REVIEW OF COSTING STUDIES CONDUCTED IN SRI LANKA 1990-2004

STUDY REPORT 6
NATIONAL COMMISSION ON MACROECONOMICS AND HEALTH SRI LANKA

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A Policy Study conducted for the
National Commission on Macroeconomics and Health, Sri Lanka

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FOREWORD

The Ministry of Healthcare and Nutrition is very pleased to present this report which highlights the work of the National Commission on Macroeconomics and Health of Sri Lanka during the past few years. I wish to thank the World Health Organization for this important initiative which has provided us with technical and financial support to study the issues related to disease burden, models of health care delivery, costs of health care and ways of financing them. These have helped me, as the Minister of Health, to obtain sound evidence to persuade my colleagues regarding the imperative need for increasing the appropriations to the health sector. Consequently, it is a matter of deep satisfaction to us that the Government of Sri Lanka has in fact granted a real increase in the budgetary allocation to the health sector.

The successes of the health sector in Sri Lanka are often commended at international health fora and have been well documented. The high life expectancy at birth, the low infant, child and maternal mortality, and the national level achievement of many of the Millennium Development Goals are often sited as evidence of the returns generated by consistent investment in the social sector. The Government of Sri Lanka is fully committed to maintain these health gains.

But it is also the reality that Sri Lanka is now facing new and more formidable challenges, which have in fact evolved partly as a result of the health developments in the past two decades. The transitions in the epidemiology and demography, which have resulted in the classical double burden of diseases, combined with a rapidly ageing population have impelled the urgent need for more innovative forms of health care delivery and health care financing.

In fact the costs of health care delivery are increasing at such a rapid pace that quite often the government faces constraints to maintain its cherished principle of high quality public sector health free at the point of delivery. However this provision being an unbending commitment of the government, will not be compromised at any cost. This means that we will need to introduce innovative schemes of financing our health care, including a judicious use of public – private partnerships, while continuing to maintain the principle of an absence of direct user fees all the time.

The knowledge and experience gained from the work of the National Commission on Macroeconomics and Health will be extremely relevant and useful in this regard. Now we have a better sense of the costs of treating and managing many of the common diseases, have an idea how to discuss and explore alternate ways of financing our health services. The work that has been undertaken simultaneously such as the National Health Development Framework and the Health sector Master Plan will also provide us with new approaches and guidance. We need to complete the formulation of a well articulated health sector investment plan that I could then pursue with my colleagues in the Government.

I must sincerely thank the Members of the National Commission who gave their valuable time and expertise, the WHO officials in Geneva and New Delhi and the WHO Representative in Sri Lanka and his staff for their continuous support during the past few years. I need to express my appreciation of the tremendous amount of work done by my own Health Ministry officials. With further support from all of them we hope to continue this work until Sri Lanka is able to successfully meet its health care financing needs and obligations in the years to come.

Nimal Siripala de Silva
Minister of Healthcare & Nutrition

PREFACE

It gives me great pleasure to write this preface to this publication of the National Commission on Macroeconomics and Health of Sri Lanka. World Health Organization felt very pleased that Sri Lanka was one of the earliest countries in the world to take up the recommendations of the global Commission on Macroeconomics and Health adopted by the World Health Assembly in 2001. The lead given by Sri Lanka helped to stimulate and energise the other countries in the South East Asia Region to follow its example.

The National Commission on Macroeconomies and Health (NCMH) of Sri Lanka was established by the National Health Council in 2003 as an advisory body to the government to recommend policy options and guidelines for investing in health. It was co-chaired by the Minister of Health and the Minister of Finance and the members included high level officials from the Government, the Universities, the private sector, civil society and the WHO.

Sri Lanka is always cited as a high performer in health with excellent health status indicators such as life expectancy, infant and maternal mortality. This has been made possible by the commitments that were made to the social sector by successive governments during the past six decades. Sri Lanka is currently experiencing demographic and epidemiological transition and the classical double burden is now a feature of the Sri Lanka disease pattern. With its successes in combating the traditional communicable diseases new challenges have emerged.The non communicable diseases, mental illness and accident and injuries have come to the fore and simultaneously there is the emergence of newer communicable diseases such as dengue, HIV and now the threat of Avian Flu. This implies that in the coming years Sri Lanka will have to make higher investment in order to meet these new challenges.

The work of the National Commission has helped the Government in two ways. At the policy level, it has helped to advocate the need for a higher investment in health, and at the marginal level the different studies that were commissioned have provided the evidence-base to make reliable assessments of these increasing investment needs.

The work of the NCMH is by any means over. It will have to continue to undertake a number of important tasks in the years to come. For example, the NCMH will need to analyse the causes of the current disease burden and define new national targets, monitor the current programmes of the government from an economic perspective, suggest cost effective strategies and monitor the present financial resources invested in health. Simultaneously, the achievement of the Millennium Development Goals will also have to be taken into reckoning in these strategies and plans. In summary it will have to formulate a comprehensive investment plan on the basis of the information that will be obtained from all these diverse studies.

The World Health Organization stands ready to collaborate with the Ministry of Health in all of this important work of the National Commission on Macroeconomics and Health in the years to come.

Dr. Agostino Borra
WHO Representative to Sri Lanka

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The Secretariat of the National Commission on Macroeconomics and Health wishes to extend its grateful thanks to Hon Nimal Siripala de Silva, Minister of Healthcare & Nutrition who has given the necessary encouragement and leadership to complete the work of the Commission successfully. We are also grateful to Mr. P. Dayaratne (former Minister of Health), and Mr. Bandula Goonewaredena (former Deputy Minister of Finance), who were co-chairs at the initiation. We acknowledge the support of the members of the National Commission who contributed their expertise to the Commission.

The Commission would like to place on record its gratitude to all those who shared their thoughts and ideas with us – researchers, professionals and academics, government officials and Non Governmental organizations.

Special mention should be made of Dr. Reggie Perera, former Secretary of Health & Welfare, who spearheaded this initiative from the very commencement. Our thanks are also due to Mr. Ranjith Maligaspe, Secretary/Healthcare & Nutrition, Dr. Nihal Jayathilaka, Additional Secretary/Medical Services, Dr. Athula Kahandaliyanage, Director General of Health Services for their unstinted support. We gratefully acknowledge the contribution made by the officials of the Ministry of Finance and Planning and the Finance Commission.

Our special thanks are due to WHO who provided the stimulation, technical support and above all funds for the purpose. We also thank Prof. Jeffrey Sachs Chairman and Dr.Sergio Spinaci, the Executive Secretary of the Global Commission for their contibution and their participation at the inaugural meeting of the Commission.

Our grateful thanks are also due to WHO Headquarters, Geneva and Regional Office of the South East Asia Region for providing the necessary technological support and funds. We have to thank Mr. B.S.Lamba of the WHO SEARO office for the continuous persuasion and advice given to us.

We also thank Dr. Kan Tun, former WHO Representative to Sri Lanka and Dr. Agostino Borra, the present WHO Representative to Sri Lanka for their magnanimous support. We are indebted to the individuals and organizations who directly supported us to develop the reports of the

Research studies and Working Group reports and the documents on "Macroeconomics and Health Initiatives – Sri Lanka". We extend our grateful thanks to the Planning Committee and Core Group members: Dr. Reggie Perera Former Secetary Health & Welfare, Mr.Ranjith Maligaspe Secretary Healthcare & Nutrition, Dr. Kan Tun former WR to Sri Lanka, Dr. Agostino Borra WR to Sri Lanka, Dr. Palitha Abeykoon WHO Consultant, Dr. Ravi Rannan-Eliya, Dr. Nimal Attanayake Head of Economics Department of the University of Colombo, Dr. Amala de Silva Senior Lecturer, Economics Department of the University of Colombo, Dr. Thushara Fernando WHO National Professional Officer, Dr. H.S.B. Tennakoon former Deputy Director General Planning and Ms Myrtle Perera of Marga Institute, for their vital support.

Word of thanks for those who provided editorial assistance: Dr. Ms Pat Alailima (former Director General National Planning), Dr. Ms Amala de Silva, Dr. Ravi Rannan-Eliya, Dr. Palitha Abeykoon and the Institute for Health Policy .

We would like to thank Dr. D. Vartharajan, Associate Professor of Sri Chitra Thirinal Institute for Medical Sciences Technology for providing consultancy services to the Commission, specially in the development of the Commissions technical report.

The Commission also offers thanks for the secretarial assistance rendered by Mrs. Shantha Perera (former Asst. Director Planning) Mrs. Samanthi Ratnayake and Dr. Anuruddha Jayasekera.

Dr. Sarath. M. Samarage

Director - Organisation Development and
Co-ordinator, National Commission on
Macroeconomics & Health

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by Authors of Review of Costing Studies

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Our special thanks to all authors who shared their documents with us: this study would not have been possible without your cooperation. Thanks too to the librarians at the Postgraduate Institute of Medicine and the Sri Lanka Medical Association for their assistance in accessing theses and articles.

We thank you, Dr Kalaichelvan, for your Research Assistance in the early stages of this study. Our sincere thanks also go to Mrs Shantha Perera and Mrs Samanthi Ratnayake for their administrative support on this project.

EXECUTIVE SUMMARY

This study, commissioned by the National Commission on Macroeconomics and Health (NCMH), was proposed as a means of assessing the availability of data relating to health care costs, to the individual and the health system in Sri Lanka It has as its objectives the assessment of cost studies from a methodological perspective; the highlighting of gaps in cost information so as to guide future research; and the provision of guidelines regarding alternative strategies and 'best practices' in costing exercises. The methodology adopted in this review consists of four steps: the first step involved identifying material; the second reviewing the material; the third step is the validation of the studies by examining the methodology adopted and assessing the empirical validity of the results presented; and finally dissemination of the study results, through this report and a workshop to be held in the future.

The study begins by listing out the varied uses of costing. It then considers the different classifications adopted in the costing literature: defining by approach, time, form, focus, function, method of cost apportionment and coverage. The two major approaches to costing are discussed in the next sections: that of using actual cost values based on aggregative and disaggregated data (both the step-down approach and the bottom-up approach) and the scenario building technique which is of particular importance in contexts where the availability of cost data is poor.

The three main chapters of this report: Costing of Hospitals/Wards, Costing of Diseases and Costing of Interventions and Services are all organized in the same manner. The first section lists the studies, providing information on the publication details of the studies, their objectives and methodology and highlighting the importance of each study. Many of the studies appear in more than one chapter so cross-references are provided in parentheses. The next section focuses on methodological issues. The third and fourth sections are devoted to comparing the methodology adopted by the studies and their results. The fifth section presents the policy conclusions emerging from the studies while the last section provides a critique of the studies.

Under costing of hospitals/wards 12 studies are reviewed. Of these three studies deal with the same multiple hospital data set covering four districts:

Griffin, Levine, and Eakin, (1994), Samarasinghe and Akin (1995) and Somanathan (1998) while Somanathan et al (2000) covers institutions in seven districts. de Silva and Attanayake (1992) covers Central Dispensaries in three selected MOH areas in the Gampaha district while at the other extreme, de Lanerolle (1996) calculates OPD costs at the Colombo South Teaching Hospital. de Silva. Dalpatadu. Samarage and Das (1997) looks at a single ward, the Merchants Ward at the NHSL; Kasturiratne (2002) at the Professorial unit at Ragama hospital, and Jayatissa at the ICU of the Lady Ridgeway Hospital (LRH). de Silva (1994) focuses on the LRH as a whole, as does Edirisinghe (2007) on District Hospital Dompe and Siriwardena (1998) on the Base Hospital Gampola.

The main conclusions emerging from the studies in this chapter are as follows: unit costs are highest in tertiary care facilities; lower level facilities have relatively higher costs due to low occupancy, turnover and utilization; many factors other than these affect unit costs including issues of hospital management, staff management and organizational environment covering such aspects as location of the hospital, competition and community support; staff and drug costs are the major components of unit costs; and significant variations in cost exist across different hospitals and even different wards in the same hospital. In critiquing the studies three major aspects are highlighted: the lack of comprehensiveness in the inclusion of cost elements, the need for validating and standardizing apportionment criteria and the treatment of capital.

Costing of diseases covers 26 studies: with malaria being the most studied disease (8 studies). Other communicable diseases focused on are diarrohea, tuberculosis and HIV/AIDS. Under non-communicable diseases studies have been done on asthma, hypertension, heart disease, diabetes, stroke, cirrhosis, dental caries and mental illness. Road traffic accidents and snake bite are also covered. Studies involving inpatient, outpatient, ICU and surgical interventions and community and household surveys are also included.

The main conclusions drawn from these disease studies are as follows: indirect costs are a significant share of patient costs; travel costs are a major element of direct costs; inpatient care costs are not significantly greater than outpatient care costs; even public sector utilization involves treatment costs; special food imposes a high direct cost and ritual costs are significant in the case of chronic illness. Critiquing the studies with

regard to statistical and methodological concerns it is noted that the use of averages could often be misleading; that differences in apportionment criteria make comparison between studies complex and the inclusion of cost elements is often not comprehensive. In the context of content it is noted that while a wide range of diseases are covered by these studies many more diseases need to be considered. The need for considering both systemic and household costs is stressed as are the ethical and equity concerns arising from such studies.

The final main chapter involves costing of intervention and services. This covers 19 studies. Among the methodological issues raised in this chapter are scope, incorporating effectiveness and quality, scenario building and time apportionment. The areas covered by these studies are deliveries, MCH services, estate health services, immunization, child nutrition, surgery, drugs, laboratory investigations, x-rays, scans, EEG, ECG, blood transfusion, provision of food, overtime, HIV/AIDS prevention, Malaria control, Cosmetics, Devices and Drugs regulation and regulation of the private sector. Two policy conclusions are reached in general relating to these studies: utilization rates significantly affect costs and staffing patterns have a major impact on costs. Many more areas need to be covered under this heading in the future. The major shortcoming highlighted in many of these studies is the lack of comprehensiveness in the inclusion of cost elements.

The final chapter, chapter 6, is the conclusion. The first part is devoted to summary and conclusions while the latter part focuses on proposals for future costing exercises.

CONTENTS

Chapter 1
INTRODUCTION

1.1 BACKGROUND

The Report of the Commission on Macroeconomics and Health (CMH) (2001) brought into sharp focus the gap between the health financing needs of countries and their present levels of financing. In the case of Sri Lanka, the historical trend shows public health expenditure as a percentage of GDP to be declining, while health transition and growth in technology have been imposing greater needs, thus widening the gap in health care financing (WHO, 2002). While increasing the health expenditure to GDP ratio as proposed by the CMH seems crucial, the extent to which it needs to increase would depend largely on the cost of health care in the country and its future epidemiological profile.

This study, commissioned by the National Commission on Macroeconomics and Health (NCMH), was proposed as a means of assessing the availability of data relating to health care costs, to the individual and the health system in Sri Lanka. Such cost information, relating to institutions, diseases and interventions was considered to be crucial in supporting future budgeting and planning exercises. While many cost studies have been undertaken in Sri Lanka, with many being done during the past five years, information gaps still remain in some areas of the health system, that prevent the derivation of national cost estimates. This study therefore also hopes to identify such lacunas.

In addition in reviewing the cost studies undertaken post 1990, this study attempts to examine the appropriateness of the methodology adopted as well as the validity of the results. The study seeks not only to assess Sri Lankan cost studies from a methodological perspective and to highlight areas where future research on costing would be welcome, paving the way to a comprehensive national costing database, but also to provide guidelines relating to alternative strategies and 'best practices' in costing exercises that would encourage further research. The central tenet of this latter exercise is 'ballpark' figures are better than no information.

1.2 JUSTIFICATION

This study was proposed in order to create a database of cost information with regard to the health system in Sri Lanka. Given the expected escalation of costs arising from health transition (resulting both from demographic and epidemiological transition), and the current difficulties faced by the government in raising revenue, such cost information would prove useful at a macro level in identifying the resource gap and projecting future costs of providing health services, and at a micro level for facilitating the evaluation of alternative approaches to financing particular components of the health system and for identifying possible areas of cost curtailment.

The interest in costing studies, as reflected by the number of studies in the recent past, is encouraging and this seems to be an appropriate time to assess these cost studies from a methodological perspective. Providing guidelines with regard to costing exercises could prove useful in guiding future work as well as in stimulating further debate among practitioners. This has led to the study report taking a 'prescriptive' stance in addition to its central task of analysis. This however does not mean that there is a 'single' infallible strategy in costing exercises but rather that alternative strategies exist in dealing with the numerous complexities arising from carrying out costing studies in contexts where regularly collated empirical data is limited.

1.3 OBJECTIVES

This study has as its objectives

- the assessment of cost studies from a methodological perspective;
- the highlighting of gaps in cost information so as to guide future research;
- the provision of guidelines regarding alternative strategies and 'best practices' in costing exercises.

At one level this study is an attempt to compare and contrast the different methodologies adopted in cost studies and to evaluate their appropriateness in their specific contexts. At a more general level the research report also seeks to be a manual for costing: an attempt to educate potential researchers on the alternative approaches and strategies that can be adopted in carrying out cost studies.

1.4 METHODOLOGY

The methodology adopted in this review consists of four steps.

The first involved identifying material through perusing lists of publications and theses, accessing electronic databases and discussions with researchers known to have worked on cost issues (i.e. snowballing using their personal knowledge of the field and bibliographies from their publications to identify other researchers). At present, 44 studies have been identified by these means, many of which are theses. In many instances we have been able to get the hard copies of the studies in their entirety; in the case of some theses where library regulations bar photocopying, and in cases where costing is only one among many issues considered we have gone through and made summarised versions while a few studies still remain untraced (see Appendix 1). The printed material collated during the study will contribute to the creation of a costing archive to be located in the Planning Unit of the Ministry of Health, which would be helpful to future researchers in the field.

The study does not review reports and theses which only focus on one cost element, the drug cost of disease treatment for example. In particular, it is considered to be important to focus on staff costs, and only studies that have attempted to value time as well as materials have been included in the review. Studies that involve aggregate costing, that do not attempt to merge utilization with macro level costing, are also not reviewed in this study. Nor does it present cost projections.

The second step involved reviewing the material. Many approaches can be adopted for categorizing the studies such as the issue being studied (disease, intervention or institution); location (whether ward, hospital or field); unit of costing (individual or institution); and type of costing methodology (actual, scenario building or a combination of both methodologies). This study will present the analyses based on the issue being studied under the following headings: hospital/ward, disease and intervention and services.

The third step involves the validation of the studies. This takes two forms. The first is examining the methodology adopted: to examine which cost elements are considered, what methods are adopted for disaggregating data by cost centres and what assumptions are used in scenario building. The second is to assess the empirical validity of the results presented, including comparison where possible with other study results.

The final step will be the dissemination of study results. This report will have chapters corresponding to the costing of hospital/ward, disease and intervention and services as well as sections for discussing costing methodology and the challenges posed by such work. A workshop to discuss costing methodology involving researchers currently working on costing studies and potential researchers in this field is also envisaged.

1.5 LIMITATIONS

Two types of limitations arise in such a study. Firstly though all possible measures have been taken to trace all the studies done on costing since 1990, we may inadvertently have overlooked some studies. If you are aware that such a shortcoming has occurred we would appreciate it being brought to our notice so that we could include the study in the costing archive. Even where we have references to some studies (see Appendix 1), these studies could not be traced in the given time period, partly due to the Post Graduate Institute of Medicine (PGIM) library collection of theses being incomplete. Here again assistance in tracing such studies would be appreciated. Secondly, an analysis of this form is by nature idiosyncratic in its choice of elements to focus on, and in its perspectives on methodology. The investigators reiterate once again that the proposals made with regard to costing methodology are intended to be useful guidelines and suggestions rather than perfect solutions or directives.

1.6 STRUCTURE OF THE REPORT

The introduction focuses on the reasons for undertaking a review of costing studies post 1990 in Sri Lanka. It justifies the need for such a study (section 1.2) and the objectives of the researchers in undertaking such a task (section 1.3) while highlighting the inherent limitations of such an endeavour (section 1.5). Section 1.4 has details of the methodology adopted in this review of cost studies.

Chapter 2 relates to costing methodology: the varied purposes of costing (2.1), the different classifications involved in costing (2.2) and the forms of costing: costing based on empirical data which can follow either the step-down or bottom up approaches and scenario building (2.3).

The three main chapters of this report: Costing of Hospitals/Wards, Costing of Diseases conditions and Costing of Interventions and Services are all organized in the same manner. The first section lists the studies, providing

information on the publication details of the studies, their objectives and methodology and highlighting the importance of the study. Many of the studies appear in more than one chapter so cross-references are provided in parentheses. The next section focuses on methodological issues. The third and fourth sections are devoted to comparing the methodology adopted by the studies and their results. The fifth section presents the policy conclusions emerging from the studies while the last section provides a critique of the studies.

The final chapter, the conclusion presents the overall conclusions of the study: highlighting areas for future costing research and methodological concerns.

Chapter 2
COSTING METHODOLOGY

2.1 PURPOSES OF COSTING

In considering the health system as a whole, both the systemic costs borne by the state and the direct and indirect costs borne by households are of importance, since it is the total costs that determine optimal provision, allocation and utilization of health services. Therefore in listing the purposes of costing no distinction has been made about the source of financing.

- To facilitate prioritization of programmes at national and institutional level.
- To provide criteria for decision making at an institutional level.
- To guide health care providers in making decisions.
- To provide a rationale for future budgeting exercises.
- To estimate the resource gap in meeting present and future health needs.
- To provide a basis for projecting future costs.
- To measure and assess efficiency in service provision: allocative efficiency, technical efficiency, economic efficiency.
- To identify optimal service provision levels.
- To identify optimal service utilization levels and patterns.
- To assess equity through comparison of unit costs.
- To evaluate the performance of health care institutions in the public and private sectors.
- To comparatively assess the performance of similar health care units or wards.
- To comparatively assess the performance of case mix adjusted health care units or wards.
- To conduct historical comparison of health care costs.

- To provide an empirical basis on which to implement cost recovery.
- To determine profitability of health providers.
- To identify functional deficiencies.
- To provide information to assist in evaluating alternative financing options.
- To assess the cost effectiveness of alternative programmes and proposed new interventions.
- To monitor trends in health care expenditure.
- To contribute to the Management Information System (MIS) database.
- To promote accountability.
- To create transparency.
- To identify elements for cost curtailment.
- To assess patient satisfaction.

2.2 TYPES OF COST

2.2.1 Defined by approach

Direct Cost: Cost of providing and accessing health services: i.e. cost of providing health care through the health system, travel costs for the household, cost of drugs and investigations etc.

Indirect Cost: Missed opportunities arising due to illness or while seeking/ receiving treatment: i.e. lost earnings due to hospital visits or hospitalisation, lost earnings due to mortality.

Psychic Cost: Cost of emotional burdens imposed by illness, such as anxiety, pain and depression.

2.2.2 Defined by time

Fixed Costs: Costs that are borne in the short run irrespective of the level of occupancy: most personnel costs for example fall into this category. Long-run fixed costs include costs of buildings and equipment.

Variable Costs: Costs that differ according to the level of occupancy – for instance cost of food, laundry.

2.2.3 Defined by form

Recurrent costs: Consists of all operating costs associated with a health facility including personnel, supplies, utilities and maintenance costs.

Capital costs: Consists of all building, machinery and equipment costs.

2.2.4 Defined by focus

Private Costs: Costs relating to the individual/organization within a market context, taking into consideration only the marginal benefits and costs of the unit under consideration.

Social Costs:
Involves the impact on society including taking into consideration externalities: for example pollution creating health hazards that adversely affect the population in the area.

2.2.5 Defined by function

Treatment Costs: Relates directly to costs involved in treating the patient – i.e. drug costs, equipment costs, diagnostic costs. Treatment costs per patient vary from day to day, tending to peak in the first few days of a hospital stay and then gradually tapering off.

Hotel Costs: Relates to costs borne in the process of providing treatment that are not directly linked to the desired improvement of health status, for instance cost of linen and catering. Hotel costs per person generally tend to be constant for each day throughout the patients stay.

2.2.6 Defined by cost apportionment

Direct: Costs involving a single cost centre.

Indirect: Costs relating to multiple cost centres, also known as overhead costs.

2.2.7 Defined by coverage

National: For the country as a whole.

Regional: For example a state or province.

District/Division: Could relate to administrative as well as geographical boundaries.

Town/Village/Municipal Area/Community: Specified locality.

2.3 FORMS OF COSTING

Two main costing methodologies can be adopted: that of directly using actual empirical information and the use of the scenario building technique. Using empirical information directly is obviously the superior strategy but in practice many difficulties are faced in adopting this approach. Often information on the cost of particular items such as buildings and equipment are unavailable. Even information with regard to dates and sources of purchase are not maintained. This creates problems in determining the annual value of such capital items, taking account of depreciation.

Problems also exist with regard to disaggregation of data by cost centres. The costs incurred for utilities such as water and electricity are not maintained on a ward or intervention basis and therefore difficulties arise in allocating such costs to cost centres. In the case of human resources as well there are often instances of staff sharing and of multi-task personnel, which creates problems in estimating costs for specific programmes or wards. These problems encourage the use of the Scenario building technique of costing (first discussed in de Silva, Dalpatadu, Samarage and Das, 1997) described below.

2.3.1 COSTING ACTUALS

Costing based on actual expenditure takes two main forms: the aggregate method and the disaggregate method. In practice, there is a trade-off in the use of the different methods: the aggregate method allows for the coverage of a large number of hospitals, while the latter allows for in-depth collection of data on a limited number of institutions.

The aggregate method merely involves combining expenditure information in relation to an institution or geographical location with performance indicators corresponding to the same institution or area, in order to calculate average costs. The expenditure information can either be the allocation of financial resources to the hospital from the centre through the budget, or the aggregate expenditure of the institution ex-post. Assumptions about relative resource intensity of different activities (e.g. outpatient visits and inpatient days) (Somanathan et al, 2000) are used to disaggregate the expenditure by activity in order to estimate average costs. Somanathan et al (2000) highlights the fact that a disadvantage of such studies is that they produce an estimate of average cost, but not marginal costs, so limit the extent to which the results can be

used to make inferences about conventional measures of economic efficiency such as economies of scale and scope.

The disaggregate method can involve two approaches: the step down approach and the bottom up approach.

(a) Step down approach

Step down studies examine ex-post hospital expenditures (Somanathan, 1998).

In most instances hospital cost data can only be gained in an aggregate form: for a hospital or a programme per se. The need to disaggregate cost data by ward or service then becomes a challenge. The step-down approach involves scrutiny of the hospital production process to enable the best assignment of costs to the outputs to which they are related. All hospital expenditures are attributed to specific departments (cost centres), and then allocation criteria, such as time use, are adopted to distribute all costs to final service categories, such as admissions or patient days (Barnum and Kutzin, 1993). The problem arises because not all costs accrue according to scale. In particular, differences in case mix can make a tremendous difference not only with regard to drug costs and equipment but even with regard to electricity, water and nursing time. This costing system is important in taking into consideration the interdependence of the different inputs into healthcare in a hospital setting, as in the impact of administration or security on patient care.

Detailed step down costing, where costs are attributed to all wards and departments in a hospital, is time consuming and can only be used when a small number of health facilities are under consideration. Therefore most studies which involve large samples allocate costs only to two main departments: inpatient and outpatient care.

(b) Bottom up approach

The bottom up approach involves using actual detailed resource use as recorded for each patient (for example use of Bed Head Ticket information) and costs are applied to each resource unit.

The bottom up approach is hardly ever practiced given that developing countries where computers are a luxury, rarely maintain detailed records at ward level. The Scenario-building approach discussed below takes the bottom up approach as its basis but substitutes assumed values of the different cost components for the non-existent disaggregated actual values,

like salaries, equipment costs and/or services such as the provision of hospital food.

2.3.2 COSTING THROUGH SCENARIO BUILDING

An important methodological aspect of the Scenario building approach is that it allows one to generalize from the observation of individual units of output, as in the case of working out the cost of caring for a 'representative' patient with a specific disease (what equipment and medication were involved, patient diet and what facilities were available to the patient) or the provision of an intervention to a 'representative' individual (i.e. immunization – what systemic costs were incurred in its provision such as staff time and cost of vaccine and what patient costs were incurred in the form of waiting time, travel time and cost etc.) without necessitating large scale surveys. This approach is particularly useful as a means of gaining a modal estimate of costs or the end (extreme) points of a costing range rather than the average cost estimate.

This methodology involves four steps. The first is to list out all the known relevant physical or personal characteristics (i.e. in the case of costing a ward the dimensions of the ward, the building materials used, the number of patients, the furniture provided, the diet sheet etc. and in the context of costing the lost earnings of a disease, information relating to age, sex, income, employment and education profiles of the patients). Secondly the list of assumptions adopted has to be explicitly stated (i.e. how is staff time allocated, life time of equipment in the case of costing wards; duration of illness/age at death in calculating lost earnings). These assumptions can be based on experiences in other countries or contexts, the views of experts in specific areas (medical as well as non-medical such as engineers, land brokers or caterers) and in some cases merely rule of thumb (i.e. equal allocation of staff time to all patients on a ward). The third step involves combining empirical information and assumptions to reach cost estimates. The final step involves validation of the cost estimates derived in this manner and the understanding of the limitations arising from the use of assumptions in the Scenario building technique (i.e. use of mid-points of salary ranges in determining staff salaries, choice of life spans or discounting rates). While this method of costing is obviously prone to the idiosyncrasies of the researcher, the practicality of this approach has led to its use, sometimes in conjunction with the use of actual empirical data, in many studies.

Chapter 3
COSTING OF HOSPITALS AND WARDS

3.1 STUDIES UNDER CONSIDERATION

(1) de Silva, U.H.S and Attanayake, Nimal (1992) Study on Utilization of Resources at Peripheral Health care institutions in Gampaha District, Mimeo (also see Chapter 4).

Study Objectives: Identify factors affecting utilization of resources at peripheral health care institutions with a view to exploring priority issues that have to be addressed in order to achieve an efficient resource allocation and utilization pattern at those institutes.

Methodology: The work involved identifying specific services/activities in peripheral health care institutions where under utilization is acute, identifying causes, nature and extent of underutilization and determining the magnitude and direction of the interrelationships between the causal factors identified and the level of utilization. As part of the analysis costing of Central Dispensaries (CD) in three selected MOH areas in the Gampaha district were carried out. Cost information collected on salary, drugs and other expenditure from the respective CDs and from the government medical stores.

Importance of the Study: Relating utilization to average cost of Central Dispensaries.

(2) de Silva, Amal Harsha (1994), Cost Analysis of Patient Care at the Lady Ridgeway Hospital for Children, The Sri Lanka Journal of Medical Administration, Official publication of the College of Medical Administrators of Sri Lanka, Vol. 1 No. 1, November 1994 (also see Chapter 5).

Study Objectives: Obtaining unit costs for different wards at Lady Ridgeway Hospital with a view to comparing costs and identifying alternative means of cost reduction, and using this information to sensitize consultants and others so as to direct their decision making and to develop

an accounting method that will make cost information such as per patient day cost easily accessible.

Methodology: Analysis based on allocated funds and patient census. Costs allocated to different locations, using different apportionment methods on an item by item basis (e.g. labour costs according to staff numbers, utilities according to utilization criteria and maintenance type costs on a square area basis).

Importance of the study: The earliest attempt to cost hospital services in Sri Lanka. This study covers the entire activities of the Lady Ridgeway Children's Hospital, a tertiary hospital.

(3) Griffin, Charles C., Levine, Ruth E. and Eakin, B. Kelly (1994) Government and private healthcare facilities in Sri Lanka: conditions, utilization, costs and revenues: Descriptive analysis of Sri Lanka Health Facility Survey 1992, World Bank, Washington.

Study Objectives: Assessing cost of providing health services in both government and private sector, through calculating cost per OPD visit, cost per bed day, unit cost of physicians and other para-medics time and distributed cost of overheads, capital charges etc.

Methodology: Collecting data on 341 government and private health facilities in four districts: Colombo, Matale, Galle and Polonnaruwa. A full facility census of private providers was undertaken for Matale and Polonnaruwa. For Colombo and Galle survey restricted to major state and private sector institutions providing Western and Ayurvedic care (all state facilities and an equal number of randomly sampled private sector facilities). Data collected on number of beds, floor area, staffing profiles, equipment and utilities, hours of operation of OPDs, utilization figures (occupancy rates and number of admissions per month for inpatient facilities and average number of outpatients seen), service specific indicators for Western style medical services (Medical, Surgical, Paediatric, Obstetric patients) and for OPD services (MCH visits, immunization, screening, pharmacy and other services). Both capital and recurrent data collected but due to data problems only recurrent costs were used in the analysis. The study estimates proportions of all non-capital costs devoted to outpatients and inpatients and by service (medical, surgical, obstetric and paediatric) not according to any actual hospital budget data but by using estimates provided by facility managers.

Information on health facility revenues were collected as well. Healthcare institutions analysed as complex, basic and OPD care.

Importance of the Study: Detailed costing of different types of health facilities in the government and private sector.

(4) Samarasinghe, D. and Akin J (1995) Report of the Health Strategy and Financing Study, Report of study undertaken at the request of the Ministry of Health with the support of the World Bank, Colombo, Sri Lanka (also see Chapter 4).

Study Objectives:

(1) compile a comprehensive database on availability of health services, including prices charged and use of services, the cost of such services and on the demand for various services including patient's ability to pay, (2) to analyse the causes of various problems currently affecting the health care system in Sri Lanka, especially as they relate to health care financing, and (3) examine various policy options, both from the vantage points of improving efficiency and equity of service provision.

Methodology: Three surveys conducted: household survey to document health status of individuals and to study determinants of health use; facility survey to determine levels of service and cost and an epidemiological survey to gauge need for care in relation to actual use. Data collection restricted to four districts: Polonnaruwa, Matale, Galle and Colombo. This study reports on the same data set and methodology adopted in Akin et al (1994) (see above) and incorporates the results generated from the health facility survey.

Importance of the Study: More detailed discussion than Akin et al (1994) regarding the costing of health facilities.

(5) Jayatissa, K.L.R (1995) An analysis of patient care cost for selected preventable diseases in Intensive Care Unit at Lady Ridgeway Hospital in 1992, Thesis for MSc. Community Medicine, Post Graduate Institute of Medicine, University of Colombo (also see chapter 4).

Study Objectives: To study patient care costs for selected preventable diseases in the Intensive Care Unit (ICU) at Lady Ridgeway Hospital (LRH) in 1992 by.

- Studying the case mix of preventable diseases in the ICU in 1992;
- Ascertaining the total number of ICU patient days with preventable diseases in 1992;
- Calculating the total cost of resources utilized by patients with preventable diseases admitted to the ICU in 1992.

Methodology: This retrospective descriptive study was carried out in order to cost intensive treatment necessitated by patients with preventable conditions admitted to the Lady Ridgeway Hospital, Intensive Care Unit, in the period from January 1st to 31st December 1992. All patients admitted to ICU were listed with diagnosis and the following diagnoses were deemed 'preventable': birth asphyxia, low birth weight, encephalitis, dengue haemorrhagic fever, gastro enteritis, tetanus and neonatal tetanus, complications of typhoid fever, complications of worm infestation, tuberculous meningitis, congenital rubella syndrome, cerebral malaria and poisoning. A checklist was used to collect data from the Bed Head Tickets (BHTs). Hospital costs: fixed, semi fixed and variable, were collected from ledgers and through empirical observation.

Importance of the study: Focusing on 'preventable conditions' and the costing of an ICU.

(6) D.L de Lanerolle (1996) Cost Analysis of Patient Management in an Out Patient Department and Study of the Impact of a Cost Awareness Programme on Prescribing Practices, Thesis submitted for the Degree of Doctor of Medicine in Community Medicine, Post Graduate Institute of Medicine, University of Colombo (also see chapter 5).

Study Objectives: Focuses mainly on drug costs but includes an exercise to cost recurrent costs of an OPD visit to the Provincial Hospital Colombo South.

Methodology: In costing an OPD visit it uses the step down technique. The study considers only recurrent expenditure.

Importance of the Study: Focusing on drug costs that are a major share of recurrent OPD costs.

(7) de Silva, Dalpatadu, Samarage and Das (1997) Assessment of the prospects of Paying Wards in government hospitals as complementary financing for hospitals, study funded by WHO, Monograph, Colombo.

Study Objectives: Costing of a patient day in a paying ward (Merchants Ward, National Hospital of Sri Lanka) to compare the cost with the room charges, in order to evaluate the relevance of the charges imposed and to assess the potential of paying wards as complementary financing for government hospitals.

Methodology: Scenario building technique was adopted as no disaggregated cost data existed for the Merchants Ward, National Hospital of Sri Lanka. This involved combining empirical information with assumptions in order to carry out the costing exercise. A 'representative patient day' was focused on (a patient post diagnosis with Diabetes Mellitus as the medical case, and a patient who underwent a laporatomy for intestinal obstruction the previous day as the surgical case). Surgery and investigation costs are not included. The choice of condition only affects the drug, equipment and material costs. Current value of land, building, equipment and furniture etc. were used with linear depreciation and materials with an assumption of equal usage across patients. Mid point of salary ranges were used in calculating staff salaries. Treatment protocol was taken from the BHT.

