

# **Cost Effectiveness of Primary Health Care**



Commonwealth Secretariat

# **Cost Effectiveness of Primary Health Care: A review of evidence**

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EXECUTIVE SUMMARY

1. Given that health care budgets in all countries are increasingly stretched in the face of competing demands, there is a pressing need for evidence on the cost and benefits of health care programmes. The objective of this project was to review the evidence on the costs, effects and benefits of key primary health care (PHC) projects, to analyse and to interpret the results of such projects, to report on the policy implications for ministries of health and to suggest further work that the Commonwealth Secretariat could undertake in this area.
2. The survey has included both existing published literature and data solicited from Commonwealth countries by use of a questionnaire. It has been found that formal economic evaluations have been undertaken of primary health care activities in more than one third of the Commonwealth countries.
3. In the first section of the report, the topic of interest is defined (Section 1.2) as economic evaluations of the delivery, in or near people's homes, of one or more of the eight essential elements of PHC identified in the Alma Ata Declaration. These eight elements are: education concerning prevailing health problems; promotion of proper nutrition; provision of safe water and basic sanitation; maternal and child health care, including family planning; immunization against the major infectious diseases; prevention and control of locally endemic diseases; appropriate treatment of common diseases and injuries; and provision of essential drugs.

4. Also in the first section of the report, the basic forms of economic evaluation are defined (Section 1.3). These have the common feature that some combination of the inputs to a health programme are compared with some combination of the outputs. In cost-effectiveness analysis the outputs of the programme are measured in the most convenient natural units (e.g. deaths averted); in cost-benefit analysis the outputs are valued in money terms so that they can be directly compared with the inputs (costs). Because of the difficulties of measuring health improvements in money terms, yet recognising the need for policy makers to make comparisons across a wide range of health programmes, analysts have developed methods of assessing outputs in such terms as healthy days of life gained and quality-adjusted life-years (QALYs) gained.
  
5. In Section 2 of the report, existing evaluations of PHC activities in Commonwealth countries are reviewed. In the developing countries the main topics addressed have been the control of communicable diseases, programmes to provide adequate nutrition, family planning and immunization services, and choices in the methods of delivering PHC, such as fixed versus mobile clinics. In the developed countries the main topics addressed have been maternal and child health (especially screening programmes for neonates and the unborn), immunization, prevention of locally endemic diseases (again primarily through screening) and appropriate treatment in the community for the elderly, mentally ill and mentally handicapped.
  
6. Several major methodological issues arising from the review of the existing studies are highlighted in Section 2.2. These include the importance of adopting a broad (societal) perspective when undertaking economic evaluations, the importance of good evidence on programme effectiveness as an input to economic studies, the importance of estimating the marginal costs of

expansions or contractions in programmes (since it is these that are relevant to most decisions) and the importance of considering objectives other than economic efficiency, such as equity or fairness in service provision. (A checklist of questions for assessing the quality of a published study is given in Table 2.2.)

7. Another key issue arising from the review of the existing studies is the potential for, and dangers of, making international comparisons (Section 2.3). This is important because some countries may not have the expertise or time to undertake their own empirical work, and will have to rely on results obtained elsewhere. The two major points to consider are the legitimacy of any price and exchange rate conversions made in order to compare studies from different countries and the range of factors that could cause the cost or effectiveness of interventions to vary from one location to another. These factors include the local availability and cost of the resources required, population density, geographical factors influencing access to services, the likely level of co-operation from health care workers and the local population, the type of existing provision and whether it can be easily adapted to accommodate the new programme at low marginal cost.

The existence of these factors means that further analysis is usually required to interpret study results obtained elsewhere for one's own purposes, although often the differences in the relative cost-effectiveness of alternative health care programmes are so large that rough estimates of their likely value for money can be obtained from the international literature.

8. In Section 3 of the report, four key PHC projects/programmes are discussed in more detail. These have been selected both because of their intrinsic merit and

because they reflect the different needs and concerns of various Commonwealth regions. The projects are: integrated health care and nutrition in India; the expanded programme of immunization in the Gambia; control of schistosomiasis in St. Lucia; and screening for disease in the developed Commonwealth. The main purpose of the four examples is to show how economic evaluation can be applied in practice, the major methodological pitfalls that should be avoided and the usefulness of the evaluation results to those planning and organising PHC activities.

