2.07	2.84	7.66	10.53	6.37	4.64	3.51	5.30	19.63	97.66
3.Naula IHA	12.48	6.64	3.11	2.46	3.25	9.11	12.75	9.28	5.61	8.19	7.48	14.11	94.47
a.Naula HA	29.69	15.87	7.46	5.76	7.60	18.45	23.19	13.54	8.98	8.94	9.76	22.55	171.78
b.Wilgamuwa HA	0.70	0.30	0.11	0.22	0.33	0.74	1.40	3.07	1.11	0.59	0.63	1.52	10.72
c.Laggala-Pallegama HA	0.00	0.00	0.00	0.00	0.00	6.30	13.64	12.83	7.56	21.87	16.46	21.65	100.31
4.Matale IHA**	16.96	10.42	6.79	3.88	6.79	13.24	13.88	8.86	6.50	5.99	6.12	6.92	106.33
a.Yatawatta HA	17.95	10.99	5.62	3.44	6.71	13.25	15.77	7.80	5.79	6.12	6.21	6.29	105.95
b.Matale HA	14.41	8.89	7.21	3.91	6.21	11.96	10.81	8.97	6.52	5.29	5.44	6.82	96.46
5.Rattota IHA	2.20	1.80	0.60	0.92	1.04	1.40	3.16	3.65	1.92	1.84	2.08	2.48	23.11
a.Rattota HA	6.65	5.44	1.81	2.78	3.15	4.23	7.74	8.35	5.81	5.57	6.29	7.50	65.34
b.Ambangaṅga Korale HA	0.00	0.00	0.00	0.00	0.00	0.00	0.97	1.42	0.00	0.00	0.00	0.00	2.40
TOTAL	15.86	8.70	4.25	2.64	4.00	9.08	11.03	8.11	5.42	5.75	5.70	12.52	93.06

* IHA = Integrated Health Area, HA = Health Area

** Includes a few cases detected from Ukuwela HA as well

Source: Regional Malaria Office, Matale

Table 7A.2: Rainfall and rain days of Matale District in 1992

Month	Rainfall (mm.)	No. of rain days
1.January	267.2	4
2.February	148.6	4
3.March	148.3	13
4.April	153.7	8
5.May	224.7	16
6.June	37.2	14
7.July	117.0	19
8.August	42.8	6
9.September	140.6	9
10.October	508.5	21
11.November	295.4	17
12.December	293.2	20
TOTAL	2377.2	151

Source: Department of Meteorology

Table 7A.3: Distribution of forest land across health areas (Acres)

Health Area	Total lands	Government forest	% of forest land
1. Galewela	47,543	6,121	12.87
2. Dambulla	112,754	10,714	9.50
3. Naula	61,774	40,350	65.32
4. Laggala-Pallegama	96,124	54,700	56.91
5. Wilgamuwa	61,916	27,238	43.99
6. Ambanganga Korale	12,960	285	2.20
7. Rattota	26,717	115	.43
8. Pallepola	21,655	1,295	5.98
9. Yatawatta	16,236	933	5.75
10.Matale	15,742	540	3.43
11.Ukuwela	21,653	666	3.08
TOTAL	495,074	142,957	28.88

Source: Statistical Abstract 1991, Matale District, Statistics Branch, District Secretariat, Matale

Table 8A.1: Policy option 1: Cost of the perennial residual spraying with a half reduction of expenditure on insecticide by year

Input	Value (Rs.)
YEAR 1:	
1.Insecticide - **ALLOCATED FUNDS**	11,556,440
Cost of each proposed insecticide (Rs.):	
- Sumithion 16,632,000	
- Icon 13,305,600	
- Vectron 18,399,237	
2.Manpower:	
a.Supervision (RMO,DDHSs,PHIs and SFAs)	377,346
b.Field	3,827,137
3.Buildings	10,408
4.Equipment	171,468
5.Supplies, communication etc.,	98,944
6.Transport	148,111
Total	16,189,855
YEAR 2: As same as above	16,189,855

Table 8A.2: Policy option 2: Cost of the perennial residual spraying with a 75 % reduction of expenditure on insecticide by year