Importance of the study: Use of the scenario building technique.

(8) Somanthan, Aparnaa (1998), Unit Cost Analysis of Public and Private Health Facilities in Sri Lanka in 1992, Institute of Policy Studies of Sri Lanka, Health Policy Programme Occasional Paper No 06

Study Objectives: Obtain estimates of the costs of providing health services in inpatient and outpatient facilities in both government and private sectors. Service indicators (bed-occupancy rate, bed turnover rate and average length of stay) used to assess performance of health facilities.

Hypotheses:
(1) Tertiary facilities are higher in cost than lower level facilities;
(2) Small inpatient and outpatient units are least costly;
(3) Public facilities are less costly than private ones.

Methodology: Based on information collected during the World Bank Health Facility Survey of 1992 (same data used in Griffin et al (1994) and Samarasinghe and Akin (1995) but involving recalculation). Sample of 781 government and private hospitals and clinics in four districts of Sri Lanka: Colombo, Galle, Matale and Polonnaruwa (both Western and

Ayurvedic care). Cost per bed day available, bed-day occupied, admission and outpatient visit were estimated for complex inpatient, basic inpatient and outpatient categories. A comparison of results with that of Griffin et al (1994) presented in the study.

Importance of the study: The study calculates unit costs across the different types of public and private hospitals, classified as basic and complex (defined as involving at least three of the following: radiography equipment, operation room, intensive care unit and central sterile supplies division).

(9) Siriwardene, K.A.R.S (1998) Cost analysis of indoor treatment at Base Hospital, Gampola, Sri Lanka, Dissertation submitted for MSc. in Medical Administration to the Post Graduate Institute of Medicine, University of Colombo (also see chapter 5).

Study Objectives: In-depth cost analysis of the Base Hospital, Gampola, focusing on issues such as cost of indoor treatment and specialized care (per patient day/per admission/per bed day), cost of interventions such as surgery, delivery and blood transfusions and analyse cost composition and utilization patterns, cost of manpower, evaluate efficiency of management of inpatient care services.

Methodology: Gampola Base hospital was selected for this study. This hospital caters to an ethnic mix and covers mainly the middle income group. Retrospective cost information for one year was used in this analysis. Only recurrent expenditure was focused on in relation only to indoor care. Unit costs were calculated for inpatient care in different wards as well as the cost of minor and major surgery, normal and caesarean deliveries and blood transfusions.

Importance of the study: Focusing on general and specialized care in a Base Hospital.

(10) Somanathan, Aparnaa, Hanson, Kara, Dorabawila, Tamara and Perera, Bileesha (2000) Operating Efficiency in Public Sector Health Facilities in Sri Lanka: Measurement and Institutional Determinants of Performance, Partnerships for Health, Small Applied Research Paper No. 12, Bethesda: ABT Associates Inc.

Study Objectives: The Objectives of the study are as follows:

(a) To explore different methods for quantifying the magnitude of technical and economic efficiency in service provision by public sector providers.
(b) To identify institutional and behavioural factors which explain differences in efficiency.
(c) To develop and evaluate policy options at different levels of the health care system to improve the performance of public sector providers.
(d) To identify factors that explain why unit costs in Sri Lanka's Ministry of Health facilities are lower than in other comparable developing countries.

Methodology: Survey of 218 healthcare facilities in seven districts (Colombo, Galle, Matale, Polonnaruwa as in the previous World Bank survey and Kurunegala, Badulla and Ratnapura), representing one district from each of the seven provinces other than the North East in 1998, using an extended form of the questionnaire used in 1991 in the World Bank survey. Average costs calculated using the direct allocation method. In facilities involving inpatient and outpatient care, costs allocated according to the following procedures: staff costs of OPD and inpatient doctors separated out and for those involved in both sections of the hospital salaries allocated on the basis of a time study carried out in 20 facilities; drug costs assigned on the basis of a study carried out on the use of 50 selected drugs by OPD and inpatients in a month; other costs such as overhead costs including maintenance and utilities allocated in the same proportion as the total salary and drug cost ratios. Teaching Hospitals and specialized hospitals classified as complex; base hospitals and hospitals that have one or more of the following four facilities (radiology unit, intensive care unit, blood bank and central sterile supplies division) classified as intermediate facility; basic inpatient if they do not have any of these four facilities; outpatient refers to those facilities that have only outpatient care other than Medical Officers of Health and MCH units. Management characteristics were determined through a questionnaire and structured interviews with facility managers. Structural quality was assessed through specially developed indicators based on the availability of equipment. Questions relating to physical environment such as cleanliness and smell were used to proxy quality of service.

Importance of the study: The emphasis on identifying the determinants of unit cost and measuring efficiency based on cost analysis. The study covers a large sample of hospitals in seven provinces. It is important in relating structural quality and quality of service indicators to cost of services.

(11) Edirisinghe, E.A.K.K (2002) Cost analysis of patient care services at the District Hospital – Dompe- 2002, Dissertation submitted for MSc. in Medical Administration, PGIM, Colombo, Sri Lanka (also see Chapter 4)

Study Objectives: To analyze the cost of patient care services at the District Hospital, Dompe.

- To calculate the average cost of care provided to an individual indoor patient at the District Hospital, Dompe.
- To calculate the average cost of care provided to an individual outdoor patient at the District Hospital, Dompe.

Methodology: Collection of cost information in each ward (recurrent and capital costs), using checklists and some elements of scenario building and entering the data into spreadsheets. Data was collected over three months to minimize impact of seasonal/unusual variation. Data on household costs collected as well.

Importance of the study: The costing of inpatient and outpatient activities of an entire District Hospital (the apex of primary healthcare) from a systemic and a household perspective.

(12) Kasturiratne, K.T.A.A (2003) Morbidity pattern and socio-economic burden of non-communicable diseases at tertiary care level, Dissertation submitted for MSc. in Community Medicine, PGIM, Colombo, Sri Lanka (also see Chapter 4).

Study Objectives: Estimation of the cost a patient day in a medical ward.

Methodology: Data was collected in relation to the Professorial medical unit at the North Colombo Teaching Hospital. Current prices of land, building, furniture and equipment were used (replacement approach). Linear depreciation adopted. Electricity, water, telephone charges allocated according to the ratio of ward patient days to total patient days in a given period. Meals, laundry and housekeeping costs included (scenario-building techniques adopted). Staff costs allocated according to inpatient/outpatient

duty. Disease specific treatment costs (cost of medication, therapeutic procedures and investigations) were not considered under this exercise but cost separately.

Importance of the study: This section of the study involves a detailed analysis of costs on a medical ward in a tertiary hospital.

3.2 METHODOLOGICAL ISSUES

3.2.1 COMPLEXITY OF INSTITUTION

In the costing of hospitals two different approaches can be adopted. The first involves costing a single institution as in de Silva's study of Lady Ridgeway Hospital (1994), Siriwardena's study of the Gampola Base Hospital (1998) and Edirisinghe's study of the Dompe District Hospital (2002). The World Bank survey related studies: Griffin et al (1994), Samarasinghe and Akin (1995) and Somanathan (1998) as well as Somanathan et al (2000) on the other hand carry out costing exercises involving a large number of hospitals at primary, secondary and tertiary level with the results being used to estimate average and in some instances marginal costs across a range of hospitals.

Some studies involve the costing of specific wards as in Kasturiratne's study of the Ragama Medical Ward (2003), de Silva, Dalpatadu, Samarage and Das's estimation of the costs at the Merchants Ward in the General Hospital (1997) and Jayatissa's study of the Intensive Care Unit at the Lady Ridgeway Hospital (1995).

Comparison of the results of these studies is a complex task. Firstly any comparison of this cost data necessitates adjusting the figures to a common year through the use of a price index. Secondly differences in the level of sophistication of the hospitals studied makes comparison relating to efficiency difficult. Even where hospitals are in the same category by name, there could be marked differences in the facilities available in practice, such as in the availability of specialists in Base Hospitals. All of the studies which involved many hospitals had to create a classification system that classified hospitals as complex, intermediate or basic. The classification took into account the level of hospital (Base, District, Rural etc.) as well as specific indicators of complexity such as the availability of blood banks, operating theatres etc. This makes generalization problematic even where a sample of hospitals has been used. Thirdly utilization plays a major role in determining average costs: as in

Somanathan et al (2000) which has the average cost per patient day at a complex institution at Rs 3446, at an intermediate institution at Rs 900 and at a Basic hospital at Rs 1545. Finally differences in the methodologies adopted also need to be taken into consideration in comparing the results of different studies.

3.2.2 APPORTIONMENT OF COSTS

One of the main problems in carrying out ward level cost studies in the context of Sri Lankan hospitals arises from the lack of disaggregated ward level data. This involves apportioning costs such as administration, utilities and maintenance to the specific wards under consideration.

Different criteria are used for apportioning general hospital expenditure and cost of utilities to cost centres:

- ratio of patients served to all patients.
- floor area under consideration as a percentage of total floor area.
- ratio of staff in ward to total staff.

The choice between such means of apportioning costs depends primarily on the particular cost item. For example while maintenance is more related to floor area, cost of electricity could be a function of the number of patients in a ward.

In attempting to compare costs across different wards or hospitals it is important to use the same apportionment method for each cost item as the use of different criteria could lead to distortions in the ranking of total cost.

3.3 COMPARING METHODOLOGY

3.3.1 LAND AND BUILDINGS

(a) Land

Four different approaches can be adopted to estimate land costs:

(i) Including the current value of the land: This current value of land can be inferred using expert opinions, that of a lawyer involved in land transactions, an employee of a property development company and a resident of the area as in de Silva, Dalpatadu, Samarage and Das (1997) or the Pradeshiya Sabhawa and a Registered Notary Public as in Kasturiratne (2003).

(ii) Considering the value of land at the time of purchase/building

(iii) Considering the rental/lease value of land: this considers the use of land for hospital buildings to have an opportunity cost. Opportunity cost occurs, according to Economists in the use of scarce resources, and represents the value of the best alternative choice foregone.

(iv) Ignoring land value, as in de Silva (1994) and Jayatissa (1995) where the land value of Lady Ridgeway Hospital is not considered, arguing that the purchase of this land occurred over 100 years ago and that hence the annualized cost of the land would be negligible.

(b) Buildings

Different approaches to costing of buildings can be employed.

(i) Considering the actual cost of building apportioned by the lifetime of the building: this could involve straight line or exponential depreciation. This strategy is feasible only where records of the cost of construction are available.

(ii) Determining the replacement value of the building: using expert opinion de Silva, Dalpatadu, Samarage and Das (1997) uses a civil engineer, Kasturiratne (2003) a quantity surveyor, based on information of the characteristics of the building (roofing material, type of walls and floor etc.) to assess the current cost of the building and then apportioning the cost using straight line depreciation. de Silva, Dalpatadu, Samarage and Das (1997) assumes a 30 year life span for buildings. Edirisinghe (2002) uses a discount rate of 2.5%.

(iii) Use of the rental value of buildings in the vicinity to proxy for the value of the building over a given period.

3.3.2 EQUIPMENT, FURNITURE AND TOILET FITTINGS

Straight line depreciation is the most common costing technique adopted. Edirisinghe (2002) assumes a 10% discount rate for equipment and machinery as does Jayatissa (1995) in assuming a 10 year life span.

Here again either the actual cost of purchase or the current price can be adopted as the basis for determining the annual value of equipment and furniture. Current values can be justified on the basis that replacement values are being considered.

In some instances where actual data cannot be obtained proxy measures have to be adopted. Often discrepancies in price exist between local and foreign products as in the case of costing a local bidet in the de Silva, Dalpatadu, Samarage and Das (1997) study. Here the current values of all toilet fitting were obtained but local bidets were not freely available on the market at this point in time. The authors argue that the use of foreign bidet prices would lead to an overestimation. Therefore the foreign bidet price was adjusted using a weight derived as the average of the ratio of local to foreign commodes and local to foreign wash basins. Likewise where particular brands are no longer available in the market, prices of alternative brands have to be substituted.

In determining the price of objects both quality and source of purchase need to be considered. Often there could be significant variation in prices depending on the location of purchase. It is important to select purchase outlets that provide similar goods to those under consideration. For example state enterprise outlets in the context of purchases for government hospitals; markets for the purchase of food items rather than supermarkets; and where possible focus on goods of similar quality (i.e. ceramic rather than porcelain crockery). The Ministry of Health and even the larger hospitals have suppliers who are registered with them for the provision of different goods and services. Such lists should be consulted in determining the source of purchase.

The argument that equipment and furniture costs can be excluded due to being donations is sometimes used in studies, but where the objective of the costing exercise is gaining a realistic cost estimate of an institution or procedure then such costs cannot be ignored. Instead costs have to be inferred for the donated goods on the lines of replacement cost. Similar arguments exist for using replacement costs in the case of old equipment and furniture instead of ignoring such costs.

3.3.3 LABOUR

Three alternative approaches can be adopted:

(i) Actual salaries are incorporated in most of the studies;

(ii) The mid point of the salary scale is adopted in the case of each category of staff member in de Silva, Dalpatadu, Samarage and Das (1997) but this could lead to underestimation particularly in Teaching Hospitals where many of the staff, tend to be close to retirement.

(iii) The personnel costs line item in the hospital budget was used in Somanathan et al (2000). For each facility, personnel costs consisting of salaries, bonuses and allowances were allocated to either outpatient or inpatient services. Data on the allocation of time to inpatient and outpatient services by different types of staff and the salaries and numbers of each type of staff were used to calculate the proportion of personnel expenditures attributable to outpatient care as follows:

$$\text{Proportion of personnel expenditures attributable to outpatient care at each facility, } \mathbf{P} = \frac{X_i \times Y_i \times Z_i}{\Sigma_i (X_i \times Z_i)}$$

X_i = No. of staff type *i* in each facility
Y_i = Proportion of time allocated to outpatient care by staff type *i*.
Z_i = Annual salary in Sri Lankan Rupees of staff type *i*.

In addition to salary, it is important to include overtime, uniform allowance and other allowances. Jayatissa (1995) for example is very comprehensive in including overtime, holiday pay, uniform and shoe allowance and tailoring and laundry bills.

It is also important to determine which categories of staff are included in the costing exercise. For example whether to include a fraction of the salary of the Hospital Director, accounts clerk, gardener or ambulance driver. In de Silva, Dalpatadu, Samarage and Das (1997) salaries of such categories are omitted as the interest is in costing a single paying ward patient, in a very large hospital. In considering large wards it is important to apportion such staff costs, based either on time allocation or patient load. Administrative and managerial staff costs are generally treated as overhead costs.

Another critical issue in estimating staff costs is the method used to estimate the share of staff time allocated to the different cost centres (wards, OPD etc). de Silva, Dalpatadu, Samarage and Das (1997) involves assumptions regarding the number of minutes/hours spent by each staff member with a single patient (gauged through a patient survey) that are then converted into financial values. Kasturiratne (2003) assumes the proportion of time spent on the ward (based on observation and discussion) and considers the corresponding fraction of their gross salary as staff costs (i.e. medical officers spend 66.6% of their time on inward patients,

medical interns 85% of their time). Somanathan et al (2000) asked different types of staff at each facility to provide an estimate of the percentage of time they spent providing inpatient and outpatient care.

Staff time utilization can vary according to four parameters: the type of patient (whether a medical, surgical or obstetric case is being considered); the treatment day being considered (day of admission, discharge or in between); severity of the patient's condition; and the personal idiosyncrasies of the patient/medical care personnel. In general it is difficult to consider all these variations, and a linear allocation of time across all patients is assumed. Ideally a costing study should be coupled with a time-motion study of the ward, allowing for the clocking of time spent by each staff member on each patient individually.

3.3.4 SUPPLIES

Medical and non-medical supplies need to be considered. Medical supplies are mainly drugs, vaccines and consumables. Records of quantities are maintained at the institutional level and in most cases at ward level as well, but prices need to be incorporated in order to gain a financial value for the supplies. Local purchase of drugs needs to be considered and often this information can be inferred from the BHT.

Allocating drug costs across patients either involves maintaining separate drug dosage registers for each patient or more often and more generally the allocation of drug costs using a formula such as the apportioning of drug costs by length of stay. Alternatively, the pharmacy at the hospital can be asked to provide information on the volume of drugs supplied to wards and OPD during the past month for about 30-50 of the most commonly used drugs. This volume combined with unit price information obtained from the MOH Medical Supplies Division can be used to estimate the value of drugs allocated to the inpatient and outpatient departments at a hospital. Although this would not provide an estimate of the actual value of total drug costs, it may be used to obtain the relative share of drugs expenditure attributable to the different departments.

Non-medical supplies range from linen and stationary to cleaning material. Linear depreciation/usage patterns are assumed in the case of products that are long lasting or large in quantity at the point of purchase.

3.3.5 ADMINISTRATION

In the Amal Harsha de Silva (1994) study total administrative cost was apportioned to the cost centres in proportion to the staff of each unit. On average medical wards were considered to need one unit of administration and the others calculated in relation to this: for example the OPD involved 2.5 units of administration.

The definition of administration is varied. Edirisinghe (2002) has included office personnel, administration building, supplies and equipment, cost of stores, dispensary and communication under this heading. Jayatissa (1995) uses a comprehensive definition of administration costs including administrative staff salaries with allowances of Directors, Administrative Officer, Accountant, Matron and Overseer, Salaries of Clerical staff with allowances, PHI and Infections Control Nurses emoluments, general supplies, staff related common expenditure such as railway warrants, stationary, travelling, communication and the floor area related expenditure such as repairs and security. The costs were apportioned to the ICU in this study on the basis of the total number of staff in this unit.

In most large sample studies (Somanathan et al 2000, Somanathan 1998) administration costs are allocated to cost centres using the same ratio used to allocate personnel and supply costs to those departments.

3.3.6 UTILITIES

Different approaches can be taken to the apportioning of utility costs.

Amal Harsha de Silva (1994) study assumes average ward consumption of water to be one unit and calculates water utilization in other specific areas of the hospital relative to this unit. In this study the cost of electricity, security and maintenance of common areas however were allocated on a square area basis.

Kasturiratne (2003) allocates electricity, water and telephone expenses to the Professorial medical unit on the basis of patient days in this ward as a ratio of total patient days in the hospital.

de Silva, Dalpatadu, Samarage and Das (1997) in adopting the scenario building approach costs electricity by approximating the cost of running a specific number of light bulbs of specific wattages, fans and other equipment, calculated with the assistance of an Engineer in the Ceylon Electricity Board. In the case of costing water the National Hospital's

expenditure on water was divided by the number of units used each month for two months in order to calculate the average expenditure per unit. This price information was then combined with the assumption that an individual approximately utilizes 5 units of water per month, which means that per day consumption is 0.17 units (5/30).

Edirisinghe (2002) uses a combination of electricity bills and watt hours in determining the electricity costs per ward.

3.4 COMPARING RESULTS

3.4.1 Cost per bed per day

(a) Study by Griffin et al (1994)

Significant differences are reported in Somanthan (1998) regarding the results as presented by Griffin et al and her own recalculation of the data based on the Griffin et al classification. Therefore both sets of results are presented here.

Cost per bed day available

	Public		Private	
	Complex	Basic	Complex	Basic
Griffin et al Results	402 (411)	378 (379)	1603	889 (962)
Griffin et al. classification (Somanathan calculation)	169.5	108.9	804.9	475.6

Note: Figures in parentheses relate to only Western-style medical care.
Sources: Griffin et al (1994), Somanathan (1998).

Cost per bed day available is higher in complex facilities than in basic facilities and higher for the private sector than the public sector.

Cost per bed-day occupied

	Public		Private	
	Complex	Basic	Complex	Basic
Griffin et al Results	489 (492)	1678 (1685)	1603	1639 (1728)
Griffin et al. classification (Somanathan calculation)	193.4	399.5	653.8	608.9

Note: Figures in parentheses relate to only Western-style medical care.
Sources: Griffin et al (1994), Somanthan (1998)

Cost per bed day occupied on the other hand is higher for basic public health facilities than for complex public facilities, due to low utilization rates in the former, and is higher for the private sector than for the public sector.

Cost per bed-day by service in hospitals offering Western Medical Care

	Public		Private	
	Complex	Basic	Complex	Basic
Medical	2,431	1,872	5,670	8,146
Surgical	1,893	-	12,048	-
Obstetric	3,389	4,724	28,524	7,305
Paediatric	2,777	11,729	12,519	11,935

The allocation of costs, to the different services, was done on the basis of estimates provided by the health facility managers. Here once again due to differences in utilization cost of Obstetric and Paediatric care is higher for basic than complex facilities.

(b) Study by de Silva (1994)

Lady Ridgeway Hospital has six medical wards, three surgical wards, one ENT ward, one ICU, one Premature Baby Unit ({PBU) and one rehabilitation unit. Around 48,000 children are inward patients annually. Total number of staff was 841 in 1992.

The study of costs in the Lady Ridgeway Hospital carried out by Amal Harsha de Silva concluded that total recurrent expenditure in 1992 was Rs 81,530,033. Given that the hospital had approximately 640 beds, cost per cot (bed) per year in 1992 was Rs 127,390 (=81,530,033/640) and cost per cot (bed) per day in 1992 was Rs 349 (i.e. 127,390/365).

(c) Study by Somanathan (1998)

The differences in figures in the table below stem from differences in the rate of utilization. Differences are small when utilization rates are high, but significant differences are evident when utilization rates are low as in the case of public basic facilities.

	Public			Private		
	Complex	Basic	Total	Complex	Basic	Total
Cost per bed-day occupied	290.7	353.5	341.8	1289.3	609.0	799.5
Cost per bed-day available	245.6	96.8	123.9	784.3	483.6	567.8

(d) Study by Siriwardene (1998)

The overall cost per bed day for the Gampola Base Hospital was Rs 231.77. When the different wards were considered separately the following cost per bed day figures are reported:

Ward	Cost (Rs)	Bed Occupancy Rate	Bed Turnover Rate
Medical	124	51.22	74.7
Surgical	247	62.37	68.8
Obstetric	307	36.91	43.4
Paediatric	227	46.03	67.2
Gynaecology	343	31.03	36.9

The costs vary widely across the wards. The high costs per bed day correspond with low bed occupancy rates and turnover rates in the Obstetric and Gynaecology wards.

3.4.2 Cost per patient day

(a) Study by de Silva (1994)

	Cost (Rs)
Medical Ward at LRH (without ICU)	228
Surgical Ward at LRH (without ICU)	326
ICU	2712

Here costs are linked to facilities, with the ICU cost per patient day being significantly higher than that on a normal ward.

(b) Study by Samarasinghe and Akin (1995)

Cost per day for Indoor care:

Public Sector Basic	Rs 402/-
Public sector Complex	Rs 500/-

Similar findings of patient day costs being linked to facilities reported in this study as well.

(c) Study by Jayatissa (1995)

Per patient day at the ICU of Lady Ridgeway Hospital was Rs 3306, which the author comments is almost ten times greater than that for general ward treatment at LRH. The ICU has 7 beds. The medical team consists of a Consultant Anaesthetist, four medical officers and twenty eight nurses. The doctor on duty to patient ratio averages 1:7 and nurses 1:1.

She also comments that money spent on treatment of birth asphyxia and complications of low birth weight at the ICU at LRH would be sufficient to provide 175 ambu bags and 83,000 hand mucus extractors to reach an island-wide coverage, thus putting prevention costs in perspective.

(d) Study by de Silva, Dalpatadu, Samarage and Das (1997)

This study costs a patient day in the Merchants ward, where each patient has their own room.

	Cost (Rs)
Medical case (post-diagnosis DM case)	807.15
Surgical case (post operative laporatomy case)	1356.70

These costs are significantly higher than the figures reported for other studies due to relating to a paying ward. These costs also highlight the need to fix charges at correspondingly high rates, unlike at present, when the paying ward patients are being subsidised.

(e) Study by Siriwardene (1998)

The cost per patient day for the Gampola Base Hospital was Rs 460.63. The average length of stay for the hospital as such was 2.6 days with a bed occupancy rate of 50% and a bed turnover rate of 63.3%.

Considering the different types of wards the per patient day costs are:

Medical ward	Rs 243
Surgical ward	Rs 396
Paediatric ward	Rs 490
Obstetric Ward	Rs 1,002
Gynaecology Ward	Rs 1,106

The high rates in the latter cases are related to low occupancy rates.

(f) Study by Somanathan et al (2000)

	N	Mean	High/Low ratio
Complex	12	635	6.4
Intermediate	9	394	5.8
Basic	64	627	119.8

The high to low ratio of costs, relating to the different hospitals, is particularly striking in the case of the basic hospital category.

(g) Study by Edirisinghe (2002)

Dompe District Hospital caters to an average of 65 indoor patients per day.

	Number of beds	Average number of patients per day	Cost (Rs)
Male Medical Ward	36	22	449
Female Medical/Surgical	26	0.62	451
Male Surgical	28	19	563
Maternity	12	0.50	9525
Paediatric	13	10	1973
Indoor care	115	65	602

The high cost of maternity care relates to the low number of maternal cases handled by this hospital,as a result of by-passing.

(h) Study by Kasturiratne (2003)

This costing of facilities of the Professorial Medical Unit of the North Colombo Medical Faculty, involving male and female wards, is an attempt to capture all costs apart from the illness specific treatment costs (costs of medication, therapeutic procedures and diagnostic investigations). The cost of a patient day for inpatient care exclusive of the specific management of the medical condition of the patient is Rs 505.70.

3.4.3 Cost per admission

(a) Griffin et al (1992)

	Public		Private	
	Complex	Basic	Complex	Basic
Griffin et al Results	3313	5442	9465	7511
Griffin et al. classification (Somanathan calculation)	1171.2	1252.2	3327.0	3148.1

Sources: Griffin et al (1994), Somanthan (1998)

Here again differences in admission rates adversely impact on the cost of public basic facilities.

Cost per admission by service in hospitals offering Western Medical Care

	Public		Private	
	Complex	Basic	Complex	Basic
Medical	8,467	6,431	29,376	34,724
Surgical	9,358	-	76,890	-
Obstetric	10,346	11,158	117,677	32,388
Paediatric	10,537	53,779	74,917	46,569

Small numbers admitted as Paediatric patients to basic facilities inflate the costs on such patients.

(b) Study by Somanathan (1998)

	Public			Private		
	Complex	Basic	Total	Complex	Basic	Total
Cost per admission	1906.2	1079.9	1230.1	4480.5	2699.5	3198.2
Average length of stay in Western inpatient facility	6.93	6.02		3.80	6.38	

Cost per admission is affected by the average length of stay in the public sector. In the private sector complex facilities the average length of stay is much shorter, possibly due to the higher costs incurred by the patient.

(c) Study by Siriwardene (1998)

Cost per admission for the Gampola Base Hospital as a whole was Rs 1219 with an average length of stay of 2.6 days. The costs for the different types of wards are given below.

Ward	Cost	Average Length of stay
Medical	550	2.26
Surgical	1207	3.04
Obstetric	2773	2.76
Paediatric	1231	2.50
Gynaecology	3392	3.06

Cost of admission seems to relate more to occupancy than to the average length of stay, though a positive correlation does seem to exist between these two variables as well.

(d) Study by Somanathan et al (2000)

	Sample size	Mean	High/Low ratio
Complex	15	3446	8.5
Intermediate	13	900	5.8
Basic	80	1545	82.4

Cost extremely high for small basic facilities as fixed cost is spread over very few patients, while costs are also high for complex facilities since they involve more sophisticated resources including senior and more qualified staff. The high to low variation in costs is particularly striking in the basic category.

3.4.4 Cost per outpatient visit

(a) de Silva and Attanayake (1992)

Cost per patient for an outpatient visit is presented along with the utilization rate for each CD, which clearly shows that a negative relationship exists between average cost of outpatient care and the utilization rate (correlation coefficient -.76).

The higher costs at locations with low utilization result directly from the underutilization of resources, though the author's warn against assuming that low costs necessarily reflect efficiency. Low utilization rates in turn are often linked to lack of resources, particularly the lack of drugs.

Central Dispensary/MOH area	Average patients per day	Average cost per patient
Mirigama		
Maligatenna	59	5.98
Muddaragama	33	18.41
Pallewela	65	8.53
Wewaeldeniya	66	6.87
Maladeniya	33	8.37
Ambepussa	58	6.91
Keleliya	54	7.69
Halpe-Mirigama	n.a.	n.a.
Divulapitiya		
Badalgama	44	8.14
Halpe-Katana	46	9.82
Kotadeniyawa	57	8.00
Minuwangoda		
Dewalapola	29	13.75
Batapotha	31	3.49
Andiambalama	73	5.86

(b) Study by de Silva (1994)

Cost per OPD visit at Lady Ridgeway Hospital is Rs 37.00.

(c) Griffin et al (1994)

	Public			Private		
	Complex	Basic	Outpatient	Complex	Basic	Outpatient
Griffin et al Results	1439	1511	43	2508	3592	24
Griffin et al. classification (Somanathan calculation)	137.6	26.4	43.7	169.7	116.3	13

Note: Figures in parentheses relate to only Western-style medical care.
Sources: Griffin et al (1994), Somanthan (1998)

The cost of a visit seems significantly lower when it is to a facility that only provides outpatient services. Whether these Griffin et al (1994) results are affected by the manner in which costs were apportioned between outpatient and inpatient care, as based on facility managers perceptions, is debatable since OPD visits to complex and basic facilities providing both inpatient and outpatient costs are so high.

(d) Study by de Lanerolle (1996)

The recurrent cost per OPD visit to Provincial Hospital Colombo South inclusive of average drug and investigation costs is Rs 27.00.

(e) Study by Somanathan (1998)

	Public			Private		
	Complex	Basic	Outpatient	Complex	Basic	Outpatient
Cost per outpatient visit to Western and combined facilities	207.4	23.2	43.7	68.2	152.8	13.4
Cost per outpatient visit to Ayurvedic facilities	20.6	84.1	35.2		57.8	41.8

The study comments that under reporting in the private sector could explain the unusual result where cost per outpatient visit is lower in the Western care private sector than the public sector.

(f) Study by Somanathan et al (2000)

	Sample size	Mean	High/Low ratio
Complex	16	153	21.5
Intermediate	12	26	4.1
Basic	79	32	37.8
Outpatient	3	35	4.6

Results relate to the public sector. The highest variation in costs between different health care facilities in the different categories is once again in the basic institutions that are most affected by variations in facilities as well as utilization rates.

(g) Study by Edirisinghe (2002)

The Dompe District Hospital caters to an average of 450 outdoor patients and 20 dental clinic patients daily, as well as around 200 medical clinic patients and 150 antenatal clinic patients per clinic day.

	Average Number	Cost (Rs)
OPD	425	39.80
Medical Clinic	215	45.90
Dental Clinic	18	283.50
Outdoor care	658	43.00

The high costs incurred by the dental clinic are clearly linked to the extremely low utilization rate.

3.5 POLICY CONCLUSIONS

3.5.1 Unit costs are highest in tertiary care facilities

Logically unit costs should be highest in tertiary care facilities, as these facilities have more sophisticated equipment and senior and qualified staff, as compared to the lower level institutions. These hospitals are also expected to act as referral centres and centres of excellence and therefore the severity of cases dealt with by such institutions would be greater, resulting in higher treatment costs as well. However there is no formal referral procedure in Sri Lanka and bypassing of lower level institutions has led to tertiary care units often being over utilized. This though adversely affecting efficiency often results in the lowering of average costs of such institutions.

In order to compare the reported cost per bed per day and outpatient visit over a number of studies, the costs were price indexed using the Colombo Consumer Price Index (CCPI).

Inpatient

	Reported cost Per bed per day	Price indexed cost per bed per day*
de Silva (1994) Medical Ward (no ICU)	228 (1992)	18
de Silva (1994) Surgical Ward (no ICU)	326 (1992)	26
Siriwardene – Base Hospital	232(1997)	11
Somanathan et al (2000) Complex	635(1998)	28
Somanathan et al (2000) Intermediate	394(1998)	17
Somanathan et al (2000) Basic	627(1998)	27
Edirsinghe (2002) District Hospital	602(2002)	19

* Adjusted using the Colombo Consumer Price Index with Base year 1952

Complex Hospitals have the highest average cost according to the above table. However the cost of Basic hospitals in the Somanathan et al (2000) study is almost equally high, though this is possibly partly a result of the wide variation reported in the cost of basic care in this study (high to low ratio of 119.8).

Outpatient

	Reported cost Per outpatient visit	Price indexed cost per outpatient visit
de Silva (1994)	37(1992)	3
Somanathan (1998) Complex	207 (1992)	16
Somanathan (1998) Basic	23 (1992)	2
de Lanerolle	28(1995)	
Somanathan et al (2000) Complex	153 (1998)	7
Somanathan et al (2000) Intermediate	26 (1998)	1
Somanathan et al (2000) Basic	32 (1998)	1
Somanathan et al (2000) Only outpatient	35 (1998)	2
Edirisinghe (2002) District Hospita	143 (2002)	1

* Adjusted using the Colombo Consumer Price Index with Base year 1952

In the case of outpatient care however clearly tertiary care facilities have higher costs than lower level facilities. This results mainly from such hospitals having more senior and qualified staff.

The econometric analysis in Somanathan et al (2000) shows that higher outpatient costs are related to facilities with larger inpatient loads. This could either be the result of patients with more severe illness or referred patients accessing such facilities or the higher cost of inputs in such facilities (Medical Officers as compared to AMOs/RMOs in lower level facilities or more Consultants).

In practice the OPDs and health clinics of tertiary facilities do not act as referral centres, so this draws attention to the issue of whether it is cost-effective to maintain outpatient clinics as part of tertiary care facilities or whether greater equity and efficiency would be gained by separating out inpatient and outpatient facilities in tertiary care facilities.

3.5.2 Lower level facilities have relatively high costs due to low occupancy and turnover

Somanathan (1998) concludes that costs of lower level facilities are very sensitive to the levels of utilization and proposes that a redistribution of patients from over crowded complex hospitals to under utilized basic care facilities would reduce the cost of lower level facilities and improve efficiency. The study results show the cost per bed-day occupied being 3.65 times higher than the cost per bed-day available for basic public facilities.

The following table from Somanathan et al (2000) shows that cost per admission, cost per bed-day occupied and cost per outpatient visit is highest in the Teaching Hospital.

	Cost per admission		Cost per bed-day occupied		Cost per outpatient visit	
	1991*	1997**	1991*	1997**	1991*	1997**
Rural Hospital	1050	1384	316	501	31	32
Peripheral Unit	880	1611	437	561	32	20
District Hospital	1764	818	215	278	54	35
Base Hospital	846	946	235	295	153	22
Teaching Hospital	4413	2681	742	597	222	152

Note: * At 1997 prices

** Covers only the four districts covered in the 1991 survey.

Source: Somanathan et al (2000)

	Bed-occupancy Rate		Turnover rate		Average length of stay	
	1991	1997*	1991	1997*	1991	1997*
Rural Hospital	55	37	65	53	3.5	2.8
Peripheral Unit	57	45	76	88	3.0	2.6
District Hospital	105	48	60	158	10.3	4.1
Base Hospital	99	86	90	100	4.1	3.7
Teaching Hospital	97	105	63	87	6.0	4.7

Note: Covers only the four districts covered in the 1991 survey.
Source: Somanathan et al (2000)

Relating the difference in unit costs to changes in bed occupancy rate we note that the cost per admission has declined only in the district hospital and the teaching hospital category. In the teaching hospital both the bed occupancy rate and the turnover rate has increased while in the district hospital bed occupancy rate has declined significantly while the turnover rate has increased radically. Cost per bed day occupied has only declined in Teaching Hospitals. Cost per outpatient visit has decreased in all but rural hospitals.

The evidence in Somanathan et al (2000) suggests that rural and peripheral units have high costs due to low utilization rates while Teaching hospitals also have high unit costs despite their high occupancy and turnover rates.

The econometric analysis adopted in Somanathan et al (2000) also shows that low bed occupancy rates in intermediate and basic inpatient facilities indicate substantial under use of capacity and therefore increasing returns to scale, whereas complex facilities are seen to be operating at near constant returns to scale.

Edirisinghe (2003) costing a district hospital illustrates this point clearly: the Obstetric ward that has an average number of patients per day value of 0.50 has a unit cost of Rs 9525, which is 17 times the unit cost of the male surgical ward (with a utilization rate of 55%). This low utilization rate is particularly striking in the context of the ante-natal clinic attendance being reported as 125 per clinic day in that hospital.

de Silva and Attanayake (1992) also shows that under-utilization of facilities in Central Dispensaries in selected MOH areas of the Gampaha district is linked with high average cost per outpatient visit. The correlation coefficient between utilization and cost per outpatient in this study is -.76.

The results of these cost studies may suggest that lower level facilities should be restructured, to respond to present day patient demand and thereby stem by-passing as well as reduce average cost, rather than continue to supply mainly MCH services as was the primary need in the 1930s to 1970s. However from an equity perspective, it may be desirable to maintain lower level facilities because they ensure access to services to remote, rural populations.