9. In Section 4 a number of policy issues arising from the application of economic evaluation to PHC activities are discussed. First, should PHC programmes continue to have high priority for development? In the context of developing countries it is argued (in Section 4.1.1) that the per capita cost of effective PHC is affordable if one recognises that both public and private funds can be drawn upon, or if some of the household resources at present used to purchase private health care can be tapped. Also, there is now fairly good evidence that certain PHC activities, particularly immunization and oral rehydration, do represent good value for money when compared to hospital-based programmes.

A similar picture emerges in the developed Commonwealth (Section 4.1.2). A major conclusion of the review is that PHC does provide a feasible and more cost-effective alternative to secondary care for a number of diseases and conditions. This is true for primary prevention of some diseases by vaccination, secondary prevention through screening for disease and for community-oriented services in the long-term care field (for the elderly, mentally ill and mentally handicapped).

However, further attention needs to be paid to whether PHC services are being delivered in the most efficient way. In the developing countries there need to be more evaluations of options in choice of target group(s), choice of the public or private sector for the delivery of supplies such as essential drugs and contraceptives, choice of the mix of PHC activities, choice of delivery strategy (e.g. integrated versus non-integrated, and static versus mobile) and choice of place of intervention (health centre versus the person's own home). The methods described in this report can be, and have been, used to evaluate these choices.

In the developed countries there are similar options to be evaluated, such as the location for long-term care (e.g. the person's own home versus residential care) in relation to the patient's dependency level, or the guidelines given (by age group, sex or previous family history of disease) for screening for disease. In addition, in the developed countries attention needs to be paid to the incentives and disincentives given to health care professionals by the way PHC is financed and organised, in order to ascertain whether these lead to efficient delivery of PHC.

10. A second policy issue arising from the report, discussed in section 4.2 and 4.3, is that of how best to commission, conduct and use economic evaluations of health care programmes. It is concluded that it is important for ministries of health to develop their own expertise in this field so that they can better interpret the results of evaluations carried out elsewhere, commission good quality work and also carry out evaluations in-house. As well as developing expertise in-house, it is clear that ministries in some countries have used other institutions (such as universities) to great effect and this should also be encouraged.

11. The recommendations, which are given in Section 5, echo the major points made here. In addition, recommendations are made for more training both for policy makers and for those who will undertake economic evaluations, so that the other aims outlined above can be fulfilled.

## 1. INTRODUCTION

### 1.1 Scope and purpose of the project

All countries, no matter what their stage of economic development, face tough choices in how they allocate their scarce resources between competing activities. Public expenditure decisions, be they within or between Ministries, are made (and will continue to be made) as a result of a complex interplay of social, cultural, economic and political factors. However, given that budgets are increasingly stretched in the face of competing demands, there is a pressing need for evidence on the costs and benefits of public sector investments. Nowhere is this need greater than in the health field, where the benefits of health programmes are typically difficult to measure, and where budgets in many countries are still under considerable strain, although they have expanded relatively quickly when compared to other fields of public expenditure. Within the health sector a key area of interest is primary health care (PHC), which is generally regarded as a central function and the most important means by which the health of the population can be improved, both in developing and developed countries (WHO-UNICEF, 1978).

It is against this background that the current project was undertaken. Its objectives were to prepare a report for consideration by the Commonwealth health ministers which would include:

(i) a literature review of cost-effectiveness and cost-benefit analyses of key primary health care projects in Commonwealth countries;

(ii) an analysis and interpretation of the results of the projects in (i) above;

(iii) a discussion of policy implications for ministries of health

(iv) suggestions for further work in this area that could be undertaken by the Commonwealth Secretariat.

The approach has been both to survey the existing published literature and to solicit data from Commonwealth countries by use of a questionnaire. The report presents our findings on both counts. More details of the questionnaire returns from individual countries are to be found in Appendix 1.