Input	Value (Rs.)
YEAR 1:	
1.Insecticide - **ALLOCATED FUNDS**	5,778,220
Cost of each proposed insecticide (Rs.):	
- Sumithion 8,316,000	
- Icon 6,652,800	
- Vectron 9,199,619	
2.Manpower:	
a.Supervision (RMO,DDHSs,PHIs and SFAs)	248,902
b.Field	2,181,444
3.Buildings	10,407
4.Equipment	85,734
5.Supplies, communication etc.,	51,933
6.Transport	74,056
Total	8,430,697
YEAR 2: As same as above	8,430,697

Table 8A.3: Predicted outputs and cost implications of introducing a new insecticide for perennial residual spraying by insecticide and policy option

Output measure/ cost implication	Proposed insecticide		
	Sumithion	Icon	Vectron
POLICY OPTION 1			
a.Number of houses sprayed twice a year	30,000	30,000	30,000
b.Number of people protected	150,000	150,000	150,000
c.Cost per house sprayed (Rs.)	354.42	298.98	383.88
d.Cost per person protected (Rs.)	141.77	119.59	153.55
POLICY OPTION 2			
a.Number of houses sprayed twice a year	15,000	15,000	15,000
b.Number of people protected	75,000	75,000	75,000
c.Cost per house sprayed (Rs.)	365.62	310.18	395.07
d.Cost per person protected (Rs.)	146..25	124.07	158.03

Table 8A.4: Estimated cost of the proposed augmentation of case detection and treatment in both policy options by activity and year (Rs.)

Activity/cost component	Ist Year	2nd Year
a.Mobile Clinics		
Manpower	338,200	67,640
Drugs	54,650	9,294
Equipment & Vehicles	35,798	7,160
Supplies (including fuel)	91,310	18,262
Sub total	519,958	102,355
b.Training/stationing MICs		
Allowance/Salaries	270,000	324,000
Training fees	225,000	
Microscopes		405,000
Sub total	495,000	729,000
c.Stationing FAs at 9 MCs		
Salaries	270,000	270,000
d.Travelling allowance for VHWs	75,000	75,000
TOTAL	1,359,958	1,176,355

Table 8A.5: Predicted output and cost implications of mobile clinics in both policy options by year

Item	Ist Year	2nd Year
a.Number of smears	25,000	5,000
b.SPR	20	15
c.Number of positive cases	5,000	750
d.Cost per smear	Rs.9.66	Rs.9.66
e.Cost per case detected	Rs.48.31	Rs.64.42
f.Cost per case treated	Rs.40.62	Rs.51.98
g.Cost per positive case	Rs.103.99	Rs.136.47

Table 8A.6: Policy option 2: Estimated cost of the proposed mosquito net impregnation programme by cost component and year (Rs.)

Cost component	Ist Year	2nd Year
1.Manpower:		
a.Supervision (RMO,DDHSs,PHIs and SFAs)	153,922	153,922
b.Field	641,457	796,171
2.Transport	114,678	114,678
3.Permethrin	3,592,408	4,973,580
4.10% allocation	450,247	603,835
Sub total	4,952,712	6,642,186
5.Training		
a.AMC employees	200,000	75,000
b.VHWs	200,000	
6.Incentives for VHWs	100,000	100,000
7.Subsidy to purchase nets	13,311,000	10,962,000
8.10% allocation of subsidy	1,331,100	1,096,200
Sub total	15,142,100	12,233,200
TOTAL	20,094,812	18,875,386

Table 8A.7: Policy option 2: Predicted output and cost implications of mosquito net impregnation by year

Item	Ist Year	2nd Year
a.No.of nets impregnated	52,800	73,210
b.No.of nets subsidised	24,650	20,410
c.No.of people protected	105,600	146,420
d.Provider's CPPP	Rs.79.37	Rs.63.12
e.Social CPPP	Rs.114.16	Rs.108.13

CPPP=cost per person protected

Table 8A.8: Estimated cost of the proposed health information system in both policy options by cost component and year (Rs.)

Cost component	Ist Year	2nd Year
1.Manpower:		
a.Supervision (RMO,DDHSs, and HIO)	159,515	156,275
b.HIAs	276,480	276,480
2.Travelling	41,904	27,936
3.Training, Programming and packages	250,000	
4.Computers	700,000	
5.Maintenance	105,000	105,000
6.Review and improvements		150,000
7.Extension towards private sector		275,000
8.10 % allocation for overheads and incidental expenses	153,290	99,069
Total	1,686,188	1,089,760