3.5.3 Many factors may contribute to differences in unit costs

Low occupancy and turnover are related with high unit costs as illustrated in Somanathan (1998) and Siriwardena (1998). Somananthan et al (2000) however notes in the context of the study done by Somanathan (1998) that levels of utilization, bed occupancy rate and average length of stay do not explain all the observed variation in cost, that can be as much as Rs 400 per bed day at lower level inpatient facilities. Factors such as the management of facilities (as reflected in the characteristics of managers and their management styles), systems of managing staff and materials and organizational environment (location, community support, competition) could have a bearing on unit cost.

Somanathan et al (2000) finds that contrary to expectations average length of stay is not closely related to average cost, nor is the relationship clearly negative as would be expected if as assumed average length of stay is closely correlated to severity of illness.

Occupancy rates however display the expected negative relationship with per inpatient day and per admission costs, particularly for intermediate facilities. In complex facilities this relationship is less apparent possibly due to the heterogeneity of case mix.

3.5.4 Staffing and drug costs are major components of unit costs

Somanathan et al (2000) provides the following tables relating to the percentage of staff and drug costs in total cost.

Inpatient

	Staff	Drugs	Other
Complex	60.1	23.5	16.4
Intermediate	67.4	11.9	20.7
Basic	66.6	8.8	24.6

Siriwardene (1998) also finds that manpower costs account for about 50% of total expenditure. Of the total manpower expenditure, 35% was spent on doctors (11% on Consultants and 24% on other medical officers), 40.4% on nurses, 5.1% on midwives, 13% on minor staff with administration salaries and overtime accounting for 4.8%.

Edirisinghe (2003) illustrates that staff diets are a major component of the diet cost, as many patients do not eat the hospital food while many staff members do avail themselves of the opportunity of benefiting from the highly subsidized meals provided.

Outpatient

	Staff	Drugs	Other
Complex	31.1	57.0	11.9
Intermediate	47.0	42.5	10.5
Basic	45.9	45.3	8.8
Outpatient	71.0	12.7	16.3

Staff costs are the major component of inpatient costs while in the case of outpatient care drugs are a significant element in total costs except in purely outpatient settings in Somanathan et al (2000).

3.5.5 Significant variations in costs across hospitals/across wards in the same hospital

Somanathan et al (2000) cite the high to low ratio of per day and per outpatient visit costs between different health facilities (reported above). The variation is extremely large, particularly in the basic health care facility category that suggests that some hospitals are performing much worse than others. Regular evaluation of hospitals on efficiency, cost and patient satisfaction criteria would ensure greater welfare.

de Silva (1994) and Edirisinghe (2002) find significant differences in costs across wards in the same hospital. This is in line with de Silva's objective that maintaining per ward cost information would lead to the automatic reduction of costs since it would alert staff to wastages and inefficient practices. Provision of incentives for cost cutting would encourage cost minimization. de Silva (1994) also suggests that a need exists to use rational criterion in order to reduce the number of hospital admissions, admissions to the ICU and the length of stay in hospital as a means of cost reduction.

3.6 CRITIQUE OF THE STUDIES

Given below are some methodological concerns relating to the different costing exercises, highlighted to alert future researchers to the dilemmas and problems faced in carrying out costing exercises.

Somanathan (1998) and Somanathan et al (2000) that focus on clusters of hospitals simultaneously by their very nature are open to criticisms relating to the accuracy in categorisation of hospitals (for instance classifying peripheral units as intermediate) and the validity of summing up across varied institutions (for example combining Teaching Hospitals and specialized hospitals). The use of structural quality indices is however an innovative approach in the classification of hospitals, and attempts to remedy the disparities that exist in facilities even within a single category.

Somanathan (1998) presents Giffin et al (1994) and analyses of the data of the World Bank Health Facility Survey of 1991.(as does Samarasinghe and Akin 1995.) In both the former sets of results large standard deviations are reported, suggesting that the observations are widely dispersed. This should be noted in the context of using the mean values, in projections for example.

Somanathan (1998) focuses only on the recurrent costs, so the cost information is an underestimation of the total cost of care. de Silva (1994) and Jayatissa (1995) omit the land value of Lady Ridgeway Hospital in their studies. Edirisinghe (2003) considers only the land value occupied by buildings as the total land area of the Dompe district hospital was not known

Jayatissa (1995) ignores the building costs of the ICU of the Lady Ridgeway Hospital and instead only includes the renovation costs borne by Kiwanis International club. This omission of capital costs in many of the studies while understandable given data constraints results in an underestimation of costs that could have significant repercussions in using such data in hospital restructuring or future health system costing exercises.

de Silva, Dalpatadu, Samarage and Das (1997) in carrying out the scenario building exercises, uses a 'representative patient day'. In the context of the medical case, drugs and treatment involve a patient diagnosed with Diabetes Mellitus. However this aspect has been totally missed out in considering the diet provided - sugar in tea and jam for breakfast! It is

important in using the scenario building technique to ensure that the scenario is consistent.

Definitions of utilities and administration vary widely in the studies. Edirisinghe (2003) for example classifies diet, electricity, laundry, sanitation and water supply, security and disposal of refuse under the heading of utilities which is wider than the usual definition that only covers electricity, water, sanitation and possibly garbage disposal. Care in classifying different cost items would make comparison of costing studies easier, and ease the validation process.

Edirisinghe (2003) includes the cost of ambulance services in his costing exercise, allocating the cost of the ambulance service in proportion to the number of patients transferred from each ward. Is the inclusion of ambulance services in ward costs justified? Yes, if one considers the point of discharge of a patient for the hospital to be the point of entering a new hospital; if not, and the point of discharge is merely leaving the present hospital then this cost is not part of the hospital costs of the Dompe District Hospital, though the expenditure is borne under its budget heading. This example highlights the type of dilemmas faced by a researcher in demarcating the cost of hospital, or more commonly a specific ward (i.e. inclusion of landscaping?).

Chapter 4
COSTING OF DISEASES/CONDITIONS

4.1 STUDIES UNDER CONSIDERATION

(1) de Silva, U.H.S and Attanayake, Nimal (1992) Study on Utilization of Resources at Peripheral Health care institutios in Gampaha District, Mimeo (also see Chapter 3).

Study Objectives: Identify factors affecting utilization of resources at peripheral health care institutions with a view to exploring priority issues that have to be addressed in order to achieve an efficient resource allocation and utilization pattern at those institutes. This involves identifying specific services/activities in peripheral health care institutions where under utilization is acute identifying causes, nature and extent of underutilization and determining the magnitude and direction of the interrelationships between the causal factors identified and the level of utilization. Objectives of the household survey included determining the cost incurred by the population serviced in seeking care from each type of health care facility.

Methodology: Household survey conducted in three MOH areas: Divulapitiya, Minuwangoda and Mirigama, 600 households selected (10 households each from 20 Grama Seva divisions from each of the three MOH areas). Where a household had not sought treatment in the past month, the closest similar household was substituted. Questionnaire sought background information, information on the sickness and care sought and data on travel time, costs and income.

Importance of the Study: In-depth analysis of a policy debate (i.e. whether by-passing results from demand or supply factors).

(2) de Lanerolle, D.L (1992) A study of the treatment cost and some related factors contributing to Road Traffic Accidents, Thesis submitted for the MSc in Community Medicine, Post Graduate Institute of Medicine, University of Colombo.

Study Objectives: Identifying factors contributing to road traffic accidents (RTAs) and treatment costs of persons affected by road traffic

accidents. This included describing the socio-demographic profile of the patients, identifying specific groups and the local environmental factors that need intervention to reduce RTAs, determine cost of treatment of RTA patients and describing how certain causative factors affect the total cost of RTA.

Methodology: Study comprised of surveying 225 road traffic accident (RTA) patients admitted consecutively to the Accident Service Unit at the Colombo South General Hospital (19/05/92 to 03/08/92). Interviewer administered structured questionnaire. Type and site of injury noted and injury classified according to the abbreviated injury scale. Information from bed head tickets used to calculate costs of RTA patient treatment.

Importance of the study: Comprehensive attempt at calculating hospital costs of RTA patients.

(3) Jayawardene, Ruwani (1993) Illness Perception: Social Cost and Coping Strategies of Malaria Cases, Social Science and Medicine, Vol. 37, No 9, pp 1169-1176.

Study Objectives: Examining the coping strategies – problem analysis, presence and use of social support – problem solving and treatment behaviour in the context of Malaria in a Mahaweli settlement. Quantitative information on economic losses due to Malaria assessed.

Methodology: Study carried out from February 1986 to November 1986. For six months all patients with clinical symptoms of Malaria in Block C were listed by the Medical Officer and these patients were systematically followed up at home for interviews. Interviews conducted till there were no symptoms (considered recovered when they went back to normal activity). Each attack was considered an episode if separated by five symptom free days. Treatment seeking behaviour and loss of economic activity observed and assessed for each episode. There were 228 households in Block C, of which patients from 142 households were interviewed. In-depth Malaria diaries were maintained for patients included in the sample in the last month of the study.

Importance of the study: Focuses on direct and indirect costs.

(4) Attanayake, N (1994) Cost effectiveness of anti-malaria activities in Sri Lanka, PhD thesis, London, London School of Hygiene and Tropical Medicine (also see Chapter 5).

Study Objectives: (a) Cost-effectiveness analysis of the Anti-Malaria Campaign 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; (b) examining the socio-economic factors underlying community behaviour in relation to acceptance and compliance with preventive and curative care for Malaria, with a view to enriching the economic evaluation methodology of communicable disease control programmes in developing countries; (c) exploring policy implications from the application of cost effectiveness analysis along with a community behaviour analysis relevant to the malaria control programme in Sri Lanka.

Methodology: In order to assess the cost-effectiveness of the Anti-Malaria campaign in Sri Lanka, a case study was carried out in a selected district, with respect to various control strategies, measures and the programme as a whole. Matale district selected on the basis of malaria incidence (Annual Parasitic Incidence rate used as the criterion) and other factors including control programmes, variety of health care services available including the private sector, climatic conditions, old and new settlements and there being no security problems in the area. Data collection involved interviews with officials and perusal of official documents at the centre, regional Malaria Office Matale and the DPDHS office. Focus groups, interviews and direct observation carried out at different stages of the study. A Time Allocation Study was carried out involving a Time Allocation Questionnaire, interviews and observation. Budgetary allocations and expenditure (manpower, drugs, buildings, supplies, vehicles etc.) figures of all district level anti-malarial activities (prevention and Medical Centre's figures) were combined with utilization figures to calculate average and incremental cost of different anti-malaria activities. Some case studies, focusing on costing were also carried out on case detection and treatment, spraying and providing prophylactics. Household survey conducted to collect information on direct costs and indirect costs and household and community response to Malaria control and treatment. The survey involved random cluster sampling on the basis of Probability Proportionate to Size (54 clusters, 1080 households and 5500 respondents). A one month long recall period was used for curative care, last visit for spraying and the past year in the case of the mosquito net and prophylaxis programmes to avert seasonality effects. The surveys occurred from January to March 1994. Cost-effectiveness analysis is carried out. Policy

options are discussed based on the cost, utilization and compliance information collated.

Importance of the study: Significant contribution in terms of expanding the costing methodology relating to the control of communicable diseases. Focus on societal costs. Evidence based policy evaluation exercise.

(5) de Silva, Amal Harsha (1995) Cost effectiveness of OPD Diarrhoea Treatment Unit (DTU) at Lady Ridgeway Hospital (LRH), The Sri Lanka Journal of Medical Administration, Official publication of the College of Medical Administrators of Sri Lanka.

Study Objectives: Assessing DTU performance in 1993. Costing of DTU and assessing the impact of DTU on diarrhoea treatment cost at LRH. Importance of this unit lies in the prevention of unnecessary admissions to the wards, by allowing for short term stay.

Methodology: Retrospective study of all admissions to the DTU in 1993. Using available data on recurrent expenditure costing carried out of resources at the DTU (capital costs ignored). Ward admissions prevented due to the existence of the DTU calculated.

Importance of the study: Calculating the cost avoided through more efficient and appropriate resource utilization.

(6) Jayatissa, K.L.R (1995) An analysis of patient care cost for selected preventable diseases in Intensive Care Unit at Lady Ridgeway Hospital in 1992, Thesis for MSc. Community Medicine, Post Graduate Institute of Medicine, University of Colombo (also see chapter 3).

Study Objectives: To study the patient care cost for selected preventable diseases in the ICU at LRH in 1992.

- Study the case mix of specific preventable diseases at the ICU in 1992.
- Ascertain the total number of ICU patient days with the specific preventable diseases in 1992.
- Study the total cost of resources utilized by patients with specific preventable diseases admitted to the ICU in 1992.

Methodology: This retrospective descriptive study was carried out in order to cost the intensive therapy necessitated by patients with specific preventable conditions admitted to the Lady Ridgeway Hospital, Intensive Care Unit, in the period from January 1st to 31st December 1992. All patients admitted to ICU were listed with diagnosis and the following diagnoses were deemed to 'preventable': birth asphyxia, low birth weight, encephalitis, dengue haemorrhagic fever, gastro enteritis, Tetanus and neonatal tetanus, complications of typhoid fever, complications of worm infestation, Tuberculous meningitis, congenital rubella syndrome, cerebral malaria and poisoning. A checklist was used to collect data from the BHTs. Hospital costs: fixed, semi-fixed and variable were collected from ledgers and empirical observation. The cost of treatment in the ICU for specific conditions was worked out separately for survivors and non-survivors.

Importance of the study: Making a distinction between the treatment cost of survivors and non-survivors and presenting the cost estimates in terms of the corresponding prevention activities that could have been undertaken.

(7) Graves, Patricia M., Fernando, Dulitha and Attanayake, Nimal (1995) Intensified Malaria Control Programme in Sri Lanka with emphasis on Primary Care approach, New Health and Family Planning Project 1995 IDA/World Bank, Consultants' Report. (Also see Chapter 5).

Study Objective: Estimating the average cost measures in order to assess the effectiveness of different approaches to Malaria control.

Methodology: Direct cost estimates of mobile clinics were based on discussions held with Malaria control employees and observations made during field visits. Recurrent costs included salaries and wages, subsistence, drugs, fuel, chemicals etc. and annualized discounted replacement cost of capital inputs such as vehicles and microscopes. Average mobile clinic attendance and slide positivity rates were taken into consideration for four districts: Polonnaruwa, Kurunegala, Anuradhapura and Matale. Information was also collected on costs of impregnating bed net programmes in the districts of Matale and Anuradhapura.

Importance of the study: Costing in multiple locations.

(8) Samarasinghe, D. and Akin J (1995) Report of the Health Strategy and Financing Study, Report of study undertaken at the request of the Ministry of Health with the support of the World Bank, Colombo, Sri Lanka (also see chapter 3).

Study Objectives: (1) compile a comprehensive database on availability of health services, including prices charged and use of services, the cost of such services and on the demand for various services including patient ability to pay, (2) to analyse the causes of various problems currently affecting the health care system in Sri Lanka, especially as they relate to health care financing, and (3) examine various policy options, both from the vantage point of improving efficiency and equity of service provision.

Methodology: Three surveys conducted: household survey to document health status of individuals and to study determinants of health use; facility survey to determine levels of service and cost and an epidemiological survey to gauge need for care in relation to actual use. Data collection restricted to four districts: Polonnaruwa, Matale, Galle and Colombo. Household survey involved 10,024 households containing 48,097 individuals (around 85% OPD visits and 15% inpatient care episodes). Self reported information on health status, with the query relating to illness in the past month. Data also collected on health seeking behaviour, cost patterns and socio-economic, demographic details relating to the household.

Importance of the Study: Focusing on household costs in seeking treatment.

(9) Fernando, Devaka (1996) Cost of Insulin Injection, Ceylon Medical Journal 41: 29-30.

Study Objective: Calculating the cost of diabetic patients' reusing disposables for self injecting as compared to visiting health care facilities or having home visits to obtain insulin injections.

Methodology: Sample of 350 patients attending the diabetic clinic at National Hospital of Sri Lanka or other health care facilities solely for getting insulin injection studied. 294 agreed to participate in the study. They were provided with disposable plastic insulin syringes and advice on use, and requested to record syringe use in a diary. Diaries recovered from 276 (92%) after one year. Self administered questionnaire used to collate information on time and money spent on travel to a clinic, fees for private

practitioner or paramedical staff at private facilities or home visits, loss of wages for patient and any accompanying person and expenses on food. Loss of wages calculated according to monthly income.

Importance of the Study: Provision of information to guide policy formulation.

(10) Konradesen, F, van der Hoek, W, Amerasinghe, P.H., Amerasinghe, F.P., and Fonseka, K.T. (1997a) Household responses to malaria and their costs: a study from rural Sri Lanka, Transactions of the Royal Society of Tropical Medicine and Hygiene, 91, 127-130.

Study Objectives: Assessing the cost of malaria at household level, community perceptions, preventive measures and illness behaviour linked to the disease.

Methodology: Study undertaken in five villages in the Anuradhapura district in the dry zone of Sri Lanka. Sample population was exclusively Sinhalese, with the majority of households being low income subsistence farmers with smaller groups seeking work outside the area. Household questionnaire survey was undertaken by a team of four Social Research Officers and a supervisor. Open ended and semi-structured questions focused on community priorities, knowledge of malaria, preventive measures taken and household income and resources. Detailed information collected on all malaria episodes that people recalled in the past 3 months with special attention to treatment seeking behaviour and costs incurred. Survey was carried out during peak malaria transmission season (also an important agricultural season). Of the 437 households in the study area 50% selected as a random sample. Wife of household head or female head of household interviewed.

Importance of the Study: Estimating household costs among poor rural subsistence farming community.

(11) Konradesn, Flemming, van der Hoek, Wim, Amerasinghe, Priyanie H. and Amerasinghe, Felix P (1997b) Measuring the Economic Cost of Malaria to Households in Sri Lanka, American Journal of Tropical Medicine and Hygiene, 56(6) pp 656-660.

Study objective: Calculating economic cost of malaria to households in Sri Lanka.

Methodology: Focuses on an agricultural community living in Mahameegaswewa in the Anuradhapura district of Sri Lanka, a traditional village surrounding a reservoir with a subsistence agriculture economy. Study conducted from September 1994 to September 1995. The village has 50 houses and all were involve in the questionnaire survey that collected personal data. Initial exploratory work had been done to determine household activities (subsistence agriculture, hunting, fishing, honey gathering, livestock raising etc.) In addition each household was visited every other day by a trained assistant to fill out a standard format seeking information on the daily activities of each member of the household (such as whether they worked a full day or half day, and whether they were ill, taking medication, whether they had accompanied a family member to seek medication). However time spent on caring for sick household members was not included among the activity list. Treatment was sought predominantly from the Kekirawa government hospital, situated 25 kms from the village, and from the mobile service.

(12) Bloom, David E., Mahal Ajay, Christiansen, Lene, de Silva, Amala, de Sylva, Soma, Dias, Malsiri, Jayasinghe, Saroj, Jayaweera, Swarna, Mahawewa, Soma, Sanmugam, Thana, and Tantirigama, Gunatilleke (1997) Socio-economic dimensions of the HIV/AIDS epidemic in Sri Lanka, in The Economics of HIV and AIDS: The Case of South and South East Asia, Delhi; Oxford University Press (also see Chapter 5).

Study Objectives: This study had three broad objectives: to gain a better understanding of the socio-economic dimensions of the HIV/AIDS epidemic in Sri Lanka; to contribute to a better appreciation of the epidemic's socio-economic dimensions in Asia through the case study of Sri Lanka; to provide insights into key research and policy questions such as the link between HIV and poverty, net benefits of blood testing and cost effectiveness of adopting universal precautions in the medical care system. Within these objectives the following aspects relate to costing:

- Calculating the Direct (treatment) cost of HIV/AIDS in Sri Lanka
- Calculating the indirect (lost earnings) cost of HIV/AIDS in Sri Lanka
- Cost effectiveness of safe blood and universal precautions

Methodology: Direct costs were calculated using 20 case studies to identify common disease profiles among AIDS patients and then costing the procedure according to WHO protocols. Cost of medication and investigations were estimated using market prices for urban and rural sector patients, using public and private healthcare institutions. Indirect costs were limited to loss of earnings and calculated using the scenario building approach. Indirect costs were estimated based on per capita GDP figures involving assumptions regarding economic growth rates. Rates of survival at different ages by gender, rural/urban, age and gender specific employment rates were used to weight the income values which were then discounted to gain the present value of lost earnings. Lifetime lost earnings were calculated assuming that the AIDS patient dies at age 30, would otherwise retire at 60 and that the discount rate is 5%.

Importance of the study: Calculation of direct and indirect costs of an emerging health challenge, methodology adopted in the calculation of direct and indirect costs and using this information to evaluate the cost-effectiveness of prevention activities.

(13) de Silva, Amala and Jayasinghe, Saroj (1998) Costs of Stigmatization: Adding to the burden of AIDS, Abstract published in the 4th Asia-Pacific Social Science and Medicine Conference – Health Social Science Action and Partnership: Retrospective and Prospective Discourse, December 7-11 Yogyakarta, Indonesia.

Study Objectives: Assessing the economic burden arising from stigmatization, a psychic cost, on HIV/AIDS patients and their families

Methodology: See Bloom et al (1997) above. Assumption imposed that the individual loses five years of working time due to stigmatization, so lost earnings are for a period five years longer than that resulting from premature death (i.e. the person tests positive at age 25, and though asymptomatic, due to stigmatization is prevented from working even till 30, which is the assumed age at death).

Importance of the study: Attempts to cost an element of psychic cost, stigmatization, by relating it to indirect cost.

(14) de Silva, Amala, de Silva, Damani and Jayasinghe, Saroj (1998) Abstract published in the 4th Asia-Pacific Social Science and Medicine Conference – Health Social Science Action and Partnership: Retrospective and Prospective Discourse, December 7-11 Yogyakarta, Indonesia.

Study Objective: Estimate the economic cost due to suicides in Sri Lanka during 1996.

Methodology: The figure for suicides was obtained from the Registrar General's Department. The scenario building technique used in Bloom et al (1997) was adopted. Differences in district-wise income levels and employment opportunities were built in. Lost earnings were calculated assuming suicide at 20, where retirement would have been at 60. Lost earnings discounted at 5%.

Importance of the Study: Focusing on the economic burden of suicide.

(15) Konradsen, F., Steele, P., Perera, D., van der Hoek, W., Amerasinghe, P.H. and Amerasinghe F.P (1999) Cost of Malaria Control in Sri Lanka, Bulletin of the World Health Organization, 77(4) pp 301-309 (see also chapter 5).

Study Objectives: Costing a range of treatment options.

Methodology: Study carried out in Anuradhapura district, in seven neighbouring villages, with 512 households and a total population of 2575, period covered October 1994 to September 1995. Cost data (salaries, travel allowance, staff input, cost of fuel, chemicals and other) provided by MOH. Fixed cost of the hospital was based on current replacement value and was annualized while fixed cost of the treatment centre was taken to be the rent of the building. Survey of households to collect household treatment costs. Cost estimates for the village based treatment centre were obtained from the reports of ongoing research activities in the study area. In order to compare different interventions the following criteria were devised for curative interventions: cost per blood slide examined by a microscopist and cost per blood slide found to be malaria positive and the patient treated. Both cost to households and government calculated for all interventions.

Importance of the study: Costing alternative treatment options.

(16) Attanayake, Nimal, Fox-Rushby, Julia and Mills Anne (2000) Household costs of 'malaria' morbidity: a study in Matale district, Sri Lanka, Tropical Medicine and International Health, Vol. 5 No 9, September.

Study Objectives: To measure and value the direct and indirect costs of perceived malaria morbidity at household level, with special attention to the valuing of indirect costs of workers in subsistence informal economies.

Methodology: Paper based on findings in Attanayake (1994). In measuring indirect cost the output-related approach is used by relating loss of time to loss of output at the individual and household level. Both complete and partially disabled days were considered for the economically active patients. Use of substitute family labour and the need for hired labour were also taken into consideration. In assessing direct costs different attendance of patients at different health care providers (Western, Ayurvedic, self care and rituals included) and details of the range of costs of treatment are taken into account In addition complementary costs of treatment were collected which included cost of vitamins, nutritional food, special foods and drinks.

Importance of the study: Focusing on the estimation of indirect costs in a subsistence informal economy.

(17) de Silva, Amala (2001) Economic Impacts of Mental Illness in Report of Study on Caring for the long term mentally ill in the community: Impacts, needs and options for interventions, Colombo: Sahanaya (study funded by the World Bank in collaboration with the Ministry of Health).

Study Objectives:

- Identifying the economic impacts of mental illness over a time period.
- Examining whether the coping strategies and expenditure patterns are affected by employment status.

Methodology: Surveys with similar questionnaire relating to costs of mental illness were conducted twice in a period of four months at the weekly clinics. The final sample size was 231 patients or accompanying persons visiting the Base Hospital, Horana. Each respondent was interviewed twice, involving a recall period of one month each time.

Importance of the study: Estimating direct and indirect costs over a period.

(18) Russell, Steven (2001) Can households afford to be ill? The role of the health system, material resources and social networks in Sri Lanka, PhD thesis, London School of Hygiene and Tropical Medicine, University of London.

Study Objectives: Record treatment seeking behaviour, measure the household costs of illness and assess coping strategies and their consequences for the household economy.

Methodology: The paper uses the household livelihood (HL) framework to examine people's utilization of health care services and illness cost burdens in a setting of free government health care. Three phases to the research: individual and group interviews; cross-sectional household survey of 423 households (2197 individuals) in two low income settlements in Colombo (total number of households 2100); and longitudinal case studies of 16 households selected from the cross-section survey on the basis of income quartile and to be representative of different illness profiles as well as non-ill families studied for a period of 8 months (data collection by visits at least every two weeks). Research carried out in 1998-99. Focuses on three categories of illness: acute illness (except for hospitalisation – recall over two weeks); chronic illness in the previous month (condition that persisted over one month or diagnosis known); and hospital inpatient (recall period one year). All cost information calculated for one month for comparison and in order to relate to income and assess vulnerability. Lost income based on average daily wage derived from local setting (Rs 150/-). Loss of income considered only for those employed. Costs reported on household basis.

Importance of the study: Costing of three different illness categories: acute, chronic and inpatient care based on a community survey and the use of in-depth longitudinal case studies.

Journal Article based on thesis findings:

Russell, Steven and Gilson, Lucy (To be published) Are health services protecting the urban poor in Sri Lanka? A household livelihood perspective.

(19) Dharmaratne, Samath D. (2001) Road Traffic Accidents in the Kandy Police Area and its Economic Implications, Thesis submitted for the MD (Community Medicine), Post Graduate Institute of Medicine, University of Colombo.

Study Objectives: Describing socio-demographic characteristics of victims, type of vehicles involved in road traffic accidents (RTA), types of injuries, environmental factors associated with RTAs, other risk factors determining RTAs and the severity of their outcomes; the economic losses incurred by the economy due to RTAs; and proposing appropriate measures for prevention and control of RTAs and modification of the RTA information system in Kandy and in Sri Lanka in general.

Methodology: Descriptive case series study, one year duration (1st October 1998 to 30th September 1999), based on all RTAs reported to the Kandy Police and recorded in the Accident Investigation Book. Information relating to the outcome of the accident, determinants and documentary evidence as well as information from the scene of the accident and the condition of vehicles recorded by Police Officers (five in number) attached to the Kandy Police using their own format which was then transcribed by the Principal Investigator into the format of his questionnaire. Principal Investigator followed up patient information on admission to the hospital using information from BHTs as well through interviews. Patients receiving OPD treatment were interviewed by the Police Officers. Procedures and tests used to maintain/check uniformity between Police Officer interviews. Seven types of costs considered including cost of medical treatment and loss of future output and pain, grief and suffering in the case of mortality. Calculation of costs omits all capital costs. Costing procedures for General Hospital Kandy (GHK) and Teaching Hospital Peradeniya (THP) were different as the Principal Investigator felt constrained by the lack of information on the floor area of the GHK. Also minor variations with regard to laundry services, existence of General stores, staff diets etc. In the case of some minor items a multiple of the THP value was used for GHK. Cost of x-rays, ECGs and blood tests calculated considering the Radiology Department and the Laboratory at THP as cost centres and considering all procedures carried out by these centres. Lost output calculated on the basis of average wage earnings by occupation multiplied by days lost due to hospitalization, convalescence, police and court procedures in the case of the injured and in the case of fatal accidents, the lost output due to premature death calculated over time discounted at 8%. A percentage of total cost was attributed to be psychic cost (cost of pain, grief and suffering).

Importance of the study: Focuses on a major problem in the current disease burden. Approach is comprehensive including costs of output loss and psychic loss, in addition to hospital treatment costs.

(20) Attanayake, Nimal (2002a) Unit cost of treatment for ten selected diseases at public medical institutions in Sri Lanka. Background paper prepared for the JICA Master Plan for strengthening the health system in Sri Lanka.

Study Objectives: Estimating the unit cost of treatment of ten selected diseases at public medical institutions.

Methodology: The ten selected diseases were: Malaria, Tuberculosis, Diarrhoea, Bronchial Asthma, Mental Illness, Diabetes Mellitus, Hypertension, Ischaemic Heart Disease and Dental caries, with the choice of diseases being determined by morbidity and mortality trends in Sri Lanka. Costing framework for each disease was formulated through discussions with Medical Consultants regarding treatment protocols. Outpatient/Clinic care considered for all except diarrhoeal disease, for which the costing was done based on a Paediatric ward in the Colombo South Teaching Hospital, designated for such care. Data relating to procedures and inputs collected from the relevant medical institutions with the prices coming mainly from the Medical Supplies Division (MSD) for drugs and equipment, with registered suppliers consulted for certain specific items only.

Importance of the study: Costing the treatment of epidemiologically significant diseases.

(21) Attanayake, Nimal (2002b) Household cost of long-term illness: Diabetes, Heart ailments and Mental illness .

Study Objectives:

- Estimating the cost of long-term illness: diabetes, ischaemic heart disease and mental illness, on the household.
- Assessing the affordability of long-term illness on the household through addressing coping mechanisms.

Methodology: Studying samples of 50 patients for each disease from five locations: Colombo, Kandy, Matara, Badulla and Anuradhapura (30 from each location). Initially patients were identified randomly in public sector clinics at the highest level of hospital available in the area, and

were then visited at home, at which point they were asked to name others in the area suffering from the same disease (this 'snowballing' allowed the sample to include those visiting the private sector as well as those accessing both forms of care) used. Patients from distant locations were interviewed at the hospital itself. Recall period of one month.

Importance of the study: Focus on household costs of non-communicable diseases.

(22) Ariyaratne, V.S (2003) Pattern of snakebite in two Divisional Secretariat Divisions of the Anuradhapura District and an Intervention to improve good practices following snakebite, Thesis submitted for the Degree of Doctor of Medicine in Community Medicine to the Post Graduate Institute of Medicine, University of Colombo.

Study Objectives: Estimating community incidence of snakebite in selected villages and examining knowledge and health seeking behaviour related to the bites pre and post intervention. The community intervention related to improving knowledge and good practices following snakebite.

Methodology: Two Divisional Secretariat Divisions were selected: one for intervention and the other as the control area. The study involved two phases. The first was a community survey involving interviewer conducted questionnaires (cross-sectional study collected retrospective data) to identify all snake bites in the selected villages and to describe health seeking behaviour related to the snake bites. Based on the results community based intervention implemented consisting of an educational programme to improve knowledge of prevention of snake bite and good practices following snake bite. First Aid centres set up in each intervention village. Information on incidence (through information from the first aid centres) and health seeking behaviour and practices following snakebite (similar questionnaire given to affected families) were collected post intervention and compared with pre-intervention information.

Importance of the study: Collecting direct and indirect cost information.

(23) Edirisinghe, E.A.K.K (2002) Cost analysis of patient care services at the District Hospital – Dompe- 2002, Dissertation submitted for MSc. in Medical Administration, PGIM, Colombo, Sri Lanka (also see Chapter 3).

Study Objectives: To collect data on household costs for inpatient and outpatient care.

- To calculate the average cost incurred by an indoor patient at the District Hospital, Dompe.
- To calculate the average cost incurred by an outdoor patient at the District Hospital, Dompe.

Methodology: Data collection using a questionnaire over a one month period. Random sampling was used. Sample size was 335 outdoor patients and 346 indoor patients.

Importance of the study: Focuses on household costs.

(24) Kasturiratne, K.T.A.A. (2003) Morbidity pattern and socio-economic burden of non-communicable diseases at tertiary care level, Dissertation submitted for MSc. in Community Medicine, PGIM, Colombo, Sri Lanka (also see Chapter 3).

Study Objectives:

(a) To calculate the cost of treating five selected non-communicable diseases (Myocardial infarction, Ischemic heart disease presenting with chest pain, stroke, cirrhosis and asthma) at a tertiary care hospital (also see Chapter 3).

(b) To calculate the household costs of inpatient care including indirect costs.

Methodology:

(a) Sample of 200 patients followed (10 patients each, for each disease, from four wards). Disease specific management data was obtained from the BHT. Information on cost of drugs, intravenous fluids and disposable surgical items from Medical Supply Division of the Ministry of Health; cost of blood from the National Blood Transfusion Service and costs of diagnostic tests from the charges imposed on General Ward patients at the Sri Jayawardenapura General Hospital. Value of other services such as physiotherapy imputed.

(b) Sample of 800 patients. Data collected using an interviewer-administered questionnaire. Questionnaire administered on a number of occasions during the hospital stay (on recruitment soon after admission, every other day during the course of

their stay and on discharge) to collect data on household direct and indirect costs.

Importance of the study:

(a) Focusing on the systemic cost of treatment of non-communicable diseases.
(b) Collecting household costs using a rigorous data collection procedure.

(25) Thasim, M.M. (2003) Cost analysis for diseases in the Medical Intensive Care Unit. National Hospital – Sri Lanka, Dissertation submitted for MSc. in Medical Administration, to the Post Graduate Institute of Medicine, University of Colombo.

Study Objectives: The general objectives are to estimate the cost of patient care for specific diseases at the Medical Intensive Care Unit of the NHSL and to examine whether this amount could be redirected to cost effective preventive measures. The specific objectives include identifying the disease mix pattern, ascertaining number of patient days, outcomes and resource utilization by disease mix, age and sex and making recommendations for cons11idering the benefits of taking preventive measures (in terms of reduced Medical Intensive Care unit costs).

Methodology: Costing done on all inpatients of the MICU, diagnosed with Dengue Fever, Leptospirosis, Poisoning, Guillain-Barre Syndrome, Diabetes Mellitus, Myocardial Infarction, Bronchial Asthma, Hypertension and alcoholism. Land and building costs ignored. Renovation costs borne by philanthropists considered. Equipment costs from invoices (20 year life span assumed). Consultant's time (50% of time), medical officers' time, nurses' time (nurse-patient ratio 1:1) labourer's time and cost of piped gas equally divided between all patients. Information on drugs, blood and blood products, tests, medical and surgical consumables, ECGs and x-rays obtained from bed head tickets on an individual basis. Electricity, water, laundry, patient diet and administration costs adjusted to cover MICU included.

Importance of the Study: Detailed study of MICU.

(26) Gajanayake, C (2004) A study of unit costs of selected dental treatment provided in different types of government clinics in the Galle district, Sri Lanka, Dissertation submitted for MSc. Medical Administration, to PGIM University of Colombo.

Study Objectives: To study (calculate and compare) the unit cost of selected dental treatment (extraction, temporary filling and Amalgam fillings) provided in different types of government clinics and private facilities in the Galle District.

Methodology: Sample was selected from among all government hospitals with dental clinics and schools with adolescent dental clinics. List of private dental facilities created, based on information from all Deputy Directors of Health Services, to which the list of government dental surgeons, dentists employed in the Faculty of Medicine and dental surgeons employed by the armed forces doing private practice, was added. Stratified (by type of hospital) random sampling method adopted. 50% of each category was selected for the study (+.5 in the case of uneven numbers). In the case of private dental care facilities five were chosen randomly. Land value omitted (to prevent distortions in cost due to differences in location). Replacement value of buildings and equipment considered (incorporating depreciation). The material necessary for fillings was distributed by the researcher while in the case of other materials, disposable syringes and gloves fixed amounts were set aside from the stocks. The dental surgeons maintained records regarding procedures and material usage. Researcher further included cost of material such as cotton wool and gauze. Time taken for procedures in different dental care facilities was assessed by the researcher. Cost of utilities taken into consideration. Two methods of time distribution were adopted: allocating staff costs by procedure merely by case mix (assuming each procedure takes the same time duration) and allocating staff costs by procedure taking into account observed time differences in carrying out the different procedures.

Importance of the study: Costing of similar dental care procedures in different types of hospitals.

4.2 METHODOLOGICAL ISSUES

The costing of diseases takes two main forms: direct costs of illness, that are either borne by the individual/family or the health system and the indirect costs of illness (particularly lost earnings) that are borne mainly by the individual and their family but also by employers, the community and the country. Psychic costs (sometimes termed emotional costs) though often large are impossible to measure and so are generally omitted underestimating the total costs of illness.