The main body of the report is organized in the following manner. The remainder of this introductory section outlines the range of activities that we have designated primary health care and discusses the extent to which the definition and activities of PHC vary between different parts of the Commonwealth. (The designation of primary health care used here follows closely that of the World Health Organization (WHO).) Also in the introductory section, we outline the methods of economic evaluation, defining key terms such as 'cost-effectiveness analysis' and 'cost-benefit analysis'.

The next section of the report contains a review of the literature on the economic evaluation of PHC activities in Commonwealth countries. The literature is fairly extensive, containing studies relating to approximately one-third of all Commonwealth countries. In the review of the literature the following points are highlighted: the range of topics examined from an economics viewpoint, the major methodological issues arising in studies and the key issues in interpretation of results for decision making purposes.

The next section contains 4 case studies of major PHC projects. The case studies have been chosen not only for

their intrinsic interest but also to reflect the needs and concerns of different parts of the Commonwealth (Asia, Africa, the Caribbean and the developed countries). In the discussion of case studies the quality of the economic evaluation (and hence reliability of results), the main lessons that policy makers can learn about the conduct of projects, and the interpretation of results are commented on.

The policy issues resulting from economic evaluations of PHC activities are discussed further in the final section. The main issues concern whether investments in PHC justify their cost and the efficient organization of PHC, the ways of mounting and undertaking economic evaluations, and the implementation of study findings. Finally, further work that might be undertaken in this field is outlined. It is our hope that the report will be of use to health ministries in all Commonwealth countries and that it will lead, albeit indirectly, to increased efficiency in the delivery of PHC.

## 1.2 Primary health care

In order to define the boundaries of this study, it is necessary to agree a definition of PHC and a listing of its essential elements. A starting point is the Declaration of Alma Ata (WHO/UNICEF 1978):

"Primary health care is essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination. It forms an integral part of the country's health system, of which it is the central function and main focus, and of the overall social and

economic development of the community. It is the first level of contact of individuals, the family and community with the national health system bringing health care as close as possible to where people live and work, and constitutes the first element of a continuing health care process".

The Declaration goes on to list the essential elements of PHC that are the responsibility of the health sector (other elements falling under other sectors):

"(PHC) includes at least: education concerning prevailing health problems and the methods of preventing and controlling them; promotion of food supply and proper nutrition; an adequate supply of safe water and basic sanitation; maternal and child health care, including family planning; immunization against the major infectious diseases; prevention and control of locally endemic diseases; appropriate treatment of common diseases and injuries; and provision of essential drugs".

PHC can thus be viewed firstly as an approach that guides the whole health system and, indeed, development strategy, secondly as a number of essential elements, and thirdly as a level of care. In this third view, of PHC as a level of care, emphasis is placed (as the first definition given above makes clear) on the location of PHC services. That is, those activities under the eight essential elements which take place in the community or in small scale health units close to the community are usually termed PHC.

While this description of PHC is relevant to all Commonwealth countries, each country will place a different emphasis on the various components, depending on its level of economic development, prevailing disease patterns and structure of its health system. The less developed countries of the Commonwealth, lacking a

comprehensive infrastructure of water and sanitation facilities and facing health problems amongst which infectious diseases loom large, are likely to put particular emphasis on disease prevention through immunization, environmental health services and health education, and on appropriate curative measures that can be delivered outside hospitals, in local health units, or in villages and homes. The more developed countries of the Commonwealth already have a well developed network of environmental health services and curative services and in general have the traditional infectious diseases well under control. In their place they face the problems resulting from an ageing population, from chronic degenerative diseases and from those environmental and life-style influences which damage health. Primary health care policies in the more developed countries are thus particularly concerned with providing supportive care to the elderly and chronically ill in the community, and with developing strategies for health promotion. In addition, PHC acts as an important filter on patient demand, to ensure a more effective and efficient use of costly secondary and tertiary care services.

Because of this difference in emphasis between the developing and developed countries (and indeed within each of these groups) it has sometimes been difficult to decide which studies are relevant to our focus on PHC and should be reported here. To guide our choice of studies, we have used the following criteria:

(a) studies which are concerned with one or more of the eight essential elements of PHC identified in the Alma Ata Declaration; and