A number of methodological challenges are posed in the costing of diseases, and these are discussed below.

4.2.1 METHODS OF COSTING ILLNESS

Three methods can be used to estimate the cost of illness (as in Bloom et al, 1997): the Cost of Illness method, the Willingness to Pay method and through using cross-country data combined with regression techniques to estimate cost information for a specific country.

The cost of illness method involves direct costs: both those incurred by the health care system in the case of the public sector and those incurred by the patient in seeking care. In addition to cost of diagnosis, treatment and care this category could include non-personal expenditure such as those incurred on health education, research or prevention activities (Bloom et al 1997). Estimating direct costs over an illness episode can involve longitudinal data collection for a sample of patients; scenario building regarding typical illness and treatment patterns of patients derived from the direct observation of a small sample (case-studies) and cost information to simulate values; or the use of interpolation based on data for variables correlated with health expenditure (i.e. average income and health expenditure on a specific disease across a cross-country sample). Indirect costs are the value of earnings or output foregone by the patient and the family, or in some cases where a more aggregative context is considered the employer or the country. Psychological or non-pecuniary costs such as the pain and suffering caused by an illness or the impact of stigmatization in the case of HIV/AIDS also impose a cost. This last category of costs is too complex to measure in isolation and its entirety, though attempts can be made to quantify the impact of such psychic costs on direct and indirect costs of illness (as in Jayasinghe and de Silva, 1998).

The Willingness to pay method, often adopted in Environmental Economics, attempts to get individuals to assess the loss or benefit of an outcome by determining the price they would bear to avoid a particular event or to achieve a specific result. For example in the context of HIV/AIDS Bloom et al, 1997 access information from chosen samples on the costs they are willing to incur to use a disposable syringe in order to avoid HIV/AIDS. This benefit is considered to reflect the burden of illness, possibly including the psychic costs, that the individual bears if he were to be infected.

4.2.2 TIME UNIT OF COSTING

The complexities in costing of diseases, particularly non-communicable diseases are many-fold. In the case of communicable diseases while the patterns of illness could vary with regard to severity, recurrence and duration, the choice of a single episode of illness allows the researcher to gain an estimate of the systemic and individual costs incurred due to a disease (for instance for Malaria in Attanayake, 1994). In the case of non-communicable diseases and injuries the task becomes more complex (see Attanayake, 2002b; de Silva, 2001; Lanerolle,1992; Dharmaratne, 2001): ideally lifetime costs post diagnosis is the relevant basis for cost estimation but given the difficulties of longitudinal studies arbitrary cut off points (based often on study requirements and concerns regarding recall) have to be chosen and these may result in over-estimating costs (period immediately post-diagnosis is often the costliest for the health system due to the need for further investigations and for the individual who is yet to formulate his/her coping strategies) or underestimating costs in the case of a degenerative disease.

4.2.3 ISOLATING COSTS OF A SINGLE ILLNESS

Complexities also arise in costing due to individuals often having multiple illnesses (for example heart disease and diabetes). Researchers use different methods in approaching this problem: at the sample stage one option is to seek patients with only one disease and to eliminate from the sample those afflicted by more than one illness; at the survey stage a possibility exists in the case of some illnesses such as mental illness to firmly anchor the questions to that illness (de Silva, 2001); alternatively at the analysis stage separate cost estimates can be given for those with single and multiple disease burdens (as in Attanayake 2002 a where he makes a distinction between patients with non-complicated diabetes and patients with diabetes with cardiac symptoms).

A further problem arises in costing illness through household surveys. Here, as in the case of Attanayake (1994) where the author raises the issue, there could be some doubt about those who report Malaria in the recall period but have not been subject to a blood test. There could be some degree of misreporting, resulting in possible under or over estimation. Even where patients are diagnosed by medical staff, if no supporting diagnostic tests have been used, then there could be some degree of inaccuracy. The fact that state hospitals (and most private sector

doctors as well) do not provide diagnostic cards or prescription records to patients compounds this problem.

4.2.4 SOURCE OF TREATMENT

Another major complexity arises from the use of multiple treatment sources. The use of both public and private services as well as each individually is captured in Attanayake (2002b) while Attanayake (2002a) in calculating the unit cost of treatment of ten selected diseases chooses to focus only on public sector medical institutions. Likewise both de Silva (2001) and Attanayake (2002b) include the cost of ritual treatment in the cost of illness in the case of mental illness. The problem of costing care is further intensified by issues such as patients in public hospitals having to gain their tests and medicines from the private sector.

Another complexity is imposed by the side-effects generated by treatment: when a patient undergoing treatment for one illness faces complications due to reacting badly to the medication, or needs other forms of treatment to counteract the effects of the former treatment. Should such costs be included in the cost of treatment? If so this is likely to increase the range of information necessary with regard to source of treatment, as this is often one factor that leads to combining traditional and Western medicine, for example.

4.2.5 APPROPRIATE RECALL PERIOD

Recall periods vary significantly by person and by event. It is generally believed that major life events, such as hospitalization allow for longer recall periods than not so significant activities such as outpatient visits. Conversely the need for responding both practically and emotionally during a crisis, may argue for short recall periods even in the case of inpatient care. The choice of recall period for inpatient care is particularly taxing in the case of community based studies where ideal short periods of recall would hamper obtaining sufficient sample size.

Alternative strategies can be used such as the use of cost diaries and repeated surveying of the same sample. Even in the case of chronic illness or regular outpatient care repeated surveying can be important: firstly to allow for verification of the provided cost information; secondly to allow for smoothing out unusual expenditure items over time; and thirdly to identify the degree of fluctuation even in the course of regular health care activities.

4.2.6 COST IDENTIFICATION AND APPROPRIATE CLASSIFICATION

What should be included within the ambit of cost varies significantly with type of disease, treatment source and socio-economic and geographical location. Some examples will clarify this point: mental illness may necessitate questions relating to damage to physical property as an element of the cost of illness unlike in the case of other diseases; those seeking traditional care may often carry gifts to the healer in place of a payment and questions should be included that capture this element; and whether the care of the elderly and sick is done largely on a paid or voluntary basis, varies not only by country and level of development but even by urban and rural location in some countries. Many studies focus on the beginning of an illness episode, by phrasing questions to relate to the period of illness even prior to diagnosis; but some go to the other extreme of even including funeral expenses and time spent on grieving. In capturing the range of costs borne during an illness it is important therefore to provide an open-ended question in the survey questionnaire and to prompt the respondent regarding "any other costs you or the family have borne due to this illness" (Attanayake, 1994).

The use of the words direct and indirect in classifying costs can be misleading. As mentioned earlier, Economists use indirect costs mainly in the context of costs borne by individuals and families as a result of the illness, such as income foregone. Indirect is also however used in some studies to indicate the health care costs that are peripheral to the procedure being costed (i.e. hospital administration in costing a surgical procedure). In this category are included costs that affect the whole institution such as costs of landscaping and security as well.

Secondly the distinction between fixed and variable is sometimes unclear. For example, in the case of electricity some fixtures are kept on irrespective of the number of patients (i.e. air-conditioning) whereas others (i.e. even light bulbs) could vary with the number of patients attending a clinic or inward.

4.2.7 SCOPE OF COST ESTIMATION

Finally there is the problem of whose costs should be considered. Studies often focus on the health system, particularly the government health system, in determining costs. Costs borne by the private sector in the diagnosis and treatment of illnesses are considered to be compensated

for by their earnings and are hence private sector costs of diagnosis, treatment and care are only important from the perspective of the patient and his/her family, and is added to such costs as travel costs, costs of bystander, cost of transporting and providing food, and lost earnings of patient and bystander that are borne by patients, irrespective of the source of treatment. Most studies therefore focus on either provider costs or costs to consumers, with some focusing on both these elements. Systemic costs are partial since they only involve the government sector, with hardly any attempts to capture the cost of private provision of health care, apart from considering hospital and professional charges.

However apart from these two perspectives, three others can be highlighted: cost of care when it is provided by the non-governmental sector; cost of illness on the employer and cost to the national economy. Cost of care to NGOs can be measured in much the same way as the cost to the state, with shadow pricing of resources and services adopted to overcome the lack of markets. Employer costs can be of many forms: firstly, where paid sick leave exists, absenteeism of patient and bystander imposes a direct cost on employers; secondly even where non-paid leave is utilized the lack of the worker can adversely affect total output by more than his mere output, for instance where workers are on an assembly line or where the worker's presence has a bearing on the quality of a product or the cohesion of a work team. The impact on the national economy involves both the effects of morbidity and mortality, and can have temporal as well as inter-temporal impacts, such as through poor levels of education resulting from high incidence of illness in children, contributing to poor levels of output and technological growth in the future. This issue of capturing future losses remains a challenge in the context of needing to build in uncertainty and realistic discounting to the present.

4.3 COMPARING METHODOLOGY

4.3.1 TREATMENT COST

Treatment cost can be estimated as being borne by the health system and/or by the individual and his/her family. Attanayake (2002a) focuses on the unit costs borne by the state in the provision of public care while Attanayake (2002b) and de Silva (2001) focus on the costs borne by the individual or the family in gaining treatment, but do not measure the costs to the system. Ideally studies should combine both aspects in order to provide a holistic picture of the economic burden of diseases.

Treatment costs also differ significantly by the source of treatment. Attanayake (2002b) by using an innovative sampling technique (see 4.1) was able to examine the cost to patients with diabetes, heart ailments and mental illness of accessing public, private and combined public and private sector care. de Silva (2001) on the other hand was limited to mental patients attending the Horana Base Hospital, but sought information on the purchase of medicine from the private sector (resulting mainly from the shortages of drugs in the public sector).

Incorporating questions relating to the costs of alternative care, such as self-treatment, private sector care and ritual care is important, even in surveys relating to patients utilizing public sector institutions, as these studies as well as anecdotal evidence clearly makes the case that patients combine sources of care, which in turn has significant cost impacts.

4.3.2 TRAVEL COST

Travel cost needs to be measured from two dimensions: financial cost and time cost (to be converted to a financial cost in the form of lost earnings). In collecting the information it is important to use cross checks such as distance, while time of travel could also be relevant due to problems of bus availability and congestion. It is also important to collect information about the travel costs of those accompanying the patient, as the average number involved in a hospital visit is clearly greater than one in the Sri Lankan context.

Three complications in costing travel should be noted. Firstly where the journey involves multiple modes of transport, the questionnaire format must be sensitive to this issue as otherwise the information collected is likely to be skewed (i.e. individual who has a long walk to get a bus may only report the costs relating to the bus journey). Secondly it is important to explicitly verify that the return journey will follow the same travel procedure (i.e. patients who come to hospital in a three wheeler in order to be on time may well take the bus back). Thirdly in the case of inpatients, while the cost borne to bring them food is relevant as part of the disease cost, the cost of visitors travel is not (this is a reflection of patient and family personality rather than a need essentially imposed by the illness!).

4.3.3 COST OF FOOD

Attanayake (2002b) includes nutritional and supplementary food under direct costs, in considering long term illnesses such as Diabetes Mellitus

and Ischaemic Heart Disease. Even in the case of Malaria, Attanayake (1994) considers it important to consider the cost of special food. The questionnaire probes the respondent in order to gain information on any special food the patient is given, as in special food items and food items purchased for the patient but the value of food items received as presents is also not included here.

In calculating the household cost of food this includes the cost of transporting home cooked food to the institution but not the value of the food itself. The argument here is that the food consumed by the patient would in any case have been consumed by him/her even if they were not ill. However food purchased for the consumption of the hospitalized patient and carer is included. This creates some discrepancy, particularly if one assumes that food quantities cooked in the household are adjusted in line with the absence of these family members.

4.3.4 LOST EARNINGS

(a) ALTERNATIVE APPROACHES TO MEASUREMENT

Lost earnings is relevant in two contexts: firstly as a cost of seeking treatment as an outpatient, as in the time spent on travel and waiting for treatment, as well as the time spent on treatment by the patient and those accompanying him/her; secondly in the context of inpatient care and recuperation the cost of time spent by the patient and carers which could have been used for productive activities.

Lost earnings could either be assessed in terms of physical output and then monetized or directly measured in financial terms. The former approach is particularly relevant in the context of subsistence farmers for example, since the loss of their income is likely to be more in the form of output affecting self-sufficiency rather than in terms of lost financial income per se. It also helps to capture the actual impact on household output, which often may remain unaffected by ill-health of a family member, either if family production involves surplus labour (zero or negative marginal benefit from the extra units of labour) or allows for labour substitution (suggesting that production was not occurring on the production possibility frontier). This output approach however imposes a further burden on the researcher in necessitating the determination of relevant prices in the course of converting physical output into financial aggregates.

Another problem is that outputs may be seasonal. If annual output is measured during the harvest season and annualised, the household's income and consequently opportunity cost of wages foregone would be overestimated.

Two main methods of calculating lost earnings exist: the first is based on the lost earnings of a sample (see below) and the second, the use of national or provincial level average data to extrapolate lost earnings (see sections below). Attanayake (2002b) and de Silva (2001) use the former method while Bloom et al (1997) uses the latter.

Calculating lost earnings for a sample involves the use of a questionnaire to determine what the income would be in the period being studied and what the extent of the loss was that was incurred due to the illness. For example if the individual is a daily wage earner, the number of days lost multiplied by the earnings per day would give the lost income for the period under consideration. Where monthly incomes are involved, the question arises whether the lost days of work affect the income (i.e. the distinction between leave with or without pay). Where no pay leave has to be used then the fraction of income lost has to be calculated. The greatest complexity arises in the case of variable income earners: either as entrepreneurs or in self-employment. In such cases individuals have to be encouraged to assess their loss of earnings for the period in a realistic manner. As Attanayake (2002b) states.

> "The interviews were not strictly confined to the questionnaire and the respondents were allowed to express their views freely, particularly about indirect costs. The qualitative data were screened and prepared for the estimation procedure of indirect cost, which was largely done at individual level".

The analysis of lost earnings based on sample data can be done in four ways: as an average (as in Attanayake, 2002b); for specific groups of individuals (by occupation for example) (as in de Silva, 2001); as a range by selecting the individuals at either end of the spectrum or by deriving an average daily wage relevant to the specific geographical location (as in Russell, 2001) which presupposes relative similarity in socio-economic and demographic profile as well as wage pattern. The choice of analytical approach depends on the purpose of the study. Where it is important to quantify losses and to come up with a single value the average earnings

lost method has to be adopted but it is characterized by the usual shortcomings of using a mean: that the average value is not representative in cases where there is a wide disparity in the income distribution, or where only a minor fraction of the sample is subject to lost earnings.

(b) FACTORING IN DEATH/DISABILITY BY OTHER DISEASES

In calculating lost earnings resulting from death, as in the case of calculating the economic burden of HIV/AIDS (Bloom et al, 1997) it is important to incorporate the probability of survival, that is to say to discount for the fact that the individual does have a non-zero probability of dieing in the period under study, by a means that is not the disease under consideration. In such cases it is important to weight the earnings of the period by the probability of survival in that period. Life tables provide information regarding the probability of survival at different age levels and this information can be used to weight lost earnings by the value relevant for the problem under consideration (i.e. in the AIDS case for example, death from AIDS is assumed to happen at 30, but lost earnings is calculated taking into consideration that the retirement age is 60, so that an individual earns in this 30 years, provided he does not succumb to death from another cause). Using the data in the life table directly to weight earnings is possible (see Appendix 3) in this instance as the incidence of AIDS is low in Sri Lanka at present, and therefore AIDS is not a significant variable in determining the probability of survival. In the case of countries like Malawi however direct use of the probabilities of death may no longer be valid, as the life tables are likely to be strongly affected by age specific death rates due to HIV/AIDS, thus necessitating a disagrregation of the probability of death by the disease being studied and by other causes.

(c) FACTORING IN UNEMPLOYMENT

Where lost earnings are calculated using average income figures it is important to factor in unemployment (see Bloom et al 1997). The Quarterly Labour Force surveys conducted by the Department of Census and Statistics are important, not only in gaining data on the most recent national unemployment rates, but in getting unemployment data disaggregated by sex and age group as well. This information allows us to estimate lost earnings for an individual building in the probability of that person being employed (see Appendix 3).

In determining the average lost earnings of a chosen sample, the probability of being unemployed is reflected in each individual's response to the question "Are you employed?". The larger the number unemployed the lower would be the average lost earnings if the sample were considered as a whole or average lost earnings could be calculated only for the employed sub-sample as in de Silva, 2001. In addition however it is important to determine both the period of unemployment and the cause of unemployment. Often individuals who respond that they are unemployed are actually students, the elderly or housewives. Here the means of assessing the loss of productive activity becomes complex. Likewise the weight of a daily paid person being unemployed in the short run may be quite different from the loss unemployment imposes on a formal sector worker, an informal sector worker or an entrepreneur. The fact that illness, and the lost days of productive activity it entails can affect future earnings streams through its impact on career profiles is also an important issue, particularly in the context of non-communicable diseases. Alternatively the ability of some categories of workers to replace current work losses with increased future earnings through changing labour-leisure patterns also needs to be considered (i.e. workers with output contracts). Attention needs to be devoted to deriving more sophisticated measures for evaluating lost income, including the use of multiple surveys to gain longitudinal data.

The availability of surplus labour results in the marginal productivity of lost labour being zero, and labour substitution within the family results in the marginal cost of production possibly remaining unchanged as well. However where the care provider could otherwise be employed, then the opportunity cost of care adds to the economic burden of illness. Assessing this opportunity cost could be based on average daily wages prevailing in the locality, assuming that the carer was of a similar profile as other workers in the neighbourhood.

(d) Complexities in the Agricultural/rural Sector

Season has a major impact on lost earnings. Illness in certain periods of the year can be far more economically debilitating than at others, for instance times of sowing and harvesting. The impact on output would depend on the feasibility of labour substitution. This in turn depends not only on the availability of surplus labour but on skill levels as well. Likewise even wages of those working in the agricultural sector as labourers is closely tied to season.

The impact of illness can result in lower quality output as well as for example, the plucking of fruit too early or too late. Attanayake et al (2000) highlights this issue and cites the fact that the questionnaire used in assessing lost income probed the loss in earnings created by having to accept lower prices for output. Quality of output could also be affected in the course of labour substitution within the family.

The fact that much of agricultural produce is not traded creates problems regarding the pricing of such output. Price distortions due to market rigidities translate into earnings distortions in the context of calculating lost earnings in the rural sector. A further complexity in the case of agricultural income is imposed through the prevalence of uncertainty with regard to crops, linked to factors such as adverse weather conditions and crop diseases.

(e) OTHER PRESPECTIVES ON COSTING LIFE AND MOBILITY

Dharmaratne (2001) in discussing different measures for costing life and injury in road traffic accidents cites three other perspectives that are of interest. Firstly the insurance approach, which similar to the willingness to pay approach uses insurance premiums as the basis for determining the loss incurred. The second is the court award approach that uses judicial determination of compensation as the basis for calculating losses incurred due to death or disability. The third is the implicit public sector valuation approach, which determines the implicit cost of disability and death in the case of road traffic accidents for example, by examining the costs borne on safety legislation and implementation.

4.3.5 SHADOW PRICING

In many studies where public sector prices are needed, private sector prices are used as a proxy, with an adjustment being made, such as using a deflator, based on known ratios between other public sector services and similar services in the private sector (as in Attanayake 2002a) or omission of an assumed profit margin (as in the case of Malalasekera et al (2003). The former mechanism assumes that costs for all services (i.e. all diagnostic tests or scans) are determined on a similar basis. However factors such as scarcity of human resources, rarity of the test or its newness could lead to ad hoc loading of charges that may skew the public/private ratio of costs. The alternative, of trying to determine the assumed profit

margin, would only succeed if the researcher had a good rapport with the private sector institution whose prices are used as the base.

4.4 COMPARING RESULTS

4.4.1 MALARIA

(a) Jayawardene (1993)

Results cover 314 Malaria cases (585 episodes) in 142 households in Block C of the Mahaweli Resettlement Scheme. Approximately 34% of all family members had more than two episodes during the first year of resettlement.

Days of activity lost to Malaria were calculated. Average number of household head days lost was 8.36 over 10 months for their own illness and 5.33 days on average lost due to illness among other family members, resulting in a total of 13.69 days lost in the 10 month period, which when converted to an annual basis gives 16.42 days per household head affected. Given the average days wages of Rs 40, this results in a loss of Rs 656.80 per annum. The study points out that further indirect costs are imposed by indebtedness caused by the burden of illness, and the penalties imposed on the new settlers by the Resettlement Organization, that took the form of cutting rations when work was not completed on houses, latrines and homestead gardens by the stipulated date.

Table: Average direct costs of malaria per episode (Rupees)

Patient category	Treatment	Travel + other
Male household head	13.12	19.73
Female household head	10.33	16.14
Children 0-5 years	10.24	16.14
Children 6-15 years	5.44	8.21

Note: 142 households
Source: Jayawardene, 1993

(b) Attanayake (1994)

(i) Government Anti-Malaria Programs Cost disaggregation

In considering the Anti-Malaria activities carried out by the government health system using the district budget for health, the district budget for

malaria, and the provision of the Anti-Malaria campaign, the study finds that 81.5% is spent on preventive care, 14.1% on detection and treatment and 4.4% on supportive activities (health education, entomological investigations and training and supervision of Voluntary Health Workers). Of the 81.5% devoted to preventive care, 80.1% is for residual spraying, with perennial spraying accounting for the major share (79.4%). Prophylactic treatment, larvicide spraying and impregnation only account for 1.5% of the total cost. Detection and treatment at fixed medical centres accounts for 10% of costs of which 5.4% is for outpatient care and 4.5% for inpatient care. Costs on Malaria detection and treatment in the field, account for 4.0% of the total cost. This analysis shows that prevention activities are heavily biased towards perennial residual spraying while detection and treatment is mostly centred on fixed medical centres.

In disaggregating the costs by type of input, malathion and personnel emoluments are the two largest components, contributing 58.1% and 34.8% respectively.

Overall the government spent Rs 166.69 per person for Malaria related activities.

(ii) Inpatient Case Detection and Treatment

On average, across all types of medical centres the cost of detection and treatment per inpatient is Rs 295.45 with manpower, supplies including drugs and food and buildings and equipment contributing Rs 160.79, Rs 68.15 and Rs 66.51 respectively. The cost per inpatient treated varies by type of institution:

Rural Hospital(RH)	Rs 354.01
Peripheral Unit(PU)	Rs 326.34
District Hospital (DH)	Rs 244.75
Base Hospital (BH)	Rs 481.29

The cost declines from as the sophistication of the hospital rises, from RH to PU and DH but is significantly higher at the Base Hospital level. The differences in average cost are mainly related to differences in manpower and utilization. The study also presents incremental costs in comparing different health units.

(iii) Outpatient Case Detection and Treatment

These costs relate to fixed medical centres. Number of smears and case load determine average cost.

The author also examined the cost of mobile clinics through two case studies and found that such costs were significantly higher: in Milawana estate the cost per case detected and cost per case treated were Rs 94.10 and Rs 50.94 while at Hattota Amuna village they were Rs 171.76 and Rs 93.54 respectively. Location of the mobile clinic and frequency had a bearing on this high cost, as did organizational factors.

	No. of smears	No. of cases detected	No. of cases treated	Cost Per Case Dectected	Cost Per Case Treated
Central Dispensary	14202	3778	3778	52.46	54.41
Rural Hospital	3358	1124	961	57.46	22.61
Peripheral Unit	18756	5594	5213	45.99	44.66
District Hospital	27315	7171	5183	41.29	52.56
Base Hospital	5418	653	104	148.41	702.48
Total	69051	18320	15239	52.61	52.84

(iv) Household costs

The household survey found 1.4 visits per patient on average. Of the visits 49.2% were to government Western Out Patient Departments, 7.1% were for government inpatient care, 22.1 were visits to government doctors involved in private practice and 13.5% to doctors in private practice.

Of the costs borne by households the highest proportion, 37.1% was for special food, 31.3% was for treatment and travel costs for patient and accompanying persons accounted for 11.5% and 10.3% respectively. Of the treatment costs only 5.8% was for informal treatment, of which 11.9% was on ritual treatment. In the case of self-treatment drugs accounted for 82% of the cost and special food for the residue (18%).

Cost per visit to a formal source cost Rs 50.79, while informal sources (comprising of self-treatment and ritual treatment) cost only Rs 4.16 on average. In accessing formal sources, treatment cost was Rs 14.26 on average and travelling Rs 11.76. The highest cost per visit was to access the Regional Malaria Office in Matale Rs 87.44 (treatment cost nil)

compared to Rs 86.47 when obtaining private doctor's services (treatment cost Rs 34.27), and Rs 77.88 in meeting a government doctor engaged in private practice (treatment cost 42.64). Cost per visit in utilizing government inpatient care was Rs 53.19 (treatment cost nil).

Travel costs and costs on special food varied significantly by source of treatment. The author notes the significant utilization of private health services in the treatment of Malaria, and highlights the fact that with subsequent visits the percentage accessing the private sector rises.

Considering direct formal and informal treatment costs an episode of illness cost a patient Rs 72.07, of which Rs 22.45 was treatment and Rs 15.64 travelling. The cost of special food was Rs 26.99.

To give the results of only the two largest sub-groups by source of treatment: those who received only outpatient care at public medical centres spent Rs 8.48 on average for receiving care (which included the travel cost of the patient and those accompanying him, the treatment cost and the payment for the blood test) and Rs 35.84 on what the author terms compliance cost (cost of vitamins, nutritional food and special food) while those seeking private western care spent Rs 86.13 on receiving care and Rs 34.05 as cost of compliance. Over the different sub-categories cost of compliance was relatively similar while differences in payments for services was counteracted substantially by differences in the cost of travel.

(v) Indirect costs

Of the 401 patients surveyed only 70 suffered a loss due to illness. Among those who did not are school children, pre-school children and those engaged primarily in household work at the onset of the illness. The study focused primarily on a farming community that allows for labour substitution and this helps to explain why large numbers of patients reported not being economically affected by illness. Of these, 27 also commented that the period when thy fell ill, was not a "special time" for agricultural work, by which they are referring to a time when agricultural work is labour intensive.

Of the indirect cost 43.1% is attributable to lost output, 34.2% to lost wages, 16.4% to the need to hire labour and 6.3% to loss of business income.

Considering the patients perceived to be fully recovered (PFRP) average indirect cost per patient is Rs 140.86 while the average indirect cost per economically active patient is Rs 364.32. The indirect cost borne by a household member to look after a patient was Rs 101.02.

The indirect cost per 'perceivably fully recovered' patient (Rs 140.86) was nearly twice the direct cost of the same (75.07).

(c) Graves, Fernando and Attanayake (1995)

Average mobile clinic attendance was found to be 31.4 patients over the period 1993-1995. The average number of cases of detected per clinic averaged 3.7 and the slide positivity rate declined from 15.16 in 1993 to 10.64 in 1995.

When average attendance per mobile clinic and average number detected and treated per clinic were taken as the denominators, total cost per clinic was 2050, cost per case detected and treated per clinic was approximately Rs 515. These figures varied for the different districts due to differences in the number of clinics conducted by a mobile team, clinic attendance and epidemiology. These authors argue that these figures are high when compared to the cost per outpatient case detected of Rs 86.36 in medical institutions with blood testing facilities and Rs 183.82 for medical institutions with only blood filming facilities cited in the PhD thesis of Nimal Attanayake (1994).

(d) Konradsen et al (1997a)

(i) Curative care

The following household expenditure estimates are presented for 178 malaria episodes in five villages in the Anuradhapura District. All patients had sought Western type healthcare. In 9% of cases more than formal treatment source had been accessed. Families with higher incomes made more use of private facilities.

The expenditure cited is mean per episode in Sri Lankan rupees with the range given in parenthesis.

Transport	31.8 (0-300)
Blood examination	1.8 (0-95)
Treatment	19.5 (0-530)
Meals at health facility	29.6 (0-600)

Special diet at home	47.6	(0-350)
Other (including hiring labour)	18.7	(0-625)
Total	1149.0	(0-1092)

The median yearly net income of these families was Rs 12900 with 19 families reporting no income at all. 84% of the households used government facilities as their first choice while 16% used private facilities that added to cost, in contrast with the free government health care.

Special food was a major cost item. Special food and food during the hospital visit were necessitated by malaria and the drugs taken to counteract malaria being considered to have a 'heating' effect on the body which could be neutralized by taking sweet drinks or eating oranges. Glucose was taken to help strengthen patients during illness episodes.

On average 7.8 days were lost due to an episode of malaria (median 6, inter-quartile range 1-10). In addition on average 2.9 days were lost (median 1, inter-quartile range 0-3) per episode by persons accompanying the malaria patient to the health facility. Labour generally substituted with the family. Outside labour was needed only in 33 episodes (18.5%). In 12 cases payment was in cash with the remaining cases paid in kind or by exchanging labour. Hired labour cost an average of rupees 362 per episode (SD = 189).

(ii) Preventive care

In 23% of families one or more members had used bed nets at a cost of approximately rupees 600-700 per double net. Families with a yearly income above the median of Rs 12900 used significantly more bed nets than the poor families.

An average of 6.3 coils were burnt per week, costing rupees 2.50 per coil. These were used by 54% of the families. Burning of traditional medicinal herbs was used by 69% of the households. High acceptance of residual spraying prevailed.

(e) Konradsen et al (1997b)

Lost earnings

The average annual net household income was 12,900 (SD = 10,412) for these households. The daily wage rate in the area was Rs 50 for children, Rs 75 for females and Rs 100 for males. The authors weight the wages by

labour demand (weighting ratio calculated as number of hours worked in that week divided by maximum number of hours worked per week during the entire period) to gain the adjusted wage figures of Rs 15 to 50 for children, Rs 23 to 75 for women and Rs 31 to 100 for men.

In a population of 298, there were 223 malaria episodes involving 134 individuals resulting in a loss of 1107 person days lost to malaria. In the age group 14-60, 650 days were lost to Malaria (13 days on average per household with a range from 0 to 44) and 1914 days to other diseases.

The average annual cost per household due to Malaria was US $ 15.56 and for other diseases US $ 47.46. The average loss due to malaria as a percentage of net income was 6%, while that for other diseases was 18%. In particular the period October to December showed high incidence of illness, 446 person days lost to malaria and 515 to other diseases, which unfortunately coincided with the season of heavy activity in paddy cultivation. Weighting of wages takes account of the impact of workdays lost in a period of high labour demand, but the methodology does not take into account of poor productivity prior and post the illness, resulting as a consequence of malaria nor the time cost involved in taking care of patients. The number of days reported as being spent on accompanying patients for treatment, predominantly to the Kekirawa government hospital, seems like under reportage. These factors may result in an under estimation of the household costs of malaria in Mahameegaswewa.

(f) Konradsen et al (1999)

The villagers predominantly seek care at the Kekirawa government hospital, situated 25 kms away from the village. The village level treatment centre is underutilized. The mobile clinic is held in the village in periods when malaria incidence is high so therefore involves the examination of a larger number of slides than does the village level treatment centre. Capital cost is however high in the case of the mobile clinic due to the cost of the vehicle. These latter options do not involve any travel costs for the patient, while travel and related expenditure to Kekirawa government hospital costs Rs 55.

	Operating cost per positive case	Capital cost per positive case	Cost to government per positive case	Cost to household per positive case	Total cost per positive case
Hospital	53	18	71	55	126
Mobile Clinic	89	64	153	0	153
Village level Treatment centre	89	23	112	0	112

When systemic costs alone are considered the best option seems to be the services provided by the Kekirawa government hospital. However once household costs are incorporated the village level treatment centre is more cost effective. If lost earnings due to travel for treatment is considered then this difference becomes even greater. Village level treatment centres would also encourage early accessing of care. This however presupposes the efficient functioning of village level centres and the constant availability of drugs and testing material.

The cost-effectiveness of treatment source is highly correlated to utilization rate, which in turn is related to the catchment area. This suggests that centrally located large healthcare centres covering larger populations is more favourable to the state but at the cost of imposing a heavy burden on households. Mobile clinics may be a viable option if they are operated rationally, targeting areas of high transmission and functioning only when malaria is most prevalent. This presupposes a good health information system.

(g) Attanayake, Fox-Rushby and Mills (2000)

(i) Treatment Costs

Considering formal treatment, outpatient care at public health care centres and hospitals account for 51.3% of visits, while care at private clinics of public doctors is 22.5%. Visits to private clinics are next in significance at 12.7% with inpatient care recording 7.5%. Of the patients, 46% sought care only from public facilities as outpatients, 25% only from private sources and 11% combined public and private services.

The average cost of receiving treatment for all cases was Rs 37 (SD 112) per patient with the cost of complementary goods/services Rs 38 (SD 40). Patients who receive care only from private Western sources had the highest average cost of treatment (Rs 86) followed by the combination of public inpatient or outpatient care with private Western treatment (Rs 73). These costs are affected by source of care, with travel costs and length of inpatient stay affecting the cost, in addition to payment for services.

Total cost of inpatient care is higher than outpatient care in the government sector (Rs 54.50 compared with Rs 34.90). The major element in both cases is the cost of special food.

Considering public field facilities the variation between mobile clinics, health workers and volunteers is small, Rs 16.60, Rs 20.00 and Rs 24.30 respectively. Again a major share of cost is on special food.

Considering the private sector average cost of treatment is Rs 42.90 for public doctors working in private practice compared to Rs 34.10 in private clinics. The next highest contribution to cost is on special food in both instances.

Informal treatment costs, whether self treatment or rituals is low, at Rs 3.70 and Rs 5.70 respectively.

Considering all the different sources of treatment the average cost per patient was Rs 75.20 (of which special food accounted for Rs 28/-, treatment cost for Rs 23/- and travel cost for the patient and accompanying person/s Rs 9/- and Rs 8/- respectively. The average cost per visit was Rs 54.80. The average was 1.35 visits per patient.

(ii) Lost earnings

Three different categories of economically active persons were considered: of 55 patients who were wage/salary earners 33 reported a loss of salary/ wage; of the 108 agricultural sector workers, 8 recorded a loss of output and 15 the need for hiring labour due to their illness; of the 21 business persons 5 noted a loss in business income. Loss per economically active patient is considered to be Rs 124/-lost salary/wages, Rs 157 output loss, Rs 60 for hiring labour and Rs 23 as lost business income.

Indirect costs borne by household members other than the patient, per fully recovered patient in 1993 was Rs 102, of which Rs 15 was the value lost time in accompanying the patient, Rs 24 a loss of output, Rs 20 lost

wages, Rs 12 the cost of incentives to friends and neighbours in carrying out services which included the cost of feeding non-household members, and Rs 31 was other losses, which were primarily incurred in labour substitution within the household (the standard deviations being large in each case because there were a large number of zero values under each item).

Intra-household labour substitution was not common, due to differences in skill often resulting from gender specialization, with only 19% of the economically active patients' unattended work being attended to by other household members. 37% of cases showed no labour substitution while 21% reported the use of hired labour and/or help from relatives and/or friends.

Lost earning varied significantly by occupation/source of income. The loss per patient whose income was affected due to illness by type of output/ income loss is reported as Rs 2613 (loss of output of agricultural production) with a further Rs 530 as the cost of hired labour, Rs 502 in the case of loss of salary/wages and Rs 610 as loss of business income.

(iii) Total Cost

Type of cost	Source of treatment			
	Public (N = 188)	Public & Private (N = 35)	Private (N = 88)	Total (N=311)
1. Direct cost:				
(a) Patient	51	127	121	80
(b) Provider	129	150	0	95
2. Indirect cost (patient + household)	159	521	160	200
3. Social cost (1+2)	340	797	281	375
4. Patient's share of direct cost	28.5	45.8	100.0	45.5
5. Household's (Patient and other members) share of social cost	61.9	81.2	100.0	74.6

Source: Attanayake, Fox-Rushby and Mills (2000)

(h) Attanayake (2002a)

Unit costs were estimated assuming a secondary level hospital. The assumption adopted was that a microscopist at such an institution examines 65 blood films per day.

The results are presented in the table below

Type of cost	Amount
1. Cost per blood film examined	19.80
2. Cost per case detected	
a) If SPR = 6.45 (current rate)	307.01
b) If SPR = 11.7 (rate in 2000)	169.25
3. Cost per case treated	
a) For a *pv* case	38.17
b) For a *pf* case with resistance to chloroquine	123.31
4. Cost per case detected and treated	
a) If SPR = 6.45 (current rate)	345.17
b) If SPR = 11.7 (rate in 2000)	207.41

Note: Slide Positivity Rates (SPR) are based on epidemiological data.
Source: Attanayake 2002a

The difference in costs between *pv* and *pf* cases are that the latter involves a second visit to the health care facility, a further blood test and treatment with the drug pyrimethrine-sulfadoxine rather than chloroquine.

4.4.2 TUBERCULOSIS (TB)

Attanayake (2002a)

The cost estimates reported are based on data from clinics conducted by the Medical Research Institute (MRI) in 2001, where the percentage of patients with TB attending the clinics was found to be 20.04%. Overhead costs are allocated on this basis. Cost of investigations were estimated using three different approaches:

i) Chest x-ray, UFR, ESR and WBC/DC – average cost of each of these tests were calculated for the study in general.

ii) AFB and Mantaux test costs estimated based on data collected from the MRI clinic.

iii) Sputum culture taken to be 50% of the cost in the private sector, with this proportion being based on comparisons of estimates of other tests in the public sector with private sector charges.

The cost of treatment of an OPD clinic visit per patient was Rs 438 (with manpower, drugs, investigations and overheads accounting for 39%, 40%, 12% and 9% respectively).

4.4.3 DIARROHEAL DISEASE

(a) de Silva (1995)

The Diarrhoea Treatment Unit (DTU) at the Lady Ridgeway Hospital was set up to prevent the overcrowding of the diarrhoea sections of the medical wards, due to the admission of even children moderately affected by diarrhoea. The main concern in such cases is the possibility of dehydration.

Costs considered include staff emoluments, supplies such as soap, plastic cups, spoons, plates, buckets and drugs.

The cost of OPD care per DTU patient was Rs 18.50 and the additional cost per DTU treatment episode Rs 43.27, which adds up to a cost of Rs 61.77. Based on a study of patient care at LRH (1993) average cost per patient day was found to be Rs 268.00, and the average length of stay in the Paediatric Medical wards at LRH 3.5 days, so the cost per diarrhoea admission would have been Rs 938.00. The use of the Diarrhoea Treatment Unit therefore saved Rs 876.23 per patient.

Total number of patients treated in the DTU in 1993 was 17612, of whom 16,903 were discharged from the DTU which translates into the fact that this number of ward admissions were prevented by the existence of the DTU. Actual admissions prevented, when adjusting for the fact that some DTU patients would not have had to be warded in any case, the number is 13523.

(b) Attanayake (2002a)

This cost estimation is based on inpatient care information from a paediatric ward, designated for the care of diarrhoeal disease, in the Colombo South Teaching Hospital (Kalubowila). The cost per patient is Rs 972 and the cost per patient day is Rs 600. Of these expenditure 84% is attributable to manpower. This is due to the low cost of drugs, mainly

Jeevani (ORS) and the fact that few investigations are conducted.The duration of hospitalization is short, on average 1.5 days.

4.4.4 HIV/AIDS

(a) Bloom et al (1997)

Data on the direct cost of HIV/AIDS was estimated by simulating the cost of WHO treatment protocol in combination with the clinical profiles of twenty AIDS patients in Sri Lanka. The cost of hospital stay and outpatient visits as estimated were as follows:

Category	Amount US $	
	Low scenario	High scenairo
Diagnosis and treatment	117.51	828.96
Hospitalization	156.25	192.19
Outpatient visits	13.74	37.50
Total	287.50	1058.65

Note: At the time the study was done the US $ = Rs 48.
Source: Dr Soma de Sylva's data; WHO (1991) as reported in Bloom, Mahal et al (1997)

In estimating the cost of diagnosis and treatment to data sets were combined. Epidemiological information was gained from the 20 patients in the sample, which allowed for the calculation of the proportion of AIDS patients suffering from a specific disease/illness (i.e. tuberculosis, herpes zoster, wasting, diarrhoea, etc.). Secondly the cost of treatment and/or investigation of the conditions were calculated based on the protocols A and C of the WHO guidelines (WHO, 1991). Combined this information gave the expected treatment cost by disease/illness with the summation corresponding to the total cost of diagnosis and treatment of HIV.AIDS.

Considering a typical HIV/AIDS patient (based on the sample considered) it was assumed that the person would live for a year after diagnosis, involving one outpatient visit per month. This has been cost using an upper and a lower bound given the prevailing channel fees at the time. Inpatient care was assumed to be 30 days, with the upper and lower bounds corresponding to public (based on Attanayake and de Silva, 1987) and private care.

An alternative estimation method involved interpolation of personal medical care cost estimates based on the results of a cross-country regression of medical care costs per case of AIDS on per capita income. Assuming an estimated per capita income level for Sri Lanka of US $ 540 this led to an estimate of personal medical care of US $ 1150.

To estimate the indirect costs, the discounted value of earnings foregone by individuals who die prematurely because of AIDS is considered. This measures the private rather than the social earnings losses. The lost earnings in this case were calculated on the basis of the following assumptions: that under the low scenario, individuals retire at 55 while under the high scenario they could continue to work till 60 but that in both cases death from AIDS occurred at age 30. In both case scenarios the average annual growth rate of labour income was assumed to be 3.6% per annum in line with the growth of national income in this period in the mid 1990s. Sex specific survival rates and unemployment rates specific to location and sex were adopted. Two different discount rates were adopted in calculating the present value of lost future earnings. The difference in Medical care costs by location, relates to treatment sources (the utilization of private services is more common in the urban sector).

Two main conclusions emerge: firstly that the indirect costs are much greater than direct costs. Medical care costs could be borne mainly by the state in countries like Sri Lanka which have a free health care system. However in the absence of a developed state social welfare system indirect costs have to be borne by the household creating hardships in the present period and even intergenerational impacts through lost education. Secondly, as a result of the costing methodology adopted in this study, where income is weighted by sex and location specific unemployment rates, the value of life differs significantly between the sexes and the urban and rural sectors. Such a conclusion is repugnant from an ethical viewpoint.

Note further that these estimates are lower bounds of the actual cost of illness measures because thy do not include psychological costs and non-personal direct costs. The former cannot be assessed. The lower bound of the latter is roughly estimated to be around US $ 4 mn, based on information about grants from international agencies and international NGOs, local NGOs and government expenditure on education and research.

Cost of HIV/AIDS – Cost of Illness Approach

	Medical care costs per case (US $ thousands)	Lost earnings per case (in US $ thousands)		Cost of Illness per case (in US $ thousands)	
Discount rate 3%		Low Scenario	High Scenario	Low Scenario	High Scenario
Urban Areas					
Male	1.15	15.11	17.87	16.26	19.02
Female	1.15	7.87	9.39	9.02	10.54
Rural Areas					
Male	0.29	9.28	10.97	9.57	11.26
Female	0.29	4.46	5.31	4.75	5.60
Discount rate 5%					
Urban Areas					
Male	1.15	12.01	13.62	13.16	14.77
Female	1.15	6.26	7.12	7.41	8.27
Rural Areas					
Male	0.29	7.38	8.37	7.67	8.66
Female	0.29	3.55	4.05	3.84	4.34

Note: Exchange rate US $ 1 – Rs 48 in 1997
Source: Bloom, Mahal et al (1997)

Bloom, Mahal et al (1997) also attempts to estimate the economic burden of AIDS using the Willingness to Pay approach (WTP). This exercise is carried out on three groups: general public, students following an Economics degree at the University of Colombo and health care workers (doctors and nurses) at the NHSL. It involves assessing the amount the first and second groups are willing to pay for disposable syringes and the testing of blood prior to transfusion, and combining this information with the incidence of risk of HIV/AIDS that is counteracted by such an action. For the third group this information corresponds to the average survey

response related to compensation required in working in a health care setting.

Cost of HIV/AIDS – Willingness to Pay Approach

	Probability of infection (%)	WTP to avoid risk (in US $)	Values of avoided HIV infection (in US $ thousands)
Students			
Non-disposable injecting equipment	0.000308	0.43	139.44
Untested Blood	0.013950	58.54	419.64
Health care workers			
Injuries.	0.004700	51.70-437.50	1100-9410
General Population			
Non-disposable injecting equipment	0.000308	0.38	123.23
Untested Blood	0.013950	56.00	401.43

Source: Bloom, Mahal et al (1997)

The Willingness to pay approach is considered to capture the psychological costs as well as the direct and indirect losses of illness. The reported willingness to pay estimates of a death averted is substantially larger than the cost of an AIDS case generated by the cost of illness method.

(b) de Silva and Jayasinghe (1998)

This study found that when it was assumed that individuals were prevented from working at the point of testing positive though asymptomatic (assumed to be age 25), rather than merely at the point of death (assumed to be age 30) that lost earnings (assuming that retirement would if not have been at age 60) would increase by US $ 1529,69 and US $ 438.39 in the case of a male and female respectively.

This additional loss of earning due to stigmatization has adverse impacts on the individual and the household, and even on the economy, as a productive individual is being side-lined. It could add to direct costs as well by encouraging individuals to see private care in the hope of greater confidentiality.

The most significant issue however is that the psychic costs imposed by stigmatization, particularly if they add to direct and indirect costs, are likely to discourage testing, which in turn is a public health disaster.

4.4.5 UPPER RESPIRATORY TRACT INFECTION

(a) Attanayake (2002a)

The cost estimation is based on information collected from the OPD in Colombo South Teaching Hospital, where 43% of patients sought treatment for upper respiratory tract infections. Costs differed only with regard to drugs, which differed by age group. The costs for the three age groups: children under 1 1/2, children over 11/2 and adults were Rs 73, Rs 60 and Rs 64 respectively.

4.4.6 ASTHMA

(a) Attanayake (2002a)

The cost estimates given are for three different scenarios: normal treatment (involving the prescribing of for example salbutamol) Rs 12, treatment with drugs and nebulization Rs 229 and treatment with drugs, and an x-ray preceding nebulization Rs 330. Use of nebulization is estimated to cost Rs 51, drugs are more costly in this acute case (Rs 148 compared to Rs 2) and the extra procedures add to overhead costs as well.

(b) Kasturiratne (2003)

This sample involved 65.5% males and the mean age was 51.4 (SD = 17.2). Mean duration of hospital stay was 2.7 (SD = 1.6).

	Mean	Percentage	Median	Inter-quartile range
Medications	125.30	16.4	52.10	22.80-105.30
Investigations	573.60	75.3	562.50	350.00-725.00
Therapeutic Procedure	63.20	8.3	29.70	5.50-132.00
Total	762.30	100.0	678.40	507.00-964.80

4.4.7 HYPERTENSION

Attanayake (2002a)

Given the complexity of the disease, the researcher chooses to provide four different cost estimates for four specific categories of patient: patient with no other complications (cost per month for one visit Rs 234/-; patient

with Diabetes Mellitus (cost per month, involving two visits, Rs 277); elderly patient with no complications (cost per month involving one visit Rs 228) and patient whose hypertension is difficult to control (cost per month, involving four visits Rs 379/-). The variation in between the relatively old and young patients (Rs 234 compared to Rs 228) stems from differences in drugs. The difference in cost for a patient with Diabetes lies in the need for a second visit involving further investigations. Similarly patients with hypertension that is difficult to control the need for multiple visits and investigations drives up the cost. In each instance investigations is the major cost item followed by a much smaller percentage of cost attributable to manpower. Investigations considered here are X-ray. FBS, ECG, UFR, Blood urea and serum electrolytes,

4.4.8 HEART DISEASE

(a) Attanayake (2002a)

Only chronic stable angina is considered in this study as uncomplicated and complicated myocardial infarction being complex had to be left out due to time and resource constraints. The cost of treatment for chronic stable angina varied from Rs 332 per month for a person only having ECG and FBS, to Rs 3,593 per year for a person having a stress ECG annually and to Rs 4,320 per annum for a person who has in addition to the stress ECG, an echocardiogram every six months.

(b) Attanayake (2002b)

This high cost of treatment in the case of heart ailments stems from the cost of medical care (fees, investigations and drugs). Travel costs as well are high for this category of patient as compared to those seeking care for Diabetes Mellitus and Mental illness. Inpatient care seems to impose a heavy burden in the form of travel costs.

Type of Cost	Public Outpatient Care	Public outpatient and inpatient care	Private Care	Public and private care
Sample size	31	7	7	2
Formal Treatment	771	1477	2427	3367
Informal Treatment	194	5	11	13
Travel	117	533	108	123
Direct Cost	1082	2015	2546	3502

Note: Unlike in the report formal treatment is here defined minus travel costs.
Source: Attanayake (2002b)

Cost of informal treatment, that relates to self treatment and ritual treatment is insignificant, except for those seeking only public outpatient care where ritual treatment is responsible for 95.4% of this cost.

Indirect costs relating to heart ailments vary widely given the source of treatment.

Type of Cost	Heart Ailments
Public Outpatient care	1692
Public Outpatient and Inpatient care	1971
Private Care	2429
Private and Public care	3750

Source: Attanayake (2002b)

The higher percentage of indirect losses occurs due to poor attendance at work rather than due to loosing employment.

(c) Kasturiratne (2003)

The sample relating to Ischaemic heart disease presenting with chest pain without Myocardial Infarction, had 40 patients of whom 52.5% were male and the mean average age was 60.6 (SD = 10.6). Their mean duration of hospital stay was 3.6 days (SD = 1.4). The average cost of treatment for this period is given below.

Ischaemic heart disease

	Mean	Percentage	Median	Inter-quartile range
Medications	1327.80	38.5	295.00	5.10-664.30
Investigations	1664.40	48.2	1512.50	1131.30-2193.80
Therapeutic Procedure	458.60	13.3	134.70	20.40-142.90
Total	3450.80	100.0	2049.00	1409.60-3212.20

The table below gives the cost information relating to the treatment of a sample of patients diagnosed as having Myocardial Infarction. Of the 40 patients, 75.7% were male and the mean age was 55.8 (SD = 12.3). Mean duration of hospital stay was 5.2 (SD = 1.6).

Myocardial Infarction

	Mean	Percentage	Median	Inter-quartile range
Medications	2211.20	50.40	3379.50	633.60-3525.60
Investigations	2025.70	46.20	2075.00	1487.50-2557.50
Therapeutic Procedure	149.42	3.40	137.50	137.50-142.00
Total	4386.30	100.0	4919.20	2676.40-5813.30

4.4.9 DIABETES

(a) Fernando (1996)

Fernando (1996) examines the cost effectiveness of encouraging patients to self-administer insulin injections using disposable syringes by comparing this cost with the cost of seeking the services of a medical practitioner or paramedical staff.

The cost for patients to seek the services of medical practitioners or paramedical staff in obtaining an insulin injection was Rs 73.58 per visit [average costs of travel time (13.10), travel expenses (21.90), other expenses (13.12) and waiting time (25.48)] as reported in a self-administered questionnaire "which comprised questions on time and money spent on travel to a clinic, fees for private practitioner or paramedical staff at private facilities or home visits, loss of wages or leave for the patient and any accompanying person, and expenses for food" (Fernando, 1996). The sample involved 350 patients attending the diabetic clinic at the Sri Lanka National Hospital or other health care facilities, solely for getting insulin injections.

For the 276 patients who maintained diaries relating to the use of disposable syringes, the per injection cost, had these patients visited a hospital clinic or private health care facility for injections over one year would have been Rs 52.73 (cost of Rs 6,871,415.46/130,305 patients) in contrast to the Rs 6.50 per injection that would be spent on syringes, cotton wool and surgical spirits that are bought by the patient.

The difference in cost of the two procedures is sizable and has significant policy implications for the running of diabetic clinics that should involve empowering patients as part of their objective.

(b) Attanayake (2002a)

The estimation process involved four steps: first the cost of blood drawing at the OPD was estimated (Rs 22); then the cost of laboratory investigations such as FBS, PPBS, UFR and ECG were estimated; thirdly the cost of treatment per patient at the diabetic clinc was estimated; finally the cost of annual eye-check up at the eye clinic was estimated and included under investigations.

Four different drug combinations were considered: I) Tolbutamide and Glibenclemide, II) Tolbutamide and Metformin, III) Glibenclemide and Metformin and IV) Insulin. Investigations here relate to FBS on a monthly basis and an annual UFR and eye-check up.

	Types of drugs prescribed			
	I	II	III	IV
1. 1st visit with all tests				
Investigations	156	156	156	156
Drugs	45	61	27	726
Manpower and overheads	14	14	14	14
Total	215	231	197	896
2. For a year* for non-complicated cases				
Investigations	437	437	437	437
Drugs	539	736	325	8717
Manpower and overheads	166	166	166	166
Total	1142	1339	928	9320

Note: *Assumes monthly visits to the clinic.

In addition it was noted that patients with cardiac symptoms would need an annual ECG as well which would add another estimated Rs 30/- to the investigations cost.

(c) Attanayake (2002b)

Formal treatment is the major component of direct cost. However surprisingly it is not drug and investigation costs that are responsible for this outcome but the cost of vitamins, nutritional and special foods prescribed by the doctor and self determined, with the latter imposing the greater cost burden. The effectiveness and usefulness of the self-determined vitamins and foods is an issue worth further investigation.

Type of Cost	Public Outpatient Care	Private	Public and private care
Sample size	33	12	2
Formal Treatment	670	1143	893
Cost of medical care (fees, investigations, drugs)	0	63	20
Doctor prescribed Vitamins, nutritional and special food	259	234	303
Self determined Vitamins, nutritional and special food	412	826	425
Informal Treatment	60	21	0
Travel	37	87	55
Direct Cost	767	1251	948

Note: Unlike in the report formal treatment is here defined minus travel costs.
Source: Attanayake (2002b)

Indirect costs are a major share of diabetic costs.

Type of Cost	Diabetes
Indirect Cost	**1466**
Loss of earnings	1384
Other losses	82

Source: Attanayake (2002b)

4.4.10 STROKE

Kasturiratne (2003)

This sample of 40 consisted of 86.8% males. The average age was 62.1 (SD = 10.7). The mean duration of hospital stay was 5.0 (SD = 4.1).

	Mean	Percentage	Median	Inter-quartile range
Medications	264.90	13.7	230.00	15.90-384.60
Investigations	1442.80	74.4	1212.50	843.80-1693.80
Therapeutic Procedure	231.30	11.9	204.00	137.50-262.00
Total	1939.00	100.0	1643.50	1157.80-2647.90

4.4.11 MENTAL ILLNESS

(a) de Silva (2001)

This study, based on patients visiting a Mental Health clinic at Horana Base Hospital, analyses its results in relation to the employment status of patients' pre and post diagnosis. Of the 231 respondents, 138 were unemployed in both periods while for 32 the job description remained the same. Of the others, 28 persons became unemployed post diagnosis of mental illness (due to leaving or losing their jobs), 9 gained employment post-diagnosis, 8 were in the category of other (i.e. retired) and there were 16 who had not answered the questions relating to their employment status completely. The weekly Mental Health clinic at the Horana Base Hospital was special in that the clinics were conducted by trained Medical Officers for three weeks of the month, under the guidance of a Psychiatrist, who only visited the clinic once a month. Such a scheme was being piloted as a response to the severe shortage of Psychiatrists in the country that limited Psychiatric care to larger hospitals, which in turn imposed a greater burden in seeking care on families.

(i) Indirect costs: patients and carers

The high level of unemployment among patients with mental illness raises two questions: firstly to what extent mental illness is a cause or effect of unemployment, and the resultant economic instability; secondly that lost earnings of such a sample do not accurately reflect the economic loss engendered by their illness.

For those whose employment status remained unchanged, average lost earnings in the two months were Rs 3633 and Rs 3517(if two clerks on no-pay leave were included), and Rs 1139 and Rs 1128 (if they were excluded), reflecting a significant loss of income, since monthly income averaged Rs 4952. Considering the small sub-sample of those who gained employment post-diagnosis, as well, the loss of earnings for those who report on it, seems significant. For those who lost employment post-diagnosis lost income is in the range of Rs 2000 to Rs 6000.

Cost of care in financial terms remains zero or minimal for all the sub-groups, as care is borne mainly by females (wives and mothers) who in most instances were unemployed. Here too a question that can be raised as to whether their unemployment is linked to their need to act as carers to patients with mental illness. Increases in the future of female employment, also suggests that lost earnings of carers may become significant over time.

Lost earnings are also imposed on patients and their families in visiting the mental health clinic. The average travel time (in both directions) for those whose employment status remained unchanged was 1 hour 45 minutes; for those who were unemployed and those who lost employment 2 hours, while the time reported for those who gained employment post diagnosis was 1 hour 48 minutes. Likewise the time spent waiting for care for the first three groups were 2 hours, 3 hours and 2 hours 42 minutes. Combining travel and waiting times suggests that half a day is spent on seeking care. This theoretically results in a half day loss of economic activity for two individuals since such patients are invariably accompanied, even if in practice, at the present time, the lost earnings are zero, with both parties in most cases being unemployed.

(ii) Direct costs: treatment and travel

Due to the patient's seeking care from the state sector, and receiving their drugs from the same source, direct costs of care were very low, being limited to the occasional purchase of drugs from the private sector when there were scarcities at the clinic. Given that the drugs prescribed for mental illness are relatively cheap this did not impose a heavy burden on families. Less than 1/6th of the sample reported spending on drugs and of those all but two report figures of over Rs 200.

Costs on rituals however are strikingly high. de Silva (2001) reports the cost of a Shanthikarma on average to be Rs 1000, a Bodhi Pujava Rs 300 and a Thovile around Rs 2500. Spending on rituals was commonest among those who were unemployed both pre and post diagnosis in this study and least so among those who gained employment post diagnosis, suggesting that resorting to ritual treatment is likely to be closely linked to stage of illness.

Cost of travel on average for the group whose employment status remained unchanged was Rs 82, Rs 70 for those unemployed in both periods; and Rs 46 and Rs 31 for those who lost employment post diagnosis and gained employment post diagnosis respectively. These travel costs are relatively low, in line the intervention of providing care through a mental health clinic at a Base Hospital.

(b) Attanayake (2002a)

Information on patients attending a clinic at the Colombo South Teaching Hospital was used in this cost estimation. No distinction was made by the type of mental disorder. The total cost of an outpatient visit is reported to be Rs 401, with manpower representing 64% (Rs 256) and drugs 24% (Rs 98) of the cost. Cost of CT scans as estimated by the researcher for the MOH, and estimates of the Thyroid function test, Liver Function test and EEGs based on private sector charges were considered as investigation costs but as such investigations were rarely carried out they only contributed 3% to the cost.

(c) Attanayake (2002b)

Direct costs

Direct costs of mental illness are reported below. Formal outpatient treatment is significantly less than informal treatment for those who had only accessed public care. Inpatient care appears to increase the burden of travel costs significantly.

Direct Cost

Type of Cost	Public Outpatient care	Public outpatient and inpatient care	Public and private Care
Sample size	42	3	3
Formal Treatment	155	428	1634
Informal Treatment	478	6670	17
Travel	35	544	187
Direct Cost	668	7642	1837

Note: Unlike in the report formal treatment is here defined minus travel costs.
Source: Attanayake (2002b)

These informal treatment costs are mainly on rituals, as shown in the table below. The highest expenditure is incurred by those seeking public outpatient and inpatient care. Those who had sought public and private care had not spent on rituals.

Average Cost of Rituals

	Mental Illness
Public outpatient care	471 (42)
Public outpatient and inpatient care	6667(3)
Public and private care	0(3)

Note: Sample size is indicated in brackets
Source: Attanayake (2002b)

Indirect Cost

According to Attanayake (2002b) the highest indirect costs are borne by mental patients (as compared to those with diabetes mellitus and heart problems) who are for the most part unemployed. The figures relate to those seeking only public sector outpatient care, public outpatient and inpatient care and public and private care.

Type of Cost	Mental Illness
Indirect Cost	3052
Loss of earnings	2705
Other losses	347

Source: Attanayake (2002b)

Here indirect costs include cost of hiring labour, losses due to losing employment and poor attendance at work of the carers as well as the patient and other unspecified indirect costs to the household.

(d) de Silva, de Silva and Jayasinghe (1998)

This study relates to the cost of suicides and is therefore included under mental illness, which is often a major factor in determining suicide.

Combining the scenario building approach adopted in Bloom et al (1997) in calculating lost earnings with the number of suicides in 1996 by district it was possible to calculate the national loss for 1997 alone due to suicides in 1996 as Rs 92,241,546 (US $ 1,512,157) for seven provinces omitting the North and East. The lost lifetime earnings of a male aged 20 range from Rs 553,460 (US $ 9,073) in Nuwara Eliya to Rs 1,288,839 (US $ 21,129) in Colombo.

There is a high economic cost imposed by the loss of life due to suicide. In addition to the obvious human viewpoint, there is a national development rationale for taking strong measures to reduce the suicide rate in Sri Lanka.

4.4.12 CIRRHOSIS

Kasturiratne

Of this patient sample 94.7% were males and the mean age was 51.2 (SD = 10.8). Mean duration of hospital stay was 4.7 (SD = 3.0).

	Mean	Percentage	Median	Inter-quartile range
Medications	1317.40	42.2	400.80	222.60-653.10
Blood and Blood products	468.40	15.0	0.00	0-925.00
Investigations	1168.70	37.4	1062.50	706.30-1325.00
Therapeutic Procedure	168.90	5.4	137.50	137.50-214.50
Total	3123.40	100.0	1643.50	1157.80-2647.90

4.4.13 ROAD TRAFFIC ACCIDENTS

(1) de Lanerolle (1992)

Results are based on the study of 225 road traffic accident patients consecutively admitted to the Accident Service Unit of the Colombo South General Hospital. Of these patients 73.3% were males, 48.44% were in the age group 21 to 40, and pedestrians accounted for 47.55% of this sample.

The highest cost was on treating pedestrian victims. The highest cost was on treating a fracture of the femur (Rs 9363), followed by Tibia/Fibula (Rs 2424), Forearm (Rs 2047) and Colles' (Rs 798).

Average cost per patient per day was Rs 290.00.

Of the total treatment cost, 30.11% was on drugs, dressings, blood and investigations while the services of the Accident Service Unit staff accounted for 25.65%. Cost of Radiological investigations contributed 17.50 of the cost and surgery 4.47%. Electricity and water (12.66), diet (5.35), general staff salaries, including administration (4.16) and Laundry (0.50) are the other cost components identified.

(b) Dharmaratne (2001)

Majority of injured were pedestrians (53.6%). Including fatalities 70% were males. Of the 353 injured in RTAs in KPA during the year under study, 245 entered the General Hospital Kandy (GHK) and 54, the Teaching Hospital Peradeniya (THP). Of those entering these two hospitals 48.2% stayed only one day in hospital. Mean duration of stay was 3.6 days, and the median duration was one day while the duration of stay ranged from 1 to 98 days. Of those injured 47 were not admitted to any hospital. Of those entering GHK and THP, 58.2% suffered injuries to the lower limbs, 40.8% injuries to the upper limbs and 11.7% to the head. Of the injuries to the upper and lower limbs, the majority 58.3% and 47.1% respectively were abrasions.

Cost of a patient day is given as follows

At General Hospital Kandy

Surgical Unit	Rs	441.64
Orthopaedic Unit	Rs	721.79
Neurosurgical Unit	Rs	868.60

At Teaching Hospital Peradeniya

Surgical Unit	Rs	384.21
ICU	Rs	3728.21

Mean cost of hospital stay for an individual suffering from a RTA was 3415.55 while median cost was Rs 633.35. 49 individuals were not admitted to the two hospitals under consideration while 50 of the 353 injured persons had a cost of hospital stay of less than Rs 501, and another 70 a cost of between Rs 501 and Rs 1000. These three categories account for 49.7% of the sample. 6.5% of the sample incurred a cost of over 10,000 resulting in the wide divergence between the mean and the median.

The mean cost of lost earnings, based on average wage rates as determined by the Occupational Prestige Scale (Gunawardena, 1990) was multiplied by the days of hospitalization and convalescence at home and days spent visiting the Kandy Police Station and the courts (3 days for any accident is mandatory, in addition the researcher after discussion with Police Officers added 20 days for a fatal accident, 10 for grievous and 5 for non grievous accidents) in the case of those injured, and for those fatally injured these earnings were used as the basis for calculating earnings lost due to premature death, discounted to the present value using a discount rate of 8%, This resulted in a mean cost of lost output per road user of Rs 11,132.13.

4.4.14 SNAKE BITE

Dharmaratne (2001)

Dharmaratne (2001) found the cost of managing an envenomed patient admitted to a rural hospital in the North Central Province to be Rs 522.75.

Ariyaratne (2003)

The average cost for all snake bites was Rs 816. There is a wide disparity between the average cost of treatment of venomous and non-venomous snake bite. Common Krait, Russell's Viper and Hump-nosed viper are all venomous snakes. The costs incurred by Russell's viper victims' were higher than that for other venomous snakes. Symptoms, severity of impact and treatment procedures vary by type of snake (for instance the Russell's viper bite can result in acute renal failure).

	Common Krait	Russell's Viper	Hump-nosed Viper	Venomous	Non-Venomous	All
Do not know/cannot	6.7	0.0	0.0	5.2	23.0	10.66
Recall						
No cost	3.3	12.1	0.0	2.1	8.2	4.36
Less than Rs 100	10.0	0.0	3.4	4.1	29.5	12.62
Rs 100-499	43.3	27.3	27.6	32.0	29.5	31.55
Rs 500-999	26.7	27.3	48.4	32.0	9.8	25.24
Rs 1000-1999	6.7	15.2	17.2	14.4	0.0	8.25
Rs 2000-2999	0.0	9.1	3.4	5.2	0.0	4.36
Rs 3000-3999	0.0	0.0	0.0	1.0	0.0	0.48
Rs 4000-4999	3.3	3.0	0.0	2.0	0.0	0.97
Rs 5000 and above	0.0	6.0	0.0	2.0	0.0	1.45
Average cost	Rs 649.56	Rs 1515.05	Rs.790.90	Rs.1041.20	Rs 256.86	Rs 815.58

Source: Ariyaratne (2003)

The modal class for the cost of treating common Krait bites is Rs100-499; for Russell's viper it is Rs 100-499 and Rs 500-999 and for the hump nosed viper it is Rs 500-999.

The distribution of average cost of snakebite is given below, by type of expenditure:

Payment to health care providers	Rs	306.50
Transport	Rs	142.39
Medicine	Rs	163.30
Special food	Rs	168.38
Payments to attendant	Rs	321.63
Loss of daily income for victim	Rs	330.51
Loss of daily income for family	Rs	181.38
Other expenses	Rs	75.00

The modal category for each type of expenditure is "no cost". Payment to health care providers is reported to be free for 45.7% of the sample, with the next highest segment (27.7%) being in the group Rs 100-500. Transport costs are relatively low with 75% reporting no cost. Likewise 74.5% and 72% report no cost on medicine and attendants respectively. The major share of these costs, as reflected by average expenditure was loss of daily income for the victim, followed by payments to the attendant and payments

to the health care provider. Even in the context of loss of earnings for the victim, 67.9% report no cost, while 12.0% report less than Rs 50.

Considering cost by type of health seeking behaviour, the average costs are as follows:

Home remedy	Rs	216.33
Government hospital	Rs	422.65
Native/Ayurvedic physician	Rs	215.41

Eight persons had reported that no treatment was sought. Due to snake bite patients seeking native care in around 1/3rd of the cases, with its relatively low cost, and the majority seeking government hospital care, the economic burden of snake bites is low.

4.4.15 DENTAL TREATMENT

(a) Attanayake (2002a)

The researcher for simplicity assumes that all dental activities such as filling and extraction involve the same time duration.

The paper provides the following cost estimates relating to the Dental Institute, Colombo.

Extraction –	Rs	108
Temporary Filling –	Rs	84
Permanent Filling (Back)	Rs	86
Permanent Filling (Front))	Rs	93
Permanent Filling (side)	Rs	136
Permanent Filling (Average)	Rs	105

The major element of all these costs is manpower, with medical supplies and equipment coming next.

(b) Edirisinghe (2002)

In a study done at Dompe District Hospital the average cost of an outpatient dental visit was Rs 283/-. The utilization rate of the dental clinic was low, only about 450 patients per month and this is likely to have resulted in the high average cost of dental care in this hospital.

(c) Gajanayake (2004)

Capital and staffing costs were directly related to the level of hospital, with the Teaching Hospital, Karapitiya reporting the highest figures and the Adolescent Dental Clinics the lowest values. Different hospitals utilized the material provided by the researcher, to treat different numbers of patients: for example using the six bottles of lignocaine the Base Hospital Balapitiya reported 86 extractions compared to only 47 at the Peripheral Unit in Hikkaduwa. Variations in average cost result mainly from differences in staffing levels and utilization.

	Extraction	Temporary Filling	Permanent Filling
Karapitiya TH	135.28	131.86	138.37
Balapitiya BH	109.83	105.23	110.31
Ambalangoda DH	103.58	98.17	104.72
Baddegama DH	72.08	66.88	74.76
Karandeniya DH	71.92	66.74	74.22
Rathgama PU	78.03	72.93	104.15
Hikkaduwa PU	63.50	57.96	65.53
Madampagama RH	79.01	73.87	85.78
Aloysuys ADC	89.72	84.25	89.29
Dewananda ADC	55.65	50.46	56.29
Average Private Facilities	128.38	98.38	182.34

Note: Gajanayake (2004)

Private facilities cost more than government facilities, particularly due to differences in the income attributed to dental care staff. However it is also noteworthy that the higher level hospitals cost more than other state hospitals and even the private facilities due to utilization not corresponding to the number of dental surgeons provided. In Karapitiya TH there is the additional adverse feature that seven dental surgeons service four dental chairs. These latter characteristics are intensified further, when staff cost allocation is done on the basis of observed time spent on the specific procedures, instead of weighting all three procedures as taking equal time.

Calculating idling time, in the Karapitiya context results in the finding that with seven dentists and four chairs, idling time is 24,494.4 minutes per month (even assuming that 50% of their time is spend on activities other than the three considered), which assuming a dentist works 8640 minutes a month (24 days, 6 hours a day), converts to 2.83 dentists' months work, which in Rupee terms is Rs 70,874 per month (assuming a monthly wage of Rs 25,000). The depreciated value of a dental chair and other clinical equipment per dentist is around Rs 3500/- a month which highlights the magnanimity of the inefficiency prevailing at present at the Karapitiya Teaching hospital (and at other such Teaching and Base Hospitals).

4.4.16 CHILDHOOD DISEASES/CONDITIONS

Jayatissa (1995)

These findings relate to patients seeking treatment at the Lady Ridgeway Hospital. The study seeks to motivate greater attention towards prevention, particularly by illustrating that treatment costs are high for survivors and non-survivors.

Preventable Condition	Cost per Survivor	Cost per Non-Survivor	Cost per Survivor day	Cost per Non-Survivor day
Birth Asphyxia	11551	5156	3262	3430
Low Birth Weight	12665	11529	3549	3183
Encephalitis	23036	12251	3291	3419
DHF	3602	5674	3602	3783
Gastroenteritis	4946	2726	3297	7269
Tetanus and Neo-natal Tetanus	7309	19507	3248	3251
Complications of Typhoid Fever	7374		3687	
Complications of worm Infestation		18492		3698
Tuberculous Meningitis	6364	9497	3182	3166
Congenital Rubella Syndrome		3110		3110
Cerebral Malaria		5351		3567
Poisoning	11968	14016	3211	3298

Source: Calculations based on Jayatissa (1995)

Cost per non-survivor day is often greater in line with the severity of the illness. The study clearly illustrates that prevention costs would be much smaller than treatment costs. Among its recommendations are: strict admission criteria for ICU treatment, procedure for transfer of patients from outstation hospitals and strict implementation of hand washing and minimal handling of sick babies by all concerned. In the case of Birth asphyxia it recommends providing mucus extractors and ambu bags to institutions around the country and better training of staff and more effective procedures to deal with birth asphyxia. In the case of low birth weight specific feeding programmes targeted to low income households, family planning advice, better monitoring of weight in pregnancies and promoting community, family and maternal education on nutrition and care during pregnancy. Better control of infectious diseases is advocated. The need for education and implementation of childproof bottle usage by pharmaceutical companies is also highlighted in the context of poisoning.

4.4.17 MEDICAL ICU CARE COSTS OF SELECTED DISEASES

Thasim (2003)

Given below is information relating to the patient numbers considered in this study of the Medical Intensive Care Unit of the National Hospital Sri Lanka. The number of days of ICU care is significantly related to average cost per day, as it reflects the severity of illness.

Disease	Number of Survivors	Number of Non-survivors	ICU days of Survivors	ICU days of Non-survivors
Dengue Fever	56	7	139	12
Leptospirosis	16	19	16	19
Poisoning	22	12	140	51
Guillain Barre Syndrome	18	1	9	183
Diabetes Mellitus	10	7	30	7
Myocardial Infarction	8	7	11	14
Bronchial Asthma	9	5	24	8
Hypertension	3	6	6	7
Alcoholism	4	4	16	6
Total	146	68	391	307

Source: Thasim, 2003

Costs differ widely by illness due to differences in treatment protocol. In the case of GB the non-survivor's cost was extremely high due to a lengthy hospital stay.

Disease	Av. Cost Survivors	Av. Cost Non-survivors	Av. Cost Total
Dengue Fever	11172	7716	10788
Leptospirosis	4678	4678	4678
Poisoning	28587	19092	25236
Guillain Barre Syndrome	2306	843954	46603
Diabetes Mellitus	13735	4578	9964
Myocardial Infarction	6346	9231	7692
Bronchial Asthma	12157	7294	10421
Hypertension	9311	5431	6725
Alcoholism	18593	6973	12783

Source: Calculations based on Thasim, 2003

4.4.18 NON COMMUNICABLE DISEASES

Kasturiratne (2003)

These costs relate to the Ragama teaching hospital and cover the entire hospital stay of the patient.

Direct Costs

Component	Mean	SD	Median	Inter-quartile range
Travelling	538.7	761.4	308	118-652
Bystander carer	111.1	328.3	0	0-25
Meals	62.5	138.5	0	0-67
Medication and therapeutic devices	73.6	180.7	0	0-75
Investigations	244.5	833.6	0	0-190
Consumables and other costs	20.6	108.7	0	0-0
Total	1051.0	1598.2	?	208-1332

Source: Kasturiratne (2003)

Cost of travel for patient and family, cost of hiring a bystander, cost of meals brought from home, cost of medicines and therapeutic devices purchased by the household, cost of laboratory investigations incurred by the household and the cost of consumables and other miscellaneous items were considered. Only travel costs were found to be a significant element in inpatient care. Cost of investigations done privately during the hospital stay was about 23% of the total direct household cost.

Mean indirect cost of the hospital stay for the household in terms of lost earnings was Rs 461.36 (SD = 1271.84). Average days of work lost by both patient and the family members due to the hospital stay was 2.13 (SD = 4.07).

4.4.19 INPATIENT/OUTPATIENT HOUSEHOLD COSTS

(a) Samarasinghe and Akin (1995)

Household survey involved 10,024 households containing 48,097 individuals. This resulted in the identification of 5908 outpatients and 1071 inpatients. Average costs per illness are given below.

Table: Average cost per illness

	Urban		Rural	
	Public	Private	Public	Private
No of outpatients	1195	1882	1452	1379
Average cost	492.96	1207.72	243.56	671.74
Standard Deviation	3573.36	5839.21	1578.07	3812.49
No of inpatients	513	64	467	27
Average cost	892.23	1529.77	503.06	722.98
Standard Deviation	4604.34	6989.03	2207.78	3854.49

Source: Samarasinghe and Akin (1995)

The high standard deviation values suggest wide dispersion in the cost information provided by the households for both inpatient and outpatient care, in both the state and public sectors, and across rural and urban areas.

In particular the high cost of public sector care borne by the households is striking. In the case of inpatient care these are attributed to drugs, utilization of paying wards, hiring of special attendants and the side payments made to minor staff to gain special privileges.

Utilization rates, by different health facility types, are likely to influence these cost levels. The table below presents utilization data categorized as major and minor state Western facilities, private Western facilities and Ayurvedic facilities.

Utilization of health facilities (in percentages)

District	Sector	Major State Western	Minor State Western	Private Western	Ayurvedic	Self care
Colombo	Urban	20.02	6.35	36.24	9.45	27.94
	Rural	12.09	13.37	33.79	12.09	28.66
Matale	Urban	21.46	13.90	33.02	8.96	22.67
	Rural	14.30	39.28	16.80	7.00	22.62
Galle	Urban	10.07	16.67	38.45	6.86	27.95
	Rural	8.39	17.31	25.87	9.97	38.46
Polonnaruwa	Urban	17.56	9.80	20.29	6.33	46.02
	Rural	11.97	20.40	22.18	6.24	39.21

Note: Here the self-care values have been omitted.28.39
Source: Samarasinghe and Akin (1995)

Itemizing costs by different cost categories gives the following information.

	Urban		Rural	
	Public	Private	Public	Private
Outpatients				
Fees only	5.33 (76.33)	181.81 (614.26)	6.06 (170.88)	237.50 (1899.50)
Fees with drugs	37.97 (406.64)	536.74 (3204.18)	10.12 (88.56)	225.98 (892.29)
Hospital charges	0.14 (4.67)	59.78 (723.65)	1.07 (20.54)	4.48 (29.39)
Drugs	205.5 (1226.85)	6695.6 (3288.02)	681.97 (887.95)	509.38 (3405.44)

	Urban		Rural	
	Public	Private	Public	Private
Inpatient				
Fees only	48.73 (423.18)	1269.78 (2338.60)	12.08 (99.81)	288.75 (692.58)
Fees with drugs	101.67 (645.18)	977.82 (2042.71)	63.60 (744.10)	638.80 (1099.53)
Hospital charges	606.28 (7223.26)	6145.38 (9140.50)	0.00 (0.00)	3032.25 (4642.40)
Drugs	713.38 (4183.26)	2079.5 (3437.86)	3325.79 (1365.38)	647.47 (1777.97)

Source: Samarasinghe and Akin (1995)

Drug costs are high even for the state sector. In the case of inpatient state sector as well costs are not negligible as would be expected. The authors attribute the high costs to cost of drugs, the paying ward component, the use of special attendants and the need for side payments in order to gain special privileges.

(b) Study by Edirisinghe (2002)

The study finds that household costs per inpatient day are Rs 224 and Rs 87 per outpatient visit at the Dompe District Hospital. Number of inpatients in the sample is 346.

	Cost per day	Cost per month	Cost per patient
Travel	109.10	37671	108.88
Loss of income	67.92	62280	180.00
Food	34	31879	92.14
Medicine	12.5	11488	33.20
Other	3.75	3429	9.91
Total	224.26		

Average travel distance is 4.8 kms for an indoor patient. Average hospital stay per patient was 2.6 days. Cost of food includes cost of transporting home cooked food, but not the cost of such food.

In the case of outdoor patients, costs per patient visit were Rs 8.70 for travel, Rs 3.09 for food and beverages and Rs 5.61 for drugs and

investigations with the highest element being Rs 26.64 as the loss of income (waiting time was on average 43.99 minutes).

4.4.20 COMMUNITY SURVEY COVERING ACUTE, CHRONIC AND INPATIENT CARE

Russell (2001)

Study covered 423 households of which 323 households had experienced illness and self-treated or sought treatment. Disease categories considered covered acute illness (in the past two weeks), chronic illness (in the past one month) and inpatient care (one year recall period). All costs were finally reported as per month.

Median direct cost of illness was Rs 138/- per household per month while mean direct cost was higher at Rs 487/- per household due to some outliers reporting high direct costs. Of these households 77% reported a direct cost burden (relative to monthly income) of 5% or less with only 10% reporting a catastrophic direct cost burden of over 10% of monthly income.

Majority of households incurred no or low indirect costs due to acute illness being predominantly among children and economically inactive adults. Only a minority of 11% incurred an indirect cost burden above 10% of monthly income.

Considering total impact, involving direct and indirect cost of illness burdens, showed that 65% reported a burden of less than 5%, 81% a burden of less than 10% and only 19.2% reported catastrophic illness burdens of costs above 10% of monthly income.

Mean Financial, Wage and Total Illness Costs for households (Rs per month)

	Chronic Care/ illness		Acute Outpatient Care/ illness		Hospital Inpatient care/ illness		All treatment/ illness	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Financial Costs	228.2	100	503.5	120	121.4	12.5	487.4	138
Wage Costs	NA	NA	392.9	0	184.2	0	331.9	0
Total Costs	228.2	100	896.4	190	305.6	53.5	819.3	240

Note: sample sizes for chronic, acute and hospital inpatient are 155, 210 and 134 respectively.

Inpatient care was predominantly public sector (98%) so that only 2% of households experienced a burden of costs over 10% of monthly income (a level termed 'catastrophic'). In the case of chronic illness a well widespread use of public providers meant that only 3% of households incurred a burden of over 10%. It was only in the case of acute illness, that the use of private sector facilities was common, and this led to 7% experiencing a burden of over 10%. Consultations and medicine for acute illness contributed 35% and 20% of total household healthcare spending per month in contrast to only 3.5% and 11.2% for chronic care and 0.9% and 1.8% for inpatient care respectively.

Acute illness posses the largest burden in terms of financial and wage costs. Many afflicted by chronic diseases were the elderly or their state of illness if mild was not sufficient to affect their earning or if acute was then classified under the other two categories.

4.4.21 HOUSEHOLD SURVEY

de Silva and Attanayake (1992)

Findings are from a household survey conducted in the Gampaha district.

I. Travel Costs

Cost per visit

Place of Treatment	Patient's travel cost	Accompanying persons' Travel cost
1. Western Government - Outdoor		
1.1 Within the surveyed area		
1.1.1 District Hospitals	10.37	8.93
1.1.2 Peripheral Unit	3.00	1.50
1.1.3 CD and MHs	0.61	0.82
1.1.4 CDs	0.97	0.89
1.2 Outside the surveyed area	28.2	127.22
2. Western Government - Indoor		
2.1 Within the surveyed area		
2.1.1 District Hospitals	17.31	19.89
2.1.2 Peripheral Unit	0.00	0.00
2.1.3 CD and MHs	0.00	0.00

Cost per visit

Place of Treatment	Patient's travel cost	Accompanying persons' Travel cost
2.1.4 CDs	0.00	0.00
2.2 Outside the surveyed area	81.24	81.16
3. Western Government-Private	15.72	12.66
4. Western Private	14.82	12.45
5. Ayurvedic Government	8.68	6.77
6. Ayurvedic Private	12.47	9.15
7. Other	11.50	0.00

Source: de Silva and Attanayake (1992)

Travel cost is higher for health care institutions at the higher end of the scale. Utilizing health care outside the surveyed area results in the highest cost. Seeking private sector care whether in the form of channel services or private services is more costly than accessing Ayurvedic care or services of lower level government health care institutions.

Cost per visit

Place of Treatment	Doctors charges	Doctors Charges inclusive of drug costs	Drugs Purchased outside	Cost of Medical tests
1. Western Government - Outdoor				
1.1 Within the surveyed area				
1.1.1 District Hospitals	0.00	0.00	12.7	2.38
1.1.2 Peripheral Unit	0.00	0.00	6.00	3.13
1.1.3 CD and MHs	0.00	0.00	12.3	20.00
1.1.4 CDs	0.00	0.00	0.82	0.00
1.2 Outside the surveyed area	0.00	0.00	13.8	73.22
2. Western Government - Indoor				
2.1 Within the surveyed area				
2.1.1 District Hospitals	0.00	0.00	50.00	0.00
2.1.2 Peripheral Unit	0.00	0.00	0.00	0.00
2.1.3 CD and MHs	0.00	0.00	0.00	0.00
2.1.4 CDs	0.00	0.00	0.00	0.00

Cost per visit

Place of Treatment	Doctors charges	Doctors Charges inclusive of drug costs	Drugs Purchased outside	Cost of Medical tests
2.2 Outside the surveyed area	0.00	0.00	0.00	0.00
3. Western Government-Private	21.20	26.03	41.45	6.91
4. Western Private	14.25	31.53	22.47	4.73
5. Ayurvedic Government	0.00	0.00	32.4	20.00
6. Ayurvedic Private	10.77	36.20	24.3	50.00
7. Other	0.00	62.50	7.88	0.00

Source: de Silva and Attanayake (1992)

Government sector health care institutions do not impose a heavy burden on households in terms of drugs purchased outside or medical tests. The cost of drugs provided in channel services is high, and much higher than the cost of consultation.

4.5 POLICY CONCLUSIONS

4.5.1 INDIRECT COSTS ARE A SIGNIFICANT SHARE OF TOTAL PATIENT COSTS

In the costing studies, whether on HIV/AIDS, Malaria or Mental Illness this characteristic is apparent. This point is apparent whether one compares household direct and indirect costs, or that for the health system as a whole.

Attanayake (1994) found that in the case of Malaria, the indirect cost per patient fully recover patient of Rs 140.86 was nearly twice the direct cost of the same (75.07).

Attanayake (2002b) finds indirect costs to be the major share of total costs.

	Mental Illness	Heart Ailments	Diabetes Mellitus
Direct Cost (%)	28	42	38
Indirect Cost (%)	72	58	62
Total Cost (Rs)	4229	3638	2365

Bloom (1997) reports

Cost of HIV/AIDS – Cost of Illness Approach

	Medical care costs per case US $ thousands)	Lost earnings per case(in US $ thousands)		Cost of Illness per case(in US $ thousands)	
Discount rate 5%					
Urban Areas					
Male	1.15	12.01	13.62	13.16	14.77
Female	1.15	6.26	7.12	7.41	8.27
Rural Areas					
Male	0.29	7.38	8.37	7.67	8.66
Female	0.29	3.55	4.05	3.84	4.34

Note: Exchange rate US $ 1 – Rs 48 in 1997
Source: Bloom, Mahal et al (1997)

However, in the case of Kasturiratne (2003) studying the hospital stay of patients with non-communicable diseases at North Colombo Teaching Hospital, direct costs were Rs 1051.00 (69.5% of total cost) per hospital stay while indirect costs were strikingly lower at Rs 461.36 (30.5% of total cost). This result stems from the fact that a large percentage of the sample were lower scale employees (as reflected in the scales defined by the author), 82.8% had GCE O/L or less than GCE O/L education and 31,1% of patients were over the age of 60 and therefore unlikely to be employed. Considering family income, 72.7% of the sample had an income of less than 10,000 per month, so even this figure is significant.

The indirect cost burden falls heavily on the household, while direct costs are shared between the state and the family, depending on the choice of healthcare source and the equitable functioning of the healthcare system.

The policy issues arising in this context are two-fold: firstly in the case of acute illness or short term hospitalization, temporary assistance to low income families would safeguard them from deprivation in the short run and becoming indebted with effects in the long run; secondly and more importantly given the magnitude of costs and the progression of health transition, is the need for safety nets in the context of long term degenerative diseases, so as to ensure the quality of life of the other household members, including safeguarding the right to education of the children.

4.5.2 TRAVEL COSTS ARE A MAJOR COMPONENT OF DIRECT COSTS

Kasturiratne (2003) found that over 50% of direct household cost consisted of cost of travel to and from the hospital. Attanayake (2002b) finds that inpatient care imposes a heavy burden in the form of travel costs in the case of heart ailments and mental illness. Cost of travel is directly related to distance between home and hospital and to mode of transport. Bypassing of facilities is common as individuals seek treatment in tertiary care centres. Such bypassing may be more common in seeking treatment for NCDs as lower level facilities do not have the necessary drugs, equipment and Consultant services. With health transition it is important to reconsider the categorization of hospitals and their corresponding facilities and services.

Attanayake (1994) finds that in the case of Malaria in the Matale district that the difference between the average cost figures of receiving services from public and private sources was small due to the relatively high costs of travelling borne by those accessing public services.

The provision of a basic psychiatric clinic service at Horana Base Hospital was an example of close-to-client care that made the service both more affordable and accessible to the population, including by reducing travel costs.

Three policy issues emerge: firstly the provision of services close-to-clients is important, if the necessary equipment, manpower and materials can be ensured and if patients demand and are satisfied with the quality of services provided; secondly the use of mobile services and travel by consultants to peripheral healthcare institutions would reduce the burden on households of high transportation costs; thirdly the provision of subsidized

transport for patients needing to access larger hospitals, further off from their residences needs to be considered, in the context of the growing elderly population and the spread of non-communicable diseases.

4.5.3 THE INPATIENT CARE COST BURDEN IS NOT SIGNIFICANTLY GREATER THAN OUTPATIENT CARE

This conclusion stems from the higher utilization of state sector inpatient care as compared to outpatient care. The utilization percentages reported in different reports vary: inpatient state sector utilization ranges from 91% - 95% while outpatient figures vary from 45% to 60%.

Edirisinghe (2002) found that household costs per inpatient day are Rs 224 and Rs 87 per outpatient visit in the Dompe District Hospital. Kasturiratne (2003) reports the entire mean household cost of hospital stay for the treatment of non-communicable diseases at the Ragama Teaching Hospital to be Rs 1051/- with an inter-quartile range of 208-1332.

Russell (2001) finds that the cost burden imposed on families in two urban low income communities supports this view, as inpatient care is predominantly state sector (98%) while even the lower income quartiles in these communities, use of private sector care for acute illness, particularly for economically active family members. In this study while inpatient care is responsible for 10.4% of total spending on health, chronic care and acute outpatient care account for 22.4% and 67.2% of the total costs respectively. This study finds that on average consultation fees for acute outpatient care was Rs 264/- per month as compared to hospital inpatient fees of Rs 24/- while drug costs in the two instances were Rs 146/- and Rs 26/- respectively.

4.5.4 EVEN PUBLIC SECTOR UTILIZERS INCUR TREATMENT COSTS

Kasturiratne (2003) found that 33.8% of patients in medical wards at the North Colombo Teaching Hospital incurred costs on medication and therapeutic devices while 33.5% had to obtain laboratory investigations from the private sector while being warded in this hospital, due to long delays or broken equipment. The author raises two policy issues. Firstly can medical care by the state sector still be termed free medical care? Secondly, if obtaining medicines and laboratory tests from the private sector is a common practice then would it not be more efficient and

equitable to formalize this public/private mix by creating formal outsourcing arrangements for diagnostic and pharmacy services. Similar issues are raised in Samarasinghe and Akin (1995).

Other studies too raise similar issues: de Silva (2001) shows that shortages of drugs in the public sector result in private purchases for mental illness; and many studies have payments to hospital minor staff in order to access services faster.

The need to study the financial burden that patients face even when accessing 'free health services' is important in the context of patient welfare and equity as well as service provision efficiency.

4.5.5 SPECIAL FOOD IMPOSES A HIGH DIRECT COST

Attanayake, Fox-Rushby and Mills (2000) report cost on special foods to be a large component of direct costs in the treatment of Malaria.

Formal Care	Cost of special food as a percentage of total cost
Public health centres and hospitals	
(a) Inpatient care	54.5
(b) Outpatient care	59.3
Public field facilities	
(a) Mobile clinics	90.4
(b) Health Workers	100.0
(c) Volunteers	76.5
Private	
(a) Public doctors private clinics	22.1
(b) Private clinics	21.9
(c) Other (i.e. Private Ayurveda)	53.1

Source: Calculation based on Attanayake, Fox-Rushby and Mills (2000)

Similar findings are also reported for diabetes in Attanayake (2002b).

The nutritional and therapeutic value of these special foods, given the financial burden they impose, is an issue that healthcare providers as well as health education in general should address. In some instances, the detrimental effect of excess consumption of such food items or the inappropriate consumption of these food items may be graver than merely the economic burden.

4.5.6 RITUAL COSTS ARE SIGNIFICANT EXPENSES IN CHRONIC ILLNESS

Both de Silva (2001) and Attanayake (2002b) suggest that the cost on rituals is non-negligible in the case of mental illness and needs to be given serious consideration in the context of the delay that is known to exist in Sri Lanka in first diagnosing such illnesses.

Russell (2001) finds that expenditure on religious observances is only incurred in the case of chronic illness (as compared to acute and inpatient care), where the cost is 4.1% of total expenditure on chronic illness. This may suggest that this dependence on religious practices as alternative treatment may be prevalent in the case of other chronic illnesses as well.

Attanayake, Fox-Rushby and Mills (2000) find the average cost of ritual treatment in an illness episode to Rs 5.70, in Matale in 1993, with this low value being in line with the idea that households respond differently to chronic and acute illness.

4.6 CRITIQUE OF THE STUDIES

4.6.1 Statistical and Methodological concerns

I. Measures of Central Tendency and Dispersion

Different studies focus on different measures of central tendency and dispersion. While most present the average cost of different elements of treatment, some also focus on the median. Some studies provide information regarding the inter-quartile range or the standard deviation but many do not. The mode does not seem a popular statistical measure, though in many cases it is a revealing statistic. This characteristic however is often captured through the presentation of the percentage contribution of various values (i.e. percentages using specific modes of transport or spending within particular ranges).

In presenting the data it is important to first analyse the distributions of the data in determining the appropriate presentation of statistics.

- Is the data distribution skewed?
- Does it have outliers?
- Is it bi-polar?

These are some of the questions that need to be posed. For example the use of the mean becomes inappropriate when a few outliers dominate the

result or when a bi-polar distribution results in a mean that is non-representative.

Secondly it is important to consider the objectives of the study in determining the presentation of data. Particularly where recommending policy is concerned it is important to present the data in a telling manner and this necessitates the use of appropriate measures and graphs. However in order to maintain the scientific rigidity that is essential in a costing exercise, it is important to present the statistics in a meaningful way, for example by combining presenting the mean with giving the standard deviation in parenthesis, to indicates the degree of dispersion.

Thirdly it is important to disaggregate the sample sometimes in order to capture the essence of one's hypothesis. For example de Silva (2001) disaggregates the responses to mental illness by the variable of employment status. Similarly Russell (2001) in a study focusing on low income households goes further in his use of case studies to divide this poor population into quartiles by level of income. Geographical disaggregation is also important, particularly if urban, rural and estate samples or districts display significant socio-economic, cultural and administrative differences.

Fourth, for comparative purposes, mean or median costs can also be presented as a share of GDP or in constant prices. Nominal values of costs make it difficult to compare across studies over time.

Fifth, it would also help if international comparisons of costs estimates relating to similar studies were presented, where possible.

II. Use of apportionment criteria

Choice of a suitable apportionment criterion is often complicated by the lack of information. However it is important to choose the apportionment criteria as logically as possible. For example disaggregation of electricity and water expenditure though both utilities may argue for the use of different apportionment criteria: water on the basis of patient numbers and electricity by floor area.

Second where ever possible it is important to use the same apportionment criteria across healthcare institutions, particularly if the objective is comparing costs. If not, the use of different apportionment methods could lead to distortions in the ranking of cost estimates.

III Omission of cost elements

Some studies tend to omit capital costs, basing this decision on the lack of available data. Others such as Gajanayake (2004) argue that the inclusion of capital costs would distort the ranking of different health care institutions by cost. The study objectives should be the primary determinant of the inclusion or exclusion of capital costs. While many different means of estimating capital cost exist (see previous chapter) the choice of which technique to use and whether to include an estimate of capital at all has to be determined by the researcher in the context of the very specific situation existing in the context of his/her study. The omission, if it occurs should be justified on grounds other than the mere lack of recorded data.

Studies are also often inconsistent in terms of which items of direct and indirect costs they include in their estimate of total costs. For instance many studies ignore items such as informal payments made to hospital staff and cost of rituals. Exclusion of such key cost items make it difficult to make meaningful comparisons about costs and even the share of costs (direct/indirect or item-wise) across different studies of the same disease or different diseases. This lack of consistency in the items included in a costing exercise also hampers comparison of costs over time. In some cases, even the very relevant aspect of indirect costs is ignored, whereas studies that focus on direct and indirect costs often conclude that the major element of costs is indirect costs.

4.6.2 CONTENT

I. Range of studies

Costing has been carried out for a wide spectrum of diseases in the recent past. It would however be desirable for more studies to be carried out on these diseases as these studies are limited by small samples and specific locations. The degree to which these findings can be generalized would have a major impact on their policy relevance. Therefore it would also be important for any further studies being carried out on the same diseases to have as one of its objectives, the verification of the findings of the previous study/studies.

Most studies are based on costs in the public sector and attempts to capture the costs incurred in the private sector, both systemic and household costs,

would be useful in gaining a more holistic view of the impact of costs of illness in the context of household welfare and the national economy. Such information would be particularly important in encouraging state health care institutions in their prevention activities as well as being useful in guiding policy.

II Choice of Cost elements

Most studies focus on the systemic costs of illness, while some of those reviewed above also focus on household costs. Given the significant use of private sources of care our society today it is important to focus on household costs, particularly in the context of the emerging demographic and epidemiological transition.

Travel costs in particular are significant in the context of direct costs. Costs of bystanders and carers are likely to become more monetized over time with growing employment opportunities for females. The need to focus on the cost of special food is highlighted in Attanayake (1994, 2002b) that find that large sums are being spent by households for self determined vitamins and nutritional and special food in the case of malaria and diabetes. This is an issue worth further investigation as the conclusions could have important repercussions not only on cost reduction but possibly on health outcomes as well.

III. Ethical and equity concerns

Bloom et al (1997) weights income by sex and sector specific unemployment rates, that then result in lost earnings due to an AIDS death differing widely: for instance using a discount rate of 3%, the death of an urban male will result in foregone earnings in the range of US $ 15,110 to 17,870 whereas for a rural female this range is US $ 4460 to US $ 5310. As an economic device in capturing the burden imposed by an illness it is important to take into account the probability that individuals are unemployed. This makes the estimates more rational. Yet the empirical conclusions that emerge are ethically uncomfortable: loss of human life is less in countries with surplus labour, and for groups who face high unemployment rates like rural women in the mid 1990s. It is important to keep in mind that such findings need to be rationalized by the thought that human life is not merely its economic worth. Such calculations do not take into account psychological costs for example and therefore

ranking of target groups based merely on economic worth is far from acceptable.

Methodologically this argues firstly for the inclusion of the cost as cost of pain, grief and suffering as done in the Dharmaratne (2001) study though the method of calculation as admitted by the researcher himself is likely to be arbitrary being based merely on an assumption adopted in a foreign study. More work on the inclusion of psychic costs is important then, partly in the arena of psychology in focusing on human emotions and possibly through considering the impact of psychic on direct and indirect costs such as has been done in the study by de Silva and Jayasinghe (1998) where the costs of stigmatization are at least partially considered through evaluating its impact on lost earnings.

Secondly attempts to measures the worth on subsistence, informal activities as in Attanayake, Fox-Rushby and Mills (2000) and to give a financial value to the services of housewives as in Dharmaratne (2001) are important in better capturing the value of time that is often disregarded in costing studies as being that of the 'unemployed'. The concept of opportunity cost is in particular crucial in the study of the economic burden of disease.

Chapter 5
COST OF INTERVENTIONS AND SERVICES

5.1 STUDIES UNDER CONSIDERATION

(1) Rajasingham, D. S (1991) A Cost study of the Expanded Programme on Immunization (EPI) in the Badulla Health Area, Thesis submitted for the MSc in Community Medicine, Post Graduate Institute of Medicine, University of Colombo.

Study Objective: To study the costs involved in the Expanded Programme on Immunization in the Badulla health area, through calculating the cost of a fully immunized child within the first year of life and to compare the costs of full immunization of a child within the first year of life in the urban, rural and estate sectors within the Badulla health area.

Methodology: Methodology based on the costing guidelines developed for the WHO by Andrew Creese. Sample selection involved stratifying by sector and in the estate and rural sectors according to the different types of clinic. After stratification, clinies chosen randomly but proportionate to strata totals. Data collection at clinic level was done through interview-cum-observation. Detailed information on the different aspects of immunization, including costs, collected. At regional level data on utilization, procedures and costs was collected from the offices of the Regional Directors of Health. Data also collected from the Janatha Estates Development Board. At the central level data and documents available at the Epidemiology Unit and the Ministry of Health were perused. Time allocation of staff for immunization was determined. Expected life span of buildings assumed to be 28 years and vehicles 15 years.Other capital, including equipment was discounted at 10%. Discount rates adopted from the WHO-EPI costing guidelines. Wastage of vaccines included. Buildings, vehicles, equipment like cold-chain items (refrigerators, ice-pack equipment, freezers, vaccine carriers) and EPI equipment such as sterilizers, syringes, needles, forceps and maintenance costs (based on log entries and invoices) included. Stationary costs (child health development records and registers) included.

(2) de Silva, Amal Harsha (1994) Cost Analysis of Patient Care at the Lady Ridgeway Hospital for Children, The Sri Lanka Journal of Medical Administration, Official publication of the College of Medical Administrators of Sri Lanka, Vol. 1 No. 1, November 1994 (also see chapter 3).

Study Objectives: Obtaining unit costs for different wards at Lady Ridgeway Hospital with a view to comparing costs and identifying alternative means of cost reduction, and using this information to sensitize consultants and others so as to direct their decision making. Study includes obtaining unit costs for different services, such as x-rays, ECG. EEG and surgical procedures.

Methodology: Analysis based on allocated funds and patient census. Allocation to different services has been done on the basis of aggregate number of procedures and costs allocated to different wards/service centres.

Importance of the study: One of the earliest attempts to cost hosptial medical services in Sri Lanka. This study covers the entire activities of the Lady Ridgeway Children's Hospital, a tertiary hospital.

(3) Attanayake, N (1994) Cost effectiveness of anti-malaria activities in Sri Lanka, PhD thesis, London, London School of Hygiene and Tropical Medicine (also see Chapter 4).

Study Objectives: (a) Cost-effectiveness analysis of the Anti-Malaria Campaign 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; (b) examining the socio-economic factors underlying community behaviour in relation to acceptance and compliance with preventive and curative care for Malaria, with a view to enriching the economic evaluation methodology of communicable disease control programmes in developing countries; (c) exploring policy implications from the application of cost effectiveness analysis along with a community behaviour analysis relevant to the malaria control programme in Sri Lanka.

Methodology: In order to assess the cost-effectiveness of the Anti-Malaria campaign in Sri Lanka, a case study was carried out in a selected district, with respect to various control strategies, measures and the programme as a whole. Matale district selected on the basis of malaria incidence (Annual Parasitic Incidence rate used as the criterion) and other factors

including control programmes, variety of health care services available including the private sector, climatic conditions, old and new settlements and there being no security problems in the area. Data collection involved interviews with officials and perusal of official documents at the centre, regional Malaria Office Matale and the DPDHS office. Focus groups, interviews and direct observation carried out at different stages of the study. A Time Allocation Study was carried out involving a Time Allocation Questionnaire, interviews and observation. Budgetary allocations and expenditure (manpower, drugs, buildings, supplies, vehicles etc.) figures of all district level anti-malarial activities (prevention and Medical Centre's figures) were combined with utilization figures to calculate average and incremental cost of different anti-malaria activities. Some case studies, focusing on costing were also carried out on case detection and treatment, spraying and providing prophylactics. Household survey conducted to collect information on direct costs and indirect costs and household and community response to Malaria control and treatment. The survey involved random cluster sampling on the basis of Probability Proportionate to Size (54 clusters, 1080 households and 5500 respondents). A one month long recall period was used for curative care, last visit for spraying and the past year in the case of the mosquito net and prophylaxis programmes to avert seasonality effects. The surveys occurred from January to March 1994. Cost-effectiveness analysis is carried out. Policy options are discussed based on the cost, utilization and compliance information collated.

Importance of the study: Significant contribution in terms of expanding the costing methodology relating to the control of communicable diseases. Focus on societal costs. Evidence based policy evaluation exercise.

(4) Graves, Patricia M., Fernando, Dulitha and Attanayake, Nimal (1995) Intensified Malaria Control Programme in Sri Lanka with emphasis on Primary Care approach, New Health and Family Planning Project 1995 IDA/World Bank, Consultants' Report. (also see chapter 4).

Study Objective: Estimating the average cost measures in order to assess the effectiveness of different approaches to Malaria control.

Methodology: Direct cost estimates of mobile clinics were based on discussions held with Malaria control employees and observations made

during field visits. Recurrent costs included salaries and wages, subsistence, drugs, fuel, chemicals etc. and annualized discounted replacement cost of capital inputs such as vehicles and microscopes. Average mobile clinic attendance and slide positivity rates were taken into consideration for four districts: Polonnaruwa, Kurunegala, Anuradhapura and Matale. Information was also collected on costs of impregnating bed net programmes in the districts of Matale and Anuradhapura.

Importance of the study: Costing of a household based Intervention in different locations.

(5) Nimal Attanayake and Harsha Aturupane (1995) Health Services Development Project in Sri Lanka: A brief assessment of the economic impact of interventions in malaria control, supplementary feeding and prevention of sexually transmitted diseases including HIV, study carried out for the World Bank.

Study objectives: To assess the economic impact of interventions in malaria control, nutrition and prevention of sexually transmitted diseases including HIV.

Methodology: Scenario-building techniques adopted.

Importance of the study: Attempting to undertake Cost-benefit analysis.

(6) D.L de Lanerolle (1996) Cost Analysis of Patient Management in an Out Patient Department and Study of the Impact of a Cost Awareness Programme on Prescribing Practices, Thesis submitted for the Degree of Doctor of Medicine in Community Medicine, Post Graduate Institute of Medicine, University of Colombo (also see chapter 3).

Study Objectives: Conduct a cost analysis of patients attending OPDs at 2 Provincial Hospitals (including studying morbidity and patient management practices) and study the impact of an educational intervention programme on drug costs and rational prescribing practices on cost of patient management at the OPD.

Methodology: Selected OPDs in two Provincial Hospitals and collected data on morbidity, patient management patterns and drug costs of a randomly selected sample of 1000 patients at each location. The diagnosis was carried out by the Principal Investigator, on the basis of the

International Classification of Health Problems in Primary Care (ICHPC) before the patients met the OPD Medical Officer. Medical records of the selected OPD patients, post drug issue, analysed to collect total cost and calculate unit cost of an OPD visit and the cost of an OPD visit for five broad disease groups (respiratory, musculoskeletal, infective, digestive and injuries and wounds). Assessing cost awareness among Medical Officers (MOs) in both hospitals (self-administered questionnaire – 54 MOs surveyed) and designing and implementing an educational intervention programme on drug costs and rational prescribing practices among medical officers in one hospital. The total and unit cost for treatment of identified disease groups were estimated, and morbidity and prescription patterns examined (considering a sample of 500 each time) two and four months following the intervention in the study hospital with the Colombo North remaining as the control, with the survey (500 respondents) including collection of cost information taking place only four months after the baseline survey there.

Importance of the Study: Focus on Drug costs that are a major share of treatment costs.

(7) Wijesekera, D.C and Vidyasagara, N.W (1996) A study to identify the actual costs incurred in the provision of health care on estates, mimeo.

Study Objectives: (1) To obtain a detailed analysis of the annual recurrent costs incurred per estate worker (or a standard number of workers) in maintaining a package of primary healthcare services on estates; (2) to utilize the results of the study to facilitate discussion regarding the organisation and financing of present and future estate healthcare programs; (3) to facilitate effective decision making with regard to allocation and utilisation of resources.

Methodology: Study involved twenty estates in the regions of Kandy, Hatton, Nuwara Eliya, Badulla and Ratnapura. Five of the seven estate regions of the plantation trust were selected (four institutions from each region). Eight estates had hospitals, seven had Maternity home cum dispensaries and five had only dispensaries. Data was collected through a questionnaire completed by estate staff. Purposive sampling was employed in order to cover the different types of health care units.

Importance of the Study: Focusing on the estate sector, the lagging sector in terms of health services and health status.

(8) Bloom, David E., Mahal Ajay, Christiansen, Lene, de Silva, Amala, de Sylva, Soma, Dias, Malsiri, Jayasinghe, Saroj, Jayaweera, Swarna, Mahawewa, Soma, Sanmugam, Thana, and Tantirigama, Gunatilleke (1997) Socio-economic dimensions of the HIV/AIDS epidemic in Sri Lanka, in The Economics of HIV and AIDS: The Case of South and South East Asia, Delhi; Oxford University Press (also see chapter 4).

Study Objectives: This study had three broad objectives: to gain a better understanding of the socio-economic dimensions of the HIV/AIDS epidemic in Sri Lanka; to contribute to a better appreciation of the epidemic's socio-economic dimensions in Asia through the case study of Sri Lanka; to provide insights into key research and policy questions such as the link between HIV and poverty, net benefits of blood testing and cost effectiveness of adopting universal precautions in the medical care system. Within these objectives the following aspects relate to costing:

- Calculating the Direct (treatment) cost of HIV/AIDS in Sri Lanka.
- Calculating the indirect (lost earnings) cost of HIV/AIDS in Sri Lanka (see chapter 4).
- Cost effectiveness of disposable syringes, safe blood and universal precautions.

Methodology: Direct costs were calculated using 20 case studies to identify common disease profiles among AIDS patients and then costing the procedure according to WHO protocols. Cost of medication and investigations were estimated using market prices for urban and rural sector patients, using public and private healthcare institutions. Indirect costs were limited to loss of earnings and calculated using the scenario building approach. Indirect costs were estimated based on per capita GDP figures involving assumptions regarding economic growth rates. Rates of survival at different ages and gender, rural/urban and age specific employment rates were used to weight the income values which was then discounted to gain the present value of lost earnings.

Lifetime lost earnings were calculated assuming that the AIDS patient dies at age 30, would otherwise retire at 60 and had a discount rate of 5%.

Importance of the study: Calculation of Direct and Indirect costs of an emerging health challenge and using this information to evaluate the cost-effectiveness of prevention activities.

(9) Jayatissa, K.L.R (1997) An Analysis of Utilisation, Quality and Costs of Maternal and Child Health Clinic Services, submitted for the Degree of Doctor of Medicine in Community Medicine to the Postgraduate Institute of Medicine, University of Colombo.

Study Objectives: To study the patterns of utilisation and factors affecting it, to estimate unit cost of antenatal, child welfare and family planning services provided at different types of clinics (single, combined, poly clinics), estimate direct cost incurred by consumers in obtaining MCH clinic services and assessing the quality of services provided through the MCH clinics in a selected DDHS area.

Methodology:

(a) Descriptive cross-sectional study focused on the DDHS area of Kaduwela situated in the Colombo district. Household survey involving 1800 respondents (pregnant females, non-pregnant females in the age group 15-49, families with children under five years). Cluster sampling. Cost information relates to the last visit within a four week period.

(b) Costing of clinics: data collected for three months on fixed, semi-fixed and variable costs using pre-prepared checklists. Daily diaries maintained by staff to record activities (as a basis for time apportionment); other costs apportioned according to floor space.

Importance of the study: Focusing on the clinical MCH Services.

(10) Russell, S and Attanayake N (1997) Sri Lanka Reforming the Health Sector: Does government have the capacity? The Role of Government in Adjusting Economies series – Paper 14 - Development Administration Group, School of Public Policy, The University of Birmingham (with Health Policy Unit, The London School of Hygiene and Tropical Medicine, University of London and Overseas Development Group, The school of Development Studies, University of East Anglia)––funded by the Overseas Development Administration.

Study Objectives: Evaluating the capacity of the Ministry of Health in Sri Lanka to carry out current administrative roles and the practices of new public sector management. The latter involved assessing the efficiency of the MOH in working with private sector partnerships (e.g. contracting out), enabling and regulating the private sector and facilitating decentralization including hospital autonomy. The case study on contracting out involved the costing of food provision services in four hospitals.

Methodology: Costing of food supply services in four hospitals where food provision has been contracted out.

Importance of the study: Focsing on the issue of public-private mix.

(11) Gunawardena, D.M., Wickremasinghe, A.R., Muthuwatta, L. Weerasingha, S., Rajakaruna, J., Senanayake, T., Kotta, P.K., Attanayake, N., and Mendis, K.N. (1998) Malaria risk factors in an endemic region of Sri Lanka and the impact and cost implications of risk factor-based interventions, American Journal of Tropical Medicine and Hygiene, Vol 58, No. 5, pp 533-542.

Study Objectives: Re-examining principles of transmission to identify risk factors to formulate interaction relating to the impact of housing construction and assessing the impact on incidence of malaria of two interventions: improving low quality housing in the buffer zone around sources of water, and relocating low quality houses away from such areas. Costing of the second intervention in comparison to regular prevention expenditure by the state to assess cost effectiveness of improving housing construction.

Methodology: Focuses on 1875 residents in 423 houses in clusters in eight contiguous villages in the Kataragama area during January 1992 and July 1993 (18 months). Incidence of malaria recorded for houses categorised as good and poor. Examining whether a difference in incidence exists in relation to housing type and then assessing the difference the two interventions mentioned above would make to malaria incidence. Assessing the cost effectiveness of improving housing construction of the poor households situated close to water (within the buffer zone).

Importance of the study: Cost effectiveness study used to substantiate epidemiological findings supporting intervention for reducing malaria incidence.

(12) Siriwardene, K.A.R.S (1998) Cost analysis of indoor treatment at Base Hospital, Gampola, Sri Lanka, Dissertation submitted for MSc. In Medical Administration to the Post Graduate Institute of Medicine, University of Colombo (also see chapter 3).

Study Objectives: In-depth cost analysis of the Base Hospital, Gampola, focusing on issues such as cost of indoor treatment and specialized care (per patient day/per admission/per bed day), cost of interventions such as surgery, delivery and blood transfusions and analyse cost composition and utilization patterns, cost of manpower, evaluate efficiency of management of inpatient care services.

Methodology: Gampola Base hospital was selected for this study. This hospital caters to an ethnic mix and covers mainly the middle income group. Retrospective cost information for one year was used in this analysis. Only recurrent expenditure was focused on in relation only to indoor care. Unit costs were calculated for inpatient care in different wards (see chapter 3) as well as the cost of minor and major surgery, normal and caesarean deliveries and blood transfusions.

Importance of the study: Focusing on costing of services in a Base Hospital.

(13) Konradsen, F., Steele, P., Perera, D., van der Hoek, W., Amerasinghe, P.H. and Amerasinghe F.P (1999) Cost of Malaria Control in Sri Lanka, Bulletin of the World Health Organization. (see also chapter 4).

Study Objectives: Costing a range of interventions for Malaria control, including water management for vector control and a village-level treatment centre.

Methodology: Study carried out in Anuradhapura district, in seven neighbouring villages, with 512 households and a total population of 2575, period covered October 1994 to September 1995. Authors assume all measures to be equally effective. Cost data (salaries, travel allowance, staff input, cost of fuel, chemicals and other) supplied provided by MOH including the Anti-Malaria campaign. Adjustment of number of workdays carried out to compensate for sick leave and personal holidays. Transport and storage costs added to import cost of chemicals. Actual capital costs from MOH used with full depreciation assumed after 7 years for vehicles and 20 years for buildings. Maintenance expenses also included. Survey

on household costs carried out. In order to compare different interventions the following criteria were devised: cost of individual protected and annual operating and capital cost per household. Both cost to households and government calculated for all interventions.

Importance of the study: Covering a range of interventions.

(14) Malalasekera, A.F, Ariyaratne M.H., Fernando, Perera, D and Deen K.I. (2003) Cost accounting in a surgical unit in a Teaching Hospital – a pilot study, Ceylon Medical Journal, Vol. 48 No 3.

Study Objectives: Costing selected major and intermediate surgery at the North Colombo Teaching Hospital and identifying areas of cost reduction.

Methodology: 80 patients undergoing routine major and intermediate surgery over a period of 6 months were selected at random. All consumables used and procedures carried out were documented and costs derived per patient (apart from capital and personnel costs) for three stages: pre-operative (investigations, blood product related costs), operative (anaesthetic charges, consumables and theatre charges – with costs of items determined on either fixed or time dependent basis) and post-operative (investigations, consumables, hospital stay) cases and averaged out to get the cost of specific surgeries. Values for consumables obtained from private sector figures. Use of variable anaesthetic charges, depending on time spent and private sector values, excluding profit. Cost of gas calculated using MSD figures.

Importance of the study: This study costs surgical procedures in order to determine measures for economising on surgical costs.

(15) Gurusinghe, J.N, (2003) Cost Analysis of Diagnostic Radiology at Colombo North Teaching Hospital, Ragama, Dissertation submitted for MSc. in Medical Administration, to the Post Graduate Institute of Medicine, University of Colombo.

Study Objectives: Costing Diagnostic Radiology services with a view to imporving effciency.

Methodology: Descriptive cross-sectional study. Costing of Radiology Department at Colombo North Teaching Hospital (CNTH), Ragama and Durdans Private Hospital. Information at CNTH collected over 3 months. Unit costs calculated for Radiological investigations at CNTH as three

month averages. Capital and recurrent costs considered. Asset Management Guidelines under Financial Management Guidelines used for determining depreciation rates for buildings, vehicles and equipment. Lease land value and rental value of buildings used. Recurrent data on personnel, utilities etc. collated from hospital records. Census of investigations (plain x-rays, special x-ray, CT scan, US scan) maintained by the staff.

Importance of the study: Assessing the cost of technology.

(16) Attanayake, Nimal and Siyambalagoda, Laxman (2003) An inquiry into the regulation of pharmaceuticals and medical practice in Sri Lanka, mimeo, funded by USAID.

Study Objectives: Map out the historical development of Cosmetics, Devices and Drugs (CDD) Act and other regulations relating to Pharmaceuticals and medical practice; to estimate enforcement and monitoring costs at central and peripheral level' estimate/identify transaction costs involved in the enforcement of regulations; to undertake an enquiry into social costs involved in non-enforcement of pharmaceutical and medical malpractice regulations; to assess compliance of field staff and pharmacy personnel; assess compliance of central and regional level officers and medical practitioners; assess achievement of social outcomes such as equity, efficiency, safety and quality in relation to aims of CDD and regulations on medical practice; identify organizational constraints and social, cultural and political constraints encountered in enforcing CDD and medical practice regulation and to reach some propose policy options to address capacity issues at the MOH for enhancing implementation of CDD and regulation of medical practice.

Methodology: Creation of conceptual framework including the mapping out of the various dimensions relating to the enactment and enforcement of the CDD Act and medical practice regulations. Three districts chosen: rural (Polonnaruwa), semi-urban (Gampaha) and Urban (Kandy district but limited to the Municipal Council area). These districts were chosen to bring out different socio-economic characteristics and distribution of pharmacies, public medical institutions and private health facilities. Purposive sampling was done within the district to bring out the heterogeneity of characteristics (i.e. pharmacies from licensed well equipped pharmacies to unlicensed drug stores). Medical practitioners sample was confined to public doctors engaged in private practice (the

variety of medical practitioners ranging from private GPs with village clinics to specialists attached to highly sophisticated hospitals owned by foreign companies was felt to be too diverse to sample even representatively).

Importance of the study: Innovative attempt to cost regulation.

(17) Suriyapperuma, S.A.C.R (2003) Study on utilization pattern, reasons/indications for use and determination of direct costs of the Computerized Tomographic (CT) scanner at the Radiology Department of National Hospital of Sri Lanka, Dissertation submitted for MSc. in Community Medicine, to the Post Graduate Institute of Medicine, University of Colombo.

Study Objectives: To study the utilization pattern, reasons/indications for use of CT scan and to determine the direct costs incurred by state and the clinicians knowledge and skills on CT and its applications.

Methodology: Descriptive cross sectional study, carried out between 31st August and 14th October involving 354 patients. Systematic sampling of all patients who underwent CT. Use of a pre-tested interviewer administered questionnaire to patients and a self-administered questionnaire for medical officers. Cost information collected by the researcher with the assistance of the Superintendent radiographer. Expert opinions sought by researcher from Consultant Radiologist as Head of the Department. Collection of direct cost information involved installation costs (purchase CIF value, cost of staff training, aligned equipment, building modification and A/C supply), maintenance cost of equipment including AC, electricity and material (film, chemicals, contrast material, cotton, syringes etc.). Indirect costs identified as staff salaries, transportation, cleaning and upkeep of CT area, building and land value and management costs ignored as were some of the direct cost components on the argument that it was logistically difficult to gain such information.

Importance of the study: This study is of limited importance as a costing study as it ignores many of the crucial components of costing, including personnel costs, electricity and building and land costs, so the cost estimates are severe underestimates.

(18) Rabel, M. Aruna Devanmini (2003) Critical analysis of expenditure on payment of overtime in a tertiary care hospital,

Dissertation submitted for MSc. in Medical Administration, to the Post Graduate Institute of Medicine, University of Colombo.

Study Objectives: To study critically the present payment scheme of overtime for medical officers, nurses and paramedical staff at Colombo South Teaching Hospital, Kalubowila. This involved the specific objectives of describing the procedures adopted in the payment of overtime, assessing the expenditure on overtime to the different categories of staff, assessing the justifiability of such overtime payments in comparison to service needs, studying the efficiency in implementing the present scheme of overtime and recommending measures to improve the cost efficiency of payment of overtime.

Methodology: Study carried out in the Colombo South Teaching Hospital. Data collection involved examination of the history and current status of the overtime scheme through perusal of documents, analysis of hospital accounts, carrying out surveys of the three staff categories to assess knowledge and attitudes to overtime schemes (110 nurses, 24 pharmacists, 20 MLTs and 10 radiographers) and two focus group discussions with staff and supervisors regarding overtime payments (two groups: 6 Consultant Medical Officers and 8 Nursing Supervisors).

Importance of the Study: The study focuses on a major cost component under debate from the perspectives of equity and efficiency.

(19) Fernando, S.D., Karunaweera, N.D, Fernando W.P, Attanayake N, and Wickremasinghe, A.R (2004) A cost analysis of the use of the rapid, whole-blood immunochromatographic P.f/P.v assay for the diagnosis of Plasmodium Vivax malaria in a rural area of Sri Lanka, Annals pf Tropical Medicine and Parasitology, vol 98, pp 5-13.

Study Objective: Assessing the cost of a rapid diagnostic test for Malaria in comparison with the traditional blood smear test.

Methodology: Between May 2001 and March 2002 a prospective study was carried out at the Kataragama Malaria Research Unit and the Kurunegala Anti Malaria Campaign Office to determine the cost and validity implications of using the traditional microscopic examination versus the use of the immunochormatographic test (ICT). Patients who reported to these centres with fever were tested using both methods after gaining their consent. The diagnosis and treatment were free of charge. A second microscopist was used, blinded to the initial result (no variation

was reported). Salaries and testing material and the discounted value of the microscope contributed to the cost of the microscopic examination. Building costs were not included as it would vary with location. Training cost was included annualized assuming that the microscopist would work for 30 years. ICT assumed to be carried out by a technician so no training costs were included. Therefore ICT costs were only the cost of the testing material and the time cost of the technician.

Importance of the Study: Use of cost effectiveness criteria in evaluating alternative testing procedures.

5.2 METHODOLOGICAL ISSUES

5.2.1 SCOPE

Costing of interventions and services is a vast area of work, much of which yet remains undone. The issue of immunization is the only area that has been tackled by more than one researcher (Rajasingham, 1991; Wickramasinghe, 1999; Gunasekera, 2003). Costing studies relating to health education and the introduction of legal interventions would be of particular interest with regard to the prevention of non-communicable diseases through improving dietary habits, lifestyles and road use. However costing such interventions is likely to be a complex process, particularly at a national level, since issues such as functional literacy and the strength of state administration and the role of civil society vary significantly by geographical area and social group, and are in any case hard to quantify the impact of.

The approach to costing of interventions can take two main forms:

Traditional Costing: Costs are determined for a cluster of activities related to a particular location (cost centre), with overhead costs being attributed to different services on the basis of input or output fractions.

Activity based Costing: Here the focus is on costing activities directly, so that overhead costs can be attributed in an empirically meaningful manner.

Services too can be categorised in a number of ways: firstly it can relate to services as defined by illness such as the cost of Malaria testing as in Attanayake, (1994); it can also cover specialised services provided within the hospital system as in the use of technology such as CT scans (Suriyaperuma, 2003' Gurusinghe, 2003) and Radiology (Gurusinge,

2003); it can relate to demographic characteristic, as in the study of MCH services carried out by Jayatissa, (1997); or involve an aspect of the health system such as catering or laundry services.

5.2.2 INCORPORATING EFFECTIVENESS OF THE INTERVENTION

The effectiveness of an intervention in relation to the cost incurred, that reflects in turn the benefit of the intervention, is an important issue in decision making. In order to compare between two rival interventions, for example Malaria spraying and bed net impregnation one has to determine the effectiveness of the different interventions. This is often a complex process as it depends on the availability of sound and scientifically compiled empirical information relating to each intervention. Often there are debates with regard to the effectiveness of specific interventions, affected by geographical and socio-economic factors, as well as by the side-effects and externalities generated by such actions (i.e. environmental impact of spraying). Researchers are often forced to impose assumptions relating to the effectiveness of the alternative interventions (i.e. based on empirical evidence from other countries), and their conclusions are often affected by the validity of these assumptions to the locality under consideration. Benefits are difficult to quantify in most instances, and costs averted are often used to proxy for such benefits. Precise determination of effectiveness is therefore also important in carrying out cost-benefit analyses.

Compliance is a major factor in ensuring effectiveness of an intervention. However compliance is highly dependent on socio-economic factors and on the effectiveness of the intervention itself. Individuals are more likely to comply if they are convinced of the benefits from the intervention. In addition compliance is dependent on perceived risk, for example, the success of vaccination is high while epidemics are apparent, and decline as the incidence of the disease becomes low, adversely affecting the opportunity to eradicate a disease.

5.2.3 INCORPORATING QUALITY

Complexities are also imposed in the costing of services by differences in quality: technical quality in the case of radiology for example, or even differences with regard to efficacy and side effects in the case of comparing drug costs.

Differences in skill level between human resources can affect both the effectiveness and the quality of services. Skill levels could differ due to differences in innate ability, education level, period and comprehensiveness of training, or even with age. Quality of services is also affected by factors such as staff motivation and attitude that in turn are linked to factors such as wage rates, working conditions, the civil society environment and political will.

Therefore though comparisons with regard to cost can be made, for example, in the provision of MCH services or blood testing, there could be significant qualitative differences in the outcomes under consideration.

5.2.4 SCENARIO BUILDING

In assessing the cost effectiveness or cost-benefit of a particular intervention, it is important to focus on a very specific situation, with regard to time and locality, since these in turn determine the parameters of the intervention and its success or failure in achieving the desired outcome. For example in assessing the benefit of shifting to disposable syringes in a Sri Lankan setting it is crucially important to take note of the fact that medical waste disposal is possibly not following an optimal path. This necessitates the concept of scenario building within the costing technique: how are the syringes stored, used and disposed of and how do these events bear on the likelihood of needle stick injuries among patients, medical personnel and waste handlers. Many assumptions have to be incorporated in determining risks and benefits, and probability and likelihood ratios adopted in quantifying these possible outcomes. For instance in assessing the reduced risk of HIV/AIDS through the use of disposable syringes, in Sri Lanka in 1997 involved assuming that the medical personnel themselves were at the time free of the disease, whereas a probability of infection among such personnel may have had to be built-in to a scenario dealing with a high prevalence country.

How are such assumptions formulated and quantified? Identifying the relevant assumptions necessitates a step-by-step analysis of the events related to the intervention. It also necessitates considering all the relevant socio-political, administrative, epidemiological and geographical details from different perspectives. In determining the corresponding quantitative values in order to incorporate the probabilities of different interactions, different strategies can be adopted:

- drawing on local knowledge
- extrapolating from foreign studies
- carrying out mini-surveys
- focus groups involving experts
- guestimates.

5.2.5 TIME APORTIONMENT

Different strategies can be adopted in apportioning time across activities. This task is of particular importance in costing an intervention since often only a fraction of a health care worker's time would go on such an activity. Time motion studies are a popular means of determining the appropriate time apportionment but the Hawthorn effect, the fact that observation itself can lead to biases in activity pattern (for instance more productive activity and less idling!) is the downside to this approach. Alternatives are the use of retrospective recall or concurrent recording (maintaining continuous diaries): the accuracy of the former depends on the period of recall and the memory of the individual, while the latter is not feasible in busy settings.

5.3 COMPARING RESULTS

5.3.1 Deliveries

Siriwardena (1998)

Siriwardene (1998) found the cost per delivery normal delivery to be Rs 1231, while a caesarean delivery cost Rs 4201. In the Gampola Base Hospital in 1997 there had been 1325 normal deliveries and 182 caesareans.

5.3.2 MCH SERVICES

(a) Jayatissa (1997)

This study seeks to assess the unit costs of different types of MCH clinics, in order to compare the efficiency of single clinics, versus combined clinics and poly clinic. The table below presents information relating to the per clinic costs that show that combined clinics are more costly than single clinics or polyclinic. Where the cost categories are concerned capital costs are very similar for all types of clinics. Semi-fixed emoluments are

relatively high for the single clinics while variable costs are significantly higher in the combined clinics However if the numbers using each of these clinics is large, high utilization rates would results in low unit costs.

Per Clinic costs

	ANC	CWC	FP	ANC+CWC	CWC+FP	Polyclinic
Number of Clinics	**5**	**4**	**4**	**2**	**1**	**3**
1 Capital Cost	3544	3652	3060	3587	3659	3389
2 Semi-fixed Costs	7192	8966	10778	8372	9192	7893
2.1 Emoluments	6631	8405	10217	7811	8631	7332
3 Variable Costs	6064	8921	9222	15505	23101	9544
3.1 Supplies (Drugs, Vaccines)	6052	8909	9210	15493	23089	9528
Total	16799	21539	23059	27463	35952	20827

Note: ANC –Antenatal Clinic, CWC – Child Welfare Clinic, FP – Family Planning
Source: Calculations based on Jayatissa (1997)

The figures below relate to the per activity cost from a systemic perspective. It examines the unit cost in different types of clinic. The costs presented here do not include land costs and pre-service or in-service training costs. It uses the cost of building per square metre taken from the Director of Buildings of the Ministry of Health and assumes a 20 year life span to determine the annualized value of the building. Jeeps are assumed to have a 15 year life span and bicycles five years. Equipment and furniture are assumed to have a lifespan of 10 years. Emoluments of staff including allowances are considered under semi-fixed costs. Under variable costs fuel, drugs and supplies, surgical consumables and stationary are considered but the costs of water and electricity are omitted.

Staff time is allocated for each activity is based on the ratio: visits by mother and children for a specific activity/all visits by mothers and children, multiplied by 100. Alternatively a time motion study also provided information on the allocation of time for different activities. While some differences resulted from the different techniques of time allocation the conclusions remained unchanged.

Activity	Single	Combined	Poly
Pregnant women			
Antenatal care	50	93	46
Immunisation	28	37	23
Children			
Child care	21	76	46
Immunization infant (triple and polio)	17	53	25
Monitor growth and development of an infant	14	30	22
Immunization pre-school (triple and polio)	17	53	25
Monitor growth and development of pre-school child	14	50	22
Family Planning			
Proving an IUD to a new acceptor	73		
Providing DMPA injection for a mother	54	26	46

Two factors influence the unit costs: rates of utilization and the total cost of production of services. Here the lowest unit costs relate to polyclinics while the highest figures are for the combined clinics. The financial advantage of using the same staff for the provision of two types of services in the combined clinics is lost due to these clinics having lower utilization rates than the single and poly clinics.

The study also examines consumer costs, through analysing information received from a household survey, in response to a query relating to expenditure involved in a clinic visit. The results are presented below.

	Median Expenditure (25th and 75th percentile values in parenthesis)			
	Antenatal Care	Child care	Family Planning	Antenatal and child care
No in sample	42	10	41	13
Transport	10.00 (6.00-14.00)	4.00 (3.00-9.00)	3.00 (3.00-6.00)	7.00 (4.00-10.00)
Accompanying Person/s	9.00 (6.00-13.00)	4.00 (3.00-9.00)	4.00 (3.00-4.00)	0.00

	Median Expenditure (25th and 75th percentile values in parenthesis)			
	Antenatal Care	Child care	Family Planning	Antenatal and child care
Doctor	0.00	0.00	0.00	0.00
Drugs	44.00 (9.00-60.00)	6.00 (0.00-6.00)	20.00 (0.00-50.00)	0.00
Incidental expenditure	50.00 (35.00-70.00)	20.00 (0.00-20.00)	14.00 (0.00-20.00	60.00 (20.000-100.000)
Total	113.00	34.00	41.00	0.00

Source: Jayatissa (1997)

Drugs and incidental expenditure are the major source of expenditure in all cases except in the combined clinic. Drugs should be provided free to patients, and the above information suggests that shortages at the clinics caused patients to have to spend on drugs. Transport costs are not significant since these clinics are located close to the clients.

5.3.3 ESTATE HEALTH SERVICES

Wijesekera and Vidyasagara (1996)

This study focuses on three categories of activity:

Category A – Immunization, family planning, routine screening of infants and preschool children, growth monitoring and nutrition education, general health education and health information.

Category B – Antenatal care, natal (delivery) care, postnatal care including care of the new born.

Category C – Control and treatment of common endemic diseases including basic curative care and other health work.

The annual recurrent expenditure per estate resident was found to be as follows: Rs 139.37 on estates with a hospital; Rs 128.98 on estates with a maternity home cum dispensary and Rs 108.56 on estates with only a dispensary.

5.3.4 IMMUNIZATION

Rajasingham (1991)

Results relate to immunization of children in the Badulla district. Cost of fully immunizing a child under 1 year with the six antigens in the Sri Lankan EPI ranges from Rs 61.47 (Badulla Municipal Clinic) to Rs 369.15 (Uva-Ketawela satellite clinic – estate sector) with a mean cost of Rs 183.40. Costs are directly related to utilization with the highest and lowest numbers corresponding to the two locations named above (910 compared to 36).

Vaccine and stationary costs were closely related to utilization numbers. Salary costs accounted for the highest proportion of costs, averaging 45.6% for all the areas. It was highest in the rural hospital sector (55.4%) and lowest among the key estates (32.8%), though the percentage of staff costs was high in proportion for the satellite estate clinics (number of total staff and staff categories varies by location). Vaccines averaged 21.9% of total costs, transport 9.2% and capital, equipment and maintenance costs 15.7% on average. Transport varied significantly as well ranging from no cost at the Badulla Municipal Clinic to 22.8% for St James satellite estate clinic (with all the satellite clinics having high transport cost proportions.

5.3.5 CHILD NUTRITION

Attanayake and Aturupane (1995)

All children aged 6 to 11 months are entitled to Thriposha, distributed by the Public Health Midwives (PHMs) in the area. Children who are nutritionally at risk are also eligible for Thirposha. Of these those aged 12 to 35 months are identified through growth monitoring charts maintained by the PHMs while those aged 36 to 59 months need a certificate from the Divisional Director of Health Services to be entitled to receive Thriposha.

The study assumes that one third of a PHMs time is allocated for child nutrition activities. Of this 60% is spent on growth monitoring, 20% on providing nutritional advice to mothers and 20% for distributing Thriposha. Costing of the nutrition component of a PHM's activities include adding to the 1/3rd cost of salary the annualized discounted value of the replacement cost of capital inputs such as the health centre and

weighing scales. A further 10% of this total cost is added as the approximate value of other recurrent costs such as electricity, cost of supervision and administration. This is the lower bound cost. An upper bound was created by assuming that 50% of the PHM's time was spent on nutritional activities and adding 15% of that cost plus the annualized discounted value of capital costs, as the recurrent cost. This gave the average cost per child examined by a PHM to be Rs 13.92.

Assuming that the PHM examines almost all the children below 59 months in her service area nd that the rate of under nourishment among them is 32.3% (based on adjusted CFS data), cost per undernourished case detected was Rs 43.09.

Assuming that a child who is detected as under nourished at age 12 months is provided with supplementary feeding up to the age of 5 years, and that the supplementary food takes the form of Thirposha, then the cost of Thriposha for four years has to be considered plus another 10% of this cost as administrative, transport and storage service costs has to be considered in determining the cost of avoiding under nourishment. In addition it is assumed that the PHM examines the child once every month and spends time on providing Thriposha to the child. The present value of the cost of avoiding under-nourishment per child was calculated to be Rs 23,297.

The benefit is assumed to accrue through increased productivity as a result of gaining a better height in adulthood. Other benefits would include reduction in morbidity rates and improvement in school attendance and hence learning capacity that would also contribute to economic gains in the future.

5.3.6 Surgery

(a) de Silva (1994)

de Silva (1994) gives the following average costs relating to Paediatric surgery.

Super major surgery (e.g.T.O.F correction, Biliary Atresia)	Rs 3028.00
Major sugery (e.g Laparatomy)	Rs 1514.00
Intermediate surgery (e.g. Appendix, Hernia, Hdrocele)	Rs 757.00
Minor surgery (e.g. Abscesses)	Rs 378.50

(b) Siriwardena (1998)

Siriwardene (1998) found cost per major surgery to be Rs 4201 in 1997 while cost per minor surgery was Rs 750 in 1997. In this year 558 major surgeries and 1370 minor surgeries had been performed at the Gampola Base Hospital.

(c) Malalasekera et al (2003)

The study reports the following average costs of intermediate and major surgical procedures. It should be noted that the costs are underestimates as they do not incorporate capital and personnel costs.

The information is based on 42 surgeries relating to the gastrointestinal tract, 10 relating to breast and endocrine, 5 urological surgeries, 22 hernia operations and 1 operation classified as a minor surgery.

In general the study found that the largest contributory factors towards total cost were basic hospital charges (median value of 30% with range from 15% to 65%), fixed theatre charges (23%, range 6% to 35%), variable theatre charges (14%, range 8% to 27%) and anaesthetic charges (15%, range 1% to 36%). These findings lead to the authors to conclude that cost curtailment would necessitate decreasing hospital stay (see above), operating theatre time and anaesthetic expenditure.

Operation	Average cost	Average days in hospital	Average days preoperative
Abdominal rectopexy	11821	4.2	1.5
Anterior resection	34002	14.8	2.6
Abdominoperineal resection	26885	9.0	3.0
Cholecystectomy	8852	3.7	1.2
Colectomy – right	22171	7.0	1.5
Fistulectomy	4543	3.0	1.0
Gracilis neosphincter	1537	89.0	1.0
Haemorrhoidectomy	5680	4.8	1.0
Lleostomy closure	9735	5.2	1.5
Ingunial herniorraphy	4221	2.6	1.1
Mastectomy and axillary clearance	11058	7.5	1.3
Mesh repair for hernia	7460	4.0	1.5

Operation	Average cost	Average days in hospital	Average days preoperative
Open prostatectomy	16365	15.5	1.5
Parumbilical hernia	5092	3.5	1.0
Thyroidectomy	9526	3.8	1.0
Transurethral resection of the prostrate	13233	11.0	2.7

Source: Malalasekara

They therefore propose pre-operative investigations being carried out on an OPD basis, same day surgery where possible, early planned discharges and avoiding operating theatre delays. Using the case of inguinal herniorraphy they illustrate that the costs of general anaesthesia, spinal anaesthesia and local anaesthesia vary from Rs. 4637/-, Rs. 3398/- to Rs. 2754/-.

5.3.7 COST OF DRUGS

de Lanerolle (1996)

For the baseline survey the average cost of drugs per patient was Rs 15.81 at the Provincial Hospital Colombo South (PHCS) and Rs 13.17 at the Provincial Hospital Colombo North (PHCN).

Use of the Pareto-Lorenz or A-B-C analysis showed that at PHCS 80.5% of total cost was contributed by 10 drugs, while at PHCN, 10 drugs accounted for 72.4% of the drug costs. Seven drugs were common to both hospitals.

By disease group the results were as follows:

	PHCS		PHCS	
	% cases	Average cost per patient (Rs)	% cases	Average cost per patient (Rs)
Respiratory	46.6	18.44	43.3	15.85
Musculoskeletal	12.0	6.50	16.8	6.70
Infective	9.7	10.55	11.0	10.36
Digestive	7.9	7.34	6.5	9.01
Injuries and wounds	7.6	27.50	8.9	18.43

Source: de Lanerolle, 1996

After the intervention involving lectures and printed material educating MOs on the cost of drugs at the PHCS the following changes were noted:

- reduction in the percentage prescribing antibiotics, namely Amoxycillin, Erythromycin and Oral Penicilin.
- reduction in the use of Chlopheniramine and Paracetamol.
- no major change in the prescription pattern of other drugs.

Average drug costs per patient declined from Rs 15.81 at the baseline to Rs 12.58 two months after the intervention and Rs 12.62 four months after.

	Baseline	2 months after intervention	4 months after intervention
Respiratory	18.44	14.49	14.02
Musculoskeletal	6.50	7.19	6.12
Infective	10.55	10.39	8.36
Digestive	7.34	9.12	7.45
Injuries and wounds	27.56	18.33	23.88

Source: de Lanerolle (1996)

Reduction of costs relate mainly to reduction in prescribing of antibiotics. During the intervention the emphasis was on reducing antibiotic costs.

	Baseline	4 months after intervention
Respiratory	15.85	20.66
Musculoskeletal	6.70	6.49
Infective	10.36	4.50
Digestive	9.01	7.72
Injuries and wounds	18.43	20.06

In order to assess if the change in costs can be attributed to the intervention, drug costs were estimated four months after the baseline in the control setting, PHCN. Here the drug costs per patient changed from Rs 13.17 (baseline) to 14.77. Disease group-wise the following results are reported.

5.3.8 Laboratory Investigations

(a) de Lanerolle (1996)

Data is only available with regard to the Provincial Hospital Colombo South. For the 1000 OPD patients whose records were examined, 37 laboratory investigations had been ordered. This included 21 WBC/DC, 3ESR and 13 UFR (see below for ECG and X-ray). Only recurrent expenditure was considered in calculating the unit cost. Staff emoluments accounted for approximately 80% of cost.

The average cost of the laboratory investigations were as follows:

WBC/DC	Rs 10.59
ESR	Rs 7.08
UFR	Rs 9.71

(b) Dharmaratne (2001)

These costs relate to the Teaching Hospital Peradeniya and were calculated while costing the treating of persons injured in RTAs. These costs however are the average costs for conducting laboratory tests in treating all patients.

Test	Number per month	Cost
Hb	1300	19.19
Blood Urea	1200	17.69
WBC/DC	1500	23.96
Blood Sugar	2500	15.60
Serum Electrolytes	1200	18.45
ESR	1200	20.24
UFR	2200	30.63

Staff costs include cost of diet. Large staff of 2 consultants, 1 Senior Registrar, 2 Registrars, 5 Medical Officers, 3 Chief Medical Laboratory Technicians, 14 MLTs and 11 labourers are considered though in the case of Medical Officers and Consultants only 5% and 1% of their time is apportioned for these investigations. Costs include staff costs, consumables, apportioned indirect variable cost, apportioned by floor area and apportioned fixed cost apportioned by staff numbers. The major share of the cost for each test is staff costs.

5.3.9 Cost of X-rays, EEG and ECG

(a) de Silva (1994)

de Silva (1994) found the cost per X-ray to be Rs 65.20 and the cost per EEG and ECG to be Rs 100.00 and Rs 50.00 respectively in a study that omits land value but considers cost of repairs to capital assets.

(b) de Lanerolle (1996)

Data is only available with regard to the Provincial Hospital Colombo South. For the 1000 OPD patients whose records were examined 10 ECGs and 2 X-rays were ordered. Only recurrent costs were considered. In the Radiology Department consumables accounted for 52% and staff emoluments for 42%, whereas in the ECG department staff emoluments were approximately 80% of recurrent cost.

The average cost of an ECG was Rs 30.00 and that of an X-ray Rs 55.30.

(c) Dharmaratne (2001)

These costs relate to the Teaching Hospital Peradeniya and were calculated while costing the treating of persons injured in RTAs. These costs however are the average costs of ECGs and x-rays in treating all patients.

Cost of an ECG was Rs 86.77 and an x-ray Rs 179.51.

(d) Gurusinghe (2003)

In Durdan's Hospital normal plain x-rays and special x-rays are handled by the same department using the same equipment so the costing is carried out jointly.

	Colombo North Teaching Hospital		Durdan's Hospital	
	Total number of investigations per day	Unit cost	Total number of investigations per day	Unit cost
Normal plain x-ray	200	182.16	169	317.24
Special x-ray	4	3942.23		

Note: Special x-rays could be categorized as Intravenous Pyelogram, Micturition Cysto Urethrogram, Barium Meal, Barium Swallow, Barium Enema,, Histero Salpingiogram, Myclogram, Retrograde Pyelogram,

Sialogram, Sianogram, Oral Cholecystogram, Endoscopic Retrograde Cholecysto Panreatogram, Percutaneous Trasnhepatic Cholecyctogram and Pre-Operative Cholangiogram.

Source: Gurusinghe, 2003.

The above feature prevents direct comparison of public and private sector x-ray costs but the data does suggest that costs are likely to be higher in the public sector due to underutilization of special x-ray facilities at Colombo North Teaching Hospital.

5.3.10 SCANS

(a) Gurusinghe (2003)

	Colombo North Teaching Hospital		Durdan's Hospital	
	Total number of investigations per day	Unit cost	Total number of investigations per day	Unit cost
CT Scans	5	21675.28	6	16263.29
US Scans	19	1060.72	33	161.52

The low number of CT scans in both sectors result in high unit costs. In the case of the public sector US scans are more expensive in the public sector again due to the low utilization rate of this facility.

(b) Suriyapperuma (2003)

Direct costs considered include CIF value of CT machine, staff training costs, printer and automat, building modification and AC. Life span of the machine was assumed to be 10 years with straight line depreciation assumed. Maintenance involves the fees to be paid on the CIF value to the company (free in 1st two years, 3rd year 3%, 4th year 4%, 5th year 5% etc. up to 10th year). Material involves cost of film (Rs 150), chemicals per CT (Rs 50) and contrast material which varies by scan site (i.e. head involves half a vial at Rs 850 while chest/abdomen costs Rs 3400 for 2 vials).

Cost per CT scan (Considering depreciation) Rs 463.40

This procedure of considering depreciation on staff training and building modification costs is incorrect and will underestimate the cost.

Maintenance Rs 240.00

This adds up to Rs 703.

Including material costs (Rs 50 for film and Rs 150 for chemicals)

Head – non-contrast	Rs	903
Head contrast	Rs	1753
Abdomen	Rs	4303

These costs however are severe underestimates since they ignore major costs such as personnel time, electricity and land and building costs.

5.3.11 BLOOD TRANSFUSION

Siriwardena (1998)

Siriwardene (1998) found the per blood transfusion cost in 1997 to be Rs 11,982. This high cost resulted from the fact that while the blood bank operated during all working hours only 75 transfusions had been done throughout 1997 at the Gampola Base Hospital.

5.3.12 PROVISION OF FOOD

Russell and Attanayake (1997)

The cost per meal on average is

Kekirawa District Hospital	49.71
Medawachchiya District Hospital	51.47
Kurunegala Provincial Hospital	32.45
Anuradhapura Provincial Hospital	29.10

5.3.13 OVERTIME PAYMENTS IN A TERTIARY HOSPITAL

Rabel (2003)

The study is of the Colombo South Teaching Hospital and the detailed staff data analysed covers the period from May to August 2003.

Information relating to overtime payments to medical officers and nurses is given below.

	Average Number of officers	Average extra duty hours per month per officer	Average extra duty payment per month per officer
Medical Officers – Grade 1	25.5	9.6	1436.50
Medical Officers – Grade II	129.8	16.5	2402.00
Medical Officers - Preliminary	51.8	33.2	3500.00
Nursing Officers – Special	4.0	67.0	3690.25
Nursing Officers – Grade 1	25.8	91.0	4097.50
Nursing Officers – Grade II A	149.8	46.0	1841.25
Nursing Officers – Grade II B	265.8	72.0	2668.25

A comparison of the expenditure on salaries and overtime payments to MLTs in the hospital in the years 2000-2003 reveals the striking burden imposed by overtime payments and the misuse of the system, particularly as the study notes that only around 20% of tests are carried out in off-duty hours.

	2000	2001	2002	2003
Average salary (per MLT per month) in Rs	7850	8229	11952	11121
Average overtime (per MLT per month) in Rs	6180	6750	9234	8637
Overtime as a percentage of salary	78.7	82.0	77.2	77.7

The need for addressing the present overtime scheme for MLTs is highlighted by the study that also proposes reconsidering the shift scheme for nurses as involuntary hours of overtime are imposed (as reflected by the results of a survey and supervisors observations) due to the shortage of nursing staff in the institution.

5.3.14 PREVENTION OF HIV/AIDS

I. BLOOD SAFETY

(a) Bloom, Mahal et al (1997)

Two different assumptions are used in this cost-benefit exercise: the low scenario refers to an HIV prevalence rate of 0.08 while the high scenario refers to an HIV prevalence rate of 0.7 (based on the projected

seroprevalence rate for 2005). In calculating the number of infections averted a number of assumptions are adopted such as the seroprevalence rate among donors as compared to the general population and processes used in blood donation and blood transfusion (i.e. average request is for 2.24 units of blood needed for each donee). In the cost of illness method the midpoint value of urban males is used while in the willingness to pay method, the mid point of the general population value is used. Downstream infections were calculated assuming that each HIV case infects another case every four years (i.e. 6.5 new infections over ten years). Discounting is at 3%.

	Downstream infections excluded		Downstream infections included	
	Low Scenario	High Scenario	Low Scenario	High Scenario
Expected No. of infections averted				
Pre-screening only	81.94	712.50	610.45	5308.13
Pre-screening plus HIV testing	94.80	829.47	706.26	6179.55
Marginal benefits from HIV testing (US $ thousands)				
Cost of illness method	226.85	2063.35	1690.09	15371.85
Willingness to pay method	3373.56	30684.74	25133.84	228599.60
Costs of HIV testing (US $ thousands)				
Cost of test kits/personnel	748.30	752.16	748.30	752.16
Cost of blood disposal	6.94	7.24	6.94	7.24
Cost of replacing destroyed blood	24.98	26.07	24.98	26.07
Total costs	780.22	785.47	780.22	785.47
Net Benefit (US $ thousands)				
Cost of illness method	553.37	1277.88	909.87	14586.38
Willingness to pay method	2593.34	29899.27	24353.62	227814.13

Source: Bloom, Mahal et al (1997)

Note: Downstream infections are calculated assuming that one individual infects another every four years.

The study suggests that in 1997, the cost of illness method finds testing blood transfusions for HIV not to be economically beneficial except when downstream infections are considered, since at this point the low prevalence rate prevailed. However given the likelihood of rising prevalence (the study cites factors such as the proximity to India, and internal and international migration as major risk factors) and downstream

infections 'safe blood' procedures were strongly recommended by this study, particularly by highlighting the complementary benefit that would accrue in the case of reducing the risk of hepatitis B and other STDs.

II. SWITCHING TO DISPOSABLE SYRINGES

Bloom, Mahal et al (1997)

This cost-effectiveness study relating to the burden imposed by HIV/AIDS considered three categories of individuals who could be affected by contaminated needles: patients, medical and nursing personnel and the handlers of medical waste. They considered the economic burden imposed through the spread of HIV/AIDS under two epidemiological scenarios: low and high rates of prevalence (based on the 1994 rate and the projected 2005 rate) and under three policy options: present situation with improper sterilization of reusable needles and injecting equipment, ensuring proper sterilization of needles and injecting equipment and the shift to disposable syringes. The benefits were assessed in terms of costs averted, with costs being calculated under two different methodologies: cost of illness (assuming an urban male in calculating indirect earning loss) and willingness to pay (see chapter 4.4.4). The findings are presented in the following table;

Expected infections averted			
Low Scenario			
No downstream infections	4.35	4.46	4.27
Downstream infections	32.40	33.23	31.81
High scenario			
No downstream infections	38.70	39.74	37.91
Downstream infections	288.32	290.06	282.42
Marginal Benefits ($US millions)			
COI method			
Low scenario	0.08-0.57	0.08-0.59	0.08-0.56
High scenario	0.68-5.09	0.07-5.22	0.67-4.98
WTP method			
Low scenario	1.14-8.50	1.17-8.72	1.12-8.34
High scenario	10.15-75.64	10.42-77.67	9.94-74.09
Marginal Costs ($US thousands)	17.24	321.09	229.31

Net benefits ($US millions)			
COI method			
Low scenario	0.06-0.55	(-)0.24-0.27	(-)0.15-0.33
High scenario	0.66-5.07	0.38-4.90	0.44-4.75
WTP method			
Low scenario	1.12-8.48	0.85-8.40	0.89-8.11
High scenario	10.13-75.62	10.10-77.35	9.71-73.86

Note: Downstream infections are calculated assuming that one individual infects another every four years.
Source: Bloom, Mahal et al (1997)

The net benefit is greatest for the option of fully sterilizing equipment but if procedural and administrative difficulties hinder such a process, then disposable syringes and needles would be beneficial, even under the cost of illness method, if a high prevalence scenario is assumed.

III. UNIVERSAL PRECAUTIONS

Bloom, Mahal et al (1997)

Universal precautions is founded on the assumption that all contact with patients, whether direct or indirect, should be considered as a potential source of infection with HIV irrespective of whether the patient is known to be HIV-positive or not. This includes practices such as wearing of gloves whenever patients might come into contact with blood or other bodily fluids; wear masks, goggles and gowns if there is a possibility of being splashed; not recap needles; keep disposable sharp objects in safe containers near the place of use; and wash hands in case of contact.

This study only considers patient to health care worker transmission and does not cover health care worker to patient or patient to patient transmission in carrying out the cost-benefit analysis. Only occupational risk of infection was considered. It also does not quantify the benefits accruing from the prevention of spread of other STDs including Hepatitis B and C.

The costing of universal precautions included the provision of gloves and protective clothing as well as the parallel health education needed to ensure implementation. High prevalence and low prevalence scenarios were considered as in the case of switching to disposable syringes. A

context where disposable syringes is already in use is taken as the baseline and risk reduction through universal precautions is considered at three hypothetical levels: 25%, 50% and 75%. Downstream infections are also included in alternative scenario. Cost of Illness (COI) and Willingness to Pay (WTP) methods of costing the benefit are adopted.

The study concludes that under the low prevalence scenario COI method universal precautions is not cost-beneficial and that even using the higher WTP approach that it is only at 75% effectiveness that it would be so. It is only combining the high prevalence assumption with the WTP calculations that strongly support the adoption of universal precautions. Note that here the adoption of universal precautions is considered to be over and above the use of disposable syringes, which as discussed previously was cost effective under WTP and COI (for the high scenario case).

5.3.15 MALARIA CONTROL

I RESIDUAL SPRAYING

(a) Attanayake (1994)

The cost of fully spraying a house under perennial residual spraying by the state is Rs 198.43 and approximately one third of this amount is spent for a partially sprayed house. Partial spraying refers to spraying the outside of the house as opposed to full spraying which covers the inside as well. Of this cost 73.21% is for Malathion, 23.21% for wages and salaries, with the cost of the spraying machine, spare parts, supplies, rent, vehicles and fuel contributing 3.54% of the cost. It was found that high coverage was linked to low cost per fully sprayed house. The cost of perennial residual spraying was found to be lower than spraying carried out under special programmes. This is due to the additional costs that have to be borne on manpower and travelling in conducting special programmes.

The indirect cost to household members in arranging a house for full spraying was Rs 12.23 for the whole district, and Rs 7.59 for a partially sprayed house.

(b) Attanayake and Aturupane (1995

Considering the cost of spraying lambda-cyhalothrin in the Kurunegala district in the years 1994 and 1995, with the impact of spraying being taken as a continuous process for the whole period of using this new insecticide, then the cost per case prevented would be Rs 2,633.

(c) Konradsen et al (1999)

It was found based on experience in the area that a spraying team from the health authority in Kekirawa town could protect 25 houses per day (by treating all sprayable surfaces) excluding refusals and absent householders. The team included 4spray machine operators and one field assistant (known as a walking unit though actually using a bicycle as the means of transport). Supervision assumed to be done by a Public Health Inspector with a driver and vehicle, who could supervise four walking units per day. Fenitrothion (Rs 404 per kg) needed to be sprayed thrice a year (approximately 0.50 Kg per house), lambda-cyhalothrin (Rs 3870) twice a year (0.06 Kg per house+ and Malathion (Rs 153 per Kg) thrice a year (0.90 per house).

Use of Alternative Chemicals

Type	Operating cost per day	Operating cost per household per intervention day	Annual capital cost per household	Annual operating cost per household	Total annual cost per individual protected
Fenitrothion	6412	256	768	24	158
Lambda-cyhalothrin	7409	296	592	16	122
Malathion	4613	185	555	24	116

Source: Konradsen et al (1999)

Acceptance in the area was high, and was likely to remain high as the newer chemicals stained the walls less and were nearly odourless.

Costs included annual protective clothing and other equipment for spraying and cost every two and a half months of routine check-ups for spray operators using the cholinesterase test.

II. BED NET IMPREGNATION

(a) Attanayake (1994)

The MNI programmes in the Thalkiriyagama village and Galewela town resulted in average costs per net impregnated of Rs 49.04 and Rs 64.69 respectively.

The cost for the purchase of a mosquito net per user was Rs 184.69 and the cost per user per year on average across the household areas was Rs 34.78, per household this was Rs 573.95 and Rs 108.10 respectively. Use of mosquito nets was linked to household income and the education level of the head of household.

The author strongly argues for expanding this activity through the provision of subsidized mosquito nets and regular impregnation processes.

(b) Graves, Fernando and Attanayake (1995)

The study found the cost per bed net treated to be Rs 82.20 in Matale and Rs 154.38 in Anuradhapura. Cost per person protected is reported as Rs 32.88 and Rs 61.75 respectively. This significant difference in cost is attributed by the authors to differences in the quantity of insecticide used (.101 litres in Anuradhapura as compared to just .046 litres in Matale).The authors point out that while the cost of a bed net is about Rs 600, the fact that it has an average life span of five years and is used on average by 2.5 persons makes this cost negligible.

(c) Konradsen et al (1999)

Government health services supported a mosquito bed net impregnation programme. The personnel involved in this programme were a public health inspector, field assistant, a ddriver and a labourer who visited an area to dip nets in a solution of permethrin. The insecticide cost Rs 1120 per litre and was sufficient for about 20 bed nets. 50 households (100 nets could be impregnated in a day) could be protected by this intervention per day. Efficiency of the scheme would depend on a large proportion of the community using bed nets. In this study only 7% of the households in the study area owned at least one privately purchased bed net.

Considering the number of households protected per day to be 50, with the operating cost per day calculated at Rs 5244, it is estimated that the operating cost per household per intervention day is Rs 105, with two

processes being needed per year for protection. This then works out to have an annual operating cost per household of Rs 210 and an annual capital cost of Rs 32, with the total annual cost per individual treated working out as Rs 48. This is an extremely cost effective measure. The government should encourage more community involvement in this project. As the initial cost of purchasing the bed nets is high, and such programmes may bypass the poorer segments of society the government should find ways of funding such purchases through community activities. NGOs are another means of encouraging bed net usage.

III. IMPROVING HOUSING CONSTRUCTION

Gunawardena et al (1998)

The study focused on 1875 residents living in eight contiguous villages in the Kataragama area. Of this population 838 lived in houses classified as 'good' (based on characteristics of walls and roofing) while 906 lived in 'poorly' constructed houses. During the period there were 1579 malaria infections among this population, of whom 424 were persons living in 'good' houses as compared to 1155 living in 'poorly' constructed houses. This led to the conclusion that incidence rates differed significantly between good and poor houses. Risk of malaria was 2.5 times higher for those living in poor houses (based on an average incidence of good and poor houses of 0.46 and 1.27 infections per person per house respectively).

This suggested that the risk of malaria could be reduced significantly by improving on house construction. Information from several contractors allowed the researchers to conclude that the cost of converting a poorly built house to a good house would cost Rs 42,500. The focus was on 59 houses that were within the buffer zone close to water, as it was found that poor houses close to water were at the highest risk.

Using information on the Anti Malaria campaign and assuming that their programmes would be 66% effective, it was found that the cost of preventing a single malaria infection was Rs 1097. Using a 10% discount rate, and the assumption that the reduction in the malaria reservoir would be reduced by 25%, 15% and 10% in the 2nd, 3rd and 4th years and would remain unchanged in subsequent years, it was determined that the cost of improving housing would be covered within 7.2 years, taking into account the net savings on malaria control.

Here the cost of malaria control was limited to state prevention measures. It also did not take into account the fact that the cost of prevention itself is linked to incidence. The study however presents simulations to take into account different discount and effectiveness rates, in reaching the conclusion that spending on improving house construction would be a cost effective means of reducing malaria incidence.

IV ALTERNATIVE SCREENING PROCEDURES

Fernando et al (2004)

The authors examine the implications of switching from traditional microscopic testing of malaria to Rapid Diagnostic Testing (RDT) using the Immunochromatographic Test (ICT). Shortages of trained microscopists create a problem in the control of malaria in some communities. Use of RDT has the advantage that it could be carried out by technicians. The cost of organization, supervision, quality control and training of skilled personnel would be less for RDT though the cost of carrying out the test is currently significantly higher than the use of microscope examinations: Rs 26.86 compared to Rs 367.26.

It was found that if the microscope examination was taken to be the gold standard then ICT achieved 70% sensitivity and 99% specificity. It had few false positives however and its cost effectiveness would improve with higher sensitivity.

The authors also highlight the fact that the wide discrepancy in cost results may also have been reduced had societal costs been calculated rather then merely focusing on systemic costs.

V COMPARISON OF RANGE OF MALRIA CONTROL INTERVENTIONS

(a) Attanayake (1994)

The high cost of residual spraying is partly due to the pilferage of Malathion. Poor compliance observed among households in allowing for the spraying of homes. Use of a new insecticide, less commonly used for agricultural purposes and better supervision could make this anti-malarial activity more cost effective.

Social cost per person per year on curative and preventive care for Malaria

Control Measure	Public Contribution	Community Contribution
Curative care a. Treatment	24.48	5.50+
Preventive care		
a. Residual spraying	133.45	6.09++
b. Prophylactic treatment	1.34	0.33
c. Mosquito Nets	0.25	6.54
d. Repellents	0.00	11.44
e. Other*	7.18	0.00
Sub-total	142.21	24.40
Total	166.69	29.90

+ 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.

Source: Attanayake (1994)

Use of mosquito nets has some community support with the major share of the cost being borne by the community. However affordability was a problem reported by many during the survey and a scheme for subsidizing the provision of impregnated bed nets would be a cost effective intervention.

The author concludes that the community is spending on self preventive measures that can substitute for the preventive measures adopted by the state, which are perceived by and large to be ineffective.

(b) Konradsen et al (1999)

The authors estimate operating and capital costs for a number of anti-malaria prevention activities. They begin by assuming that all measures are equally effective.

Type	Operating cost per day	Operating cost per household per intervention day	Annual operating cost per household	Annual capital cost per household	Total annual cost per individual protected
Spraying					
Fenitrothion	6412	256	768	24	158
Lambda-cyhalothrin	7409	296	592	16	122
Malathion	4613	185	555	24	116
Bed net impregnation	5244	105	210	32	48
Larviciding	1652	30	120	16	27
Water management	6600	11	66	0	13

Source: Konradsen et al (1999)

Larviciding relates to applying larvicide to streams and resultant pools running close to human settlements, in this case to the Yan Oya that crosses the study area. A team of spray machine operators and a field assistant are involved with the process with supervision being carried out by the PHI every fourth day, who has an official car and driver. The team spray pools along an average of 1 km of stream bed per day. It is assumed that mosquito breeding in the stream could have an impact on households living within 1.5 km of the stream so it is assumed that it would take one day to protect an average of 56 households. Larvicide used is temephos (cost Rs 753 per litre) with 0.4 litres being consumed over a 1 km stretch. Four site visits are needed to effectively protect the area, during the 10 week peak stream-bed breeding period.

Water management relates to eliminating mosquito breeding through the release of upstream water to flush out the existing pools and reduce the formation of pools in the stream, thereby disturbing the breeding of the larvae present in the stream. The water (22,000 m3) has to be released every tenth day over a two day period. During the 10 week peak breeding season this process has to be carried out about six times. Value of water lost through conveyance was estimated to be Rs 6600 per control intervention. A farmer under supervision of an Irrigation Department official carries out the regulation of the gate at the upsteam reservoir so

the management input was negligible. Due to this flushing, an estimated 600 households would be protected along this 25 km streatch of the Yan Oya stream.

The assumption regarding equal effectiveness of all measures may need validation, since differences in effectiveness could otherwise affect the cost estimates radically.

5.3.16 COSMETICS, DEVICES AND DRUGS (CDD) REGULATION

Attanayake and Siyambalagoda (2003)

The Enforcement Division of the Drug Regulation Authority spent a total of Rs 4,772,082 in 2001. The average cost per pharmacy was estimated to be Rs 2400 per year (Rs 200 per month).

Considering the cost to the regional authorities of enforcement and monitoring of drug regulations in the study locations in 2001 it was found that the cost per pharmacy per year was as follows:

Urban (Kandy)	Rs	2003
Semi-Urban (Gampaha District)	Rs	2237
Rural (Polonnaruwa District)	Rs	7595

This cost has been calculated by adding a fraction of the salaries of the DPDHS, MOH, and Divisional Pharmacist, salary of Food and Drug Inspectors (FDI), other officers, transport, overheads etc. The salary component of the FDI's is the major element of this cost. Cost variation is due to number of pharmacies regulated, which varied from 107 in Kandy to just 18 in Polonnaruwa.

5.3.17 REGULATION OF PRIVATE PRACTICE BY PUBLIC SECTOR MEDICAL OFFICERS

Attanayake and Siyambalagoda (2003)

Total cost of the Investigation Unit for the year 2001 was Rs 4,413,752. It was assumed, based on analysing its case load, that on average about 70% of its resources were used for investigations relating to privat4e practice by medical officers and Assistant/Registered Medical Officers. Considering the total service period from 1998 (inception) to 2003 (since

cases are not fully investigated in any calendar year and some take many years) it can be calculated that the average cost per investigation on private practice accounts for Rs 165,000/- at the central level. As the PDHS and DPDHS do not spend a significant amount of time detecting private practice undertaken during working hours the cost of enforcement and monitoring of medical malpractice regarding time of practice is negligible at peripheral level.

5.4 POLICY CONCLUSIONS

5.4.1 Utilization levels have a major bearing on Costs

Rajasingham (1991) in his study on immunization finds that the lowest and highest costs per fully immunized child under one year coincide with rates of utilization, 910 in the Badulla Municipal Clinic (cost per child of Rs 61.47) and 36 at the Uva-Ketawela estate satellite clinic (cost per child of Rs 369.15). The correlation coefficient calculated using his data for utilization of clinics and cost per child fully immunized is -.71.

Similarly Jayatissa (1997) finds combined clinics that have lower utilization rates than single and polyclinics to have the highest cost in the provision of MCH services.

Gurusinghe (2003) in the context of special x-rays and scans finds that underutilization drives the cost of these investigations above that of the private sector.

Attanayake and Siyamabalagoda (2003) studying regulation of pharmaceuticals similarly finds that regional costs of enforcement is highest in the rural district of Polonnaruwa which has few pharmacies as compared to the urban and semi-urban districts of Kandy and Gampaha.

5.4.2 STAFFING PATTERNS HAVE A MAJOR IMPACT ON COSTS

This point relates both to numbers of staff and to the composition of the staff. Determining the optimal staff cadre for a particular health care centre or activity is however a complex task given that externalities and scale factors exist. In most of the studies staff costs contribute over 70% of the cost.

Rajasingham (1991) illustrates, in the case of immunization, that different combinations of staff can carry out the same healthcare activity and that this in turn has a bearing on cost. This conclusion holds for some other healthcare activities as well, such as MCH clinics and malaria control. Determining the optimal combination of staff to man a healthcare institution or carry out a specific activity is worth analysing in-depth and once such conclusions are reached they should be recorded in the form of guidelines so as to contribute to future decision making by medical administrators and policy makers.

Attanayake and Siyambalagoda (2003) shows that the relationship between the number of Food and Drug Investigators and the number of pharmacies has a bearing on average cost. Similarly the relationship between equipment and staff numbers has a bearing on cost as well: mismatch due to excessive machinery or manpower both lead to factors idling and higher costs. Both demand factors, and appropriate complementary input ratios need to be taken into consideration in planning health system activities and reforms.

5.5 CRITIQUE OF THE STUDIES

The diversity of the studies coming under this chapter makes it difficult to compare and contrast their findings. Similarly no attempt was made to compare methodology in this chapter. This characteristic also limited the extraction of relevant policy conclusions.

The range of studies undertaken under the heading of interventions and services tends to be skewed towards hospital based interventions. More interest in prevention related activities in areas other than vector borne diseases would be desirable. In particular costing relating to NCD prevention: primary, secondary and tertiary prevention would be relevant in the context of health transition.

Many intervention and service studies omit building and land costs, mainly due to the lack of easily accessible information in this regard. Time allocation for different healthcare activities however is given much thought, and cost apportionment based on some specific criterion is carried out in most cases. While most of the studies are based on aggregating different cost elements, Attanayake and Aturupane (1995) and Attanayake and Siyambalagoda (2003) incorporate elements of scenario building into their costing exercises.

Costing of interventions by different authors have not followed the same pattern: for example they have not included the same cost components, same procedures in incorporating effectiveness and discounting, and these prevent the comparison of the costing exercises. Such comparisons would have been very useful in determining the changes that occur over location and time.

Chapter 6
CONCLUSIONS

6.1 SUMMARY AND CONCLUSIONS

There has been an encouraging expansion in interest in costing, resulting in an exponential increase in costing studies in Sri Lanka over time. The majority of studies reviewed under this exercise involved a single author and were undertaken as part of a higher degree programme. Many of these studies have tried hard to adhere to scientific methods of cost estimation. They provide many valuable insights and a very useful basis for undertaking future work in the area of costing. However by nature they are constrained both in terms of funding and time, and are so forced to focus on specific locations or small samples in the course of addressing a health issue. The need for national cost estimates, as a pre-requisite for budgeting and for formulating investment plans for the health sector, then argues for more systematic costing exercises to be undertaken. This could take two complementary forms: firstly national level costing exercises covering very specific healthcare issues to address in particular the current healthcare debates such as the viability and advisability of maintaining maternity homes or the present forms of providing hospital diets. Secondly an attempt should be made to create a costing matrix to incorporate the findings from such small studies and to encourage future researchers to fill in the missing cells of the matrix so that a comprehensive costing database is created for the country. With this second approach in mind the following tables are presented based on the studies reviewed and information on studies recently concluded or currently underway.

COST STUDIES CLASSIFIED BY AREA OF RESEARCH

Table 1: Studies by Institution

Type of Hospital	Study
Teaching Hospitals	Attanayake et al (2005) – Sri Jayawardenapura Hospital Kasturiratne (2003) – North Colombo Teaching Hospital de Silva et al (1997) – Paying Ward - NHSL de Lanerolle (1996) Colombo South Teaching Hospital
Special Hospitals	de Silva (1994) – Lady Ridgeway Hospital Jayatissa (1995) – Lady Ridgeway Hospital
Provincial Hospitals	
Base Hospitals	Siriwardena (1998) – Gampola
Complex Hospitals	*Griffin et al (1994)* *Samarasinghe and Akin 1995* *Somanathan (1998)* *Somanathan et al (2000)*
District Hospital	Edirisinghe (2002) – Dompe
Peripheral Units	
Rural Hospitals	
Central Dispensaries	de Silva and Attanayake (1992)
Maternity Homes	
Basic Hospitals	*Griffin et al (1994)* *Samarasinghe and Akin 1995* *Somanathan (1998)* *Somanathan et al (2000)*

Note; Categorization based on present hospital status.

This table suggests that studies focusing on the lower level hospitals, maternity homes in particular given the evidence regarding high cost of deliveries in such hospitals, would be useful, both in contributing to the costing matrix and to the policy debate regarding their usefulness.

The list of diseases used in the table below has been built up using leading causes of hospitalization and death as presented in the Annual Health Bulletins. The cells record studies carried out and some of those that are currently on-going.

Table 2: Studies by disease/disability

Disease/Disability	Systemic Cost	Household Cost
Anaemia		
Asthma	Attanayake (2002a) Kasturiratne (2003)	
Cancer		
Cirrhosis	Kasturirante (2003)	
Dental caries	Attanayake (2002a) Edirisinghe (2003) Gajanayake (2004)	
Diarrhoea	De Silva (1995) Attanayake (2002a)	
Diabetes Mellitus	Fernando (1996) Attanayake (2002a)	Attanayake (2002b)
Diphtheria		
Gastrointestinal tract diseases		
Heart Disease	Attanayake (2002a) Kasturiratne (2003)	Attanayake (2002b)
Helminthiasis		
HIV/AIDS	Bloom et al (1997)	Bloom et al (1997) de Silva and Jayasinghe (1998)
Hypertension	Attanayake (2002a)	
Intestinal Infectious diseases		
Japanese Encephalitis	Study underway	
Malaria	Jayawardena (1993) Attanayake (1994) Graves et al (1995) Attanayke and Aturupane (1995) Gunawardena et al (1998) Konradesen et al (1999) Konradesen et al (xxxx) Konradesen et al (xxxx) Attanayake et al (2000) Attanayake (2002a)	Attanayake (1994) Attanayake et al (2000)
Measles		
Mental Illness	Attanayake (2002a) Wickramasinghe et al (2005)	de Silva et al (1998) de Silva (2001) Wickramasinghe et al (2005)

Disease/Disability	Systemic Cost	Household Cost
Nutritional deficiencies	Attanayake and Aturupane (1995)	
Preventable major Paediatric Illness	Jayatissa (1995)	
Poisoning		
Rabies		
Respiratory Infections	Attanayake (2002a)	
Road Traffic Accidents	de Lanerolle (1992) Dharmaratne (2001)	
Snake bite	Ariyaratne (2003)	
Stroke	Kasturiratne (2003)	Study underway
STDs		
Thalassmia	Study underway	
Tuberculosis	Attanayake (2002a) Study underway	
Viral Hepatitis		
Whooping Cough		

Table 3: Services/Interventions

Service/Intervention	**Study**
Blood Transfusion	Siriwardena (1998)
Child Malnutrition	Attanayke and Aturupane (1995)
CT Scans	Suriyapperiuma (2003)
Deliveries	Siriwardena (1998)
Drugs	de Lanerolle (1996)
Food	Russell and Attanayake (1997)
Immunization	Rajasingham (1991)
Laboratory services	de Lanerolle (1996)Dharmaratne (2001)
Maternal and Child Health Services	Jayatissa (1997)
Overtime	Rabel (2003)
Prevention – HIV/AIDS	Bloom et al (1997)
Prevention – Malaria	Jayawardena (1993) Attanayake (1994) Graves et al (1995) Attanayke and Aturupane (1995) Gunawardena et al (1998)

Service/Intervention	Study
	Konradesen et al (1999) Konradesen et al (1997a) Konradesen et al (1997b) Attanayake et al (2000) Attanayake (2002a)
Radiology	Gurusinghe (2003)
Regulation	Attanayake and Siyamabalagoda (2003)
Scans	Gurusinghe (2003), Suriyapperuma (2003)
Surgery	de Silva (1994) Siriwardena (1998) Malalasekera et al (2003)
x-rays, EEG and ECG	de Silva (1994) de laneraolle (1996) Dharmartne (2001) Gurusinghe (2003)

Studies on interventions seem limited (apart from Malaria) suggesting that more attention should be paid to the costing of interventions.

6.2 PROPOSALS FOR FUTURE COSTING EXERCISES

The continuous maintaining of a costing matrix incorporating the findings of small studies on a regular basis, as well as national efforts at undertaking the costing of specific diseases, services and interventions are crucial in developing the health system in Sri Lanka along rational cost-effective lines.

More studies on costing of non-communicable diseases and interventions would be useful. Such studies should focus on gaining a comprehensive insight into the costs of health care of NCDs, focusing on systemic and household costs and as on preventive as well as curative care. Not only would more empirical work be useful in determining future costs in Sri Lanka but a greater interest in the methodological complexities of costing such diseases would prove fruitful in developing costing methodology and contributing to the wider arena of debates relating to costing research.

When we analyse the studies by demographic characteristics, we note the lack of costing studies relating to the care of the elderly. Likewise more interest in the costing of Obstetric care and deliveries would be desirable.

Studies have focused on curative care to a large extent, with the studies on health care prevention limited manily to malaria. More emphasis on the costing of prevention, particularly health education would be desirable. Health promotion and education relating to NCDs should be focused on, given the rapidly aging population and the epidemiological transition currently affecting Sri Lanka. Another aspect that necessitates attention is that of costing rehabilitative care.

Focusing on the costing of small lower level health care institutions would be desirable in the current debate about the problems created by underutilization at the lower end of the hospital scale and overcrowding at the upper end. Focusing on household costs is also desirable in determining the viability of referral systems and the distribution of health manpower and resources.

The costing work carried out in the last 15 years in Sri Lanka has focused almost exclusively on the state sector. Given the rising demand for private health care facilities and the allied issue of healthcare financing, and the competition engendered by the rising supply, the need for costing exercises in the private sector should also be noted.

The lack of disaggregated data at institutional level in the public sector has been a major problem in costing services and wards in the hospital system. Administrative measures to encourage more disaggregated data recording and financial management should be encouraged to support better costing of services. Likewise studies to determine the lifespan of medical equipment and healthcare service vehicles and buildings would be a useful complementary activity.

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Appendix 1

Studies Still to be Traced for the Cost Review

Articles

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Appendix 2
Suggested Readings

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APPENDIX 3
CALCULATING LOST EARNINGS: INCOPORATING PROABILITIES OF SURVIVAL AND EMPLOYMENT

Lost Earnings example - Considering male, Colombo District specific income level
Sex and District specific employment rates, Sex and age specific survival rates

Age	Income	Probability of employment	Income if Alive	Probability of employment	Expected Income	Discount Rate	Discounted Income
20	35376.94	0.988	34952.42	0.918	32086.32	1.00	32086.32
21	36650.51	0.988	36210.70	0.918	33241.43	1.05	31658.50
22	37969.93	0.988	37514.29	0.918	34438.12	1.1025	31236.39
23	39336.85	0.988	38864.81	0.918	35677.89	1.1576	30819.91
24	40752.97	0.988	40263.93	0.918	36962.29	1.2155	30408.97
25	42220.08	0.988	41713.44	0.918	38292.94	1.2763	30003.52
26	43740.00	0.988	43215.12	0.918	39671.48	1.3401	29603.47
27	45314.64	0.988	44770.86	0.918	41099.65	1.4071	29208.76
28	46945.97	0.988	46382.62	0.918	42579.24	1.4775	28819.31
29	48636.02	0.988	48052.39	0.918	44112.09	1.5513	28435.05
30	50386.92	0.989	49832.66	0.918	45746.39	1.6289	28084.31
31	52200.85	0.989	51626.64	0.918	47393.26	1.7103	27709.86
32	54080.08	0.989	53485.20	0.918	49099.41	1.7959	27340.39
33	56026.96	0.989	55410.66	0.918	50866.99	1.8856	26975.85
34	58043.93	0.989	57405.45	0.918	52698.20	1.9799	26616.17
35	60133.52	0.989	59472.05	0.918	54595.34	2.0789	26261.29
36	62298.32	0.974	60678.56	0.918	55702.92	2.1829	25518.15
37	64541.06	0.974	62862.99	0.918	57708.23	2.2920	25177.91
38	66864.54	0.974	65126.06	0.918	59785.72	2.4066	24842.20
39	69271.66	0.974	67470.60	0.918	61938.01	2.5270	24510.97
40	71765.44	0.974	69899.54	0.918	64167.78	2.6533	24184.16
41	74349.00	0.952	70780.25	0.918	64976.27	2.7860	23322.74
42	77025.56	0.952	73328.33	0.918	67315.41	2.9253	23011.76
43	79798.48	0.952	75968.15	0.918	69738.76	3.0715	22704.94
44	82671.23	0.952	78703.01	0.918	72249.36	3.2251	22402.21
45	85647.39	0.952	81536.32	0.918	74850.34	3.3864	22103.51
46	88730.70	0.922	81809.71	0.918	75101.31	3.5557	21121.55
47	91925.00	0.922	84754.85	0.918	77804.95	3.7335	20839.93
48	95234.30	0.922	87806.02	0.918	80605.93	3.9201	20562.06
49	98662.74	0.922	90967.05	0.918	83507.75	4.1161	20287.90
50	102214.60	0.922	94241.86	0.918	86514.03	4.3219	20017.40
51	105894.30	0.880	93186.98	0.918	85545.65	4.5380	18850.79
52	109706.50	0.880	96541.72	0.918	88625.30	4.7649	18599.45
53	113656.00	0.880	100017.28	0.918	91815.86	5.0032	18351.47
54	117747.60	0.880	103617.89	0.918	95121.22	5.2533	18106.78
55	121986.50	0.880	107348.12	0.918	98545.57	5.5160	17865.36
56	126378.00	0.824	104135.47	0.918	95596.36	5.7918	16505.42
57	130927.60	0.824	107884.34	0.918	99037.83	6.0814	16285.35
58	135641.00	0.824	111768.18	0.918	102603.19	6.3855	16068.21
59	140524.10	0.824	115791.86	0.918	106296.93	6.7048	15853.97
60	145582.90	0.824	119960.31	0.918	110123.56	7.0400	15642.58

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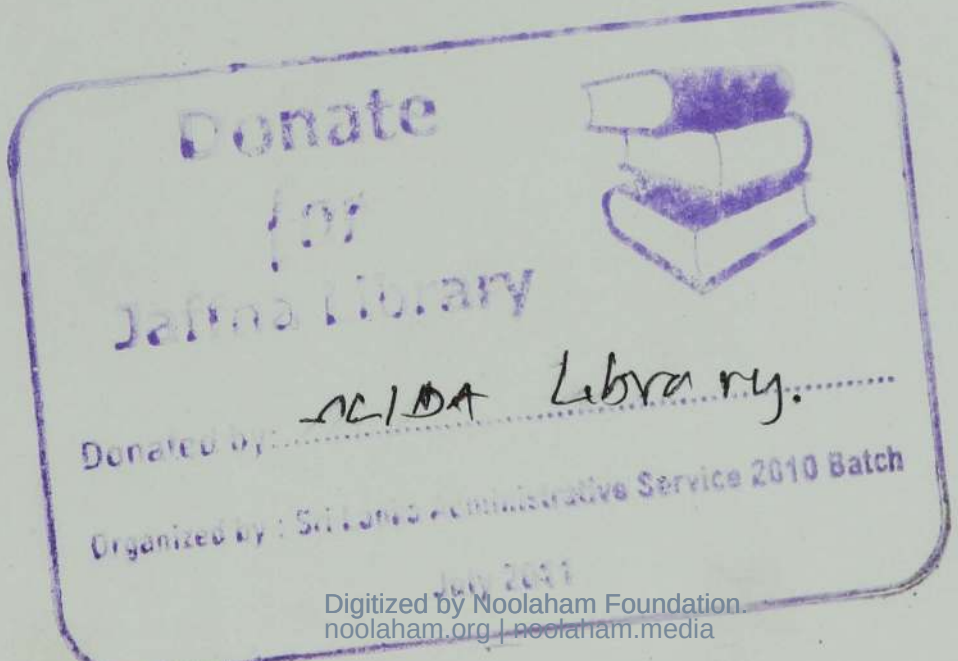

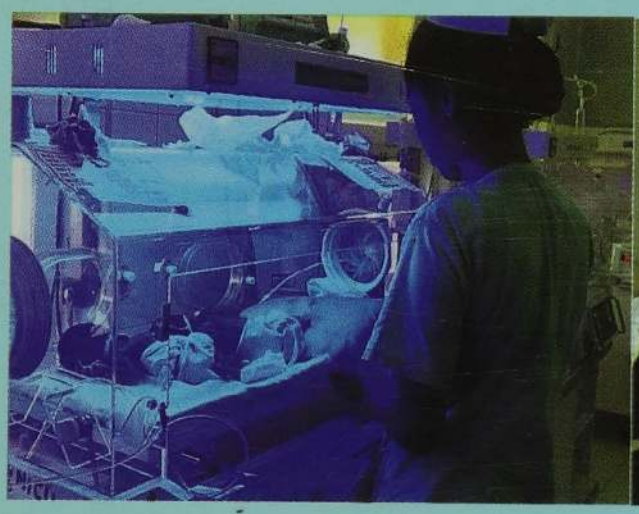

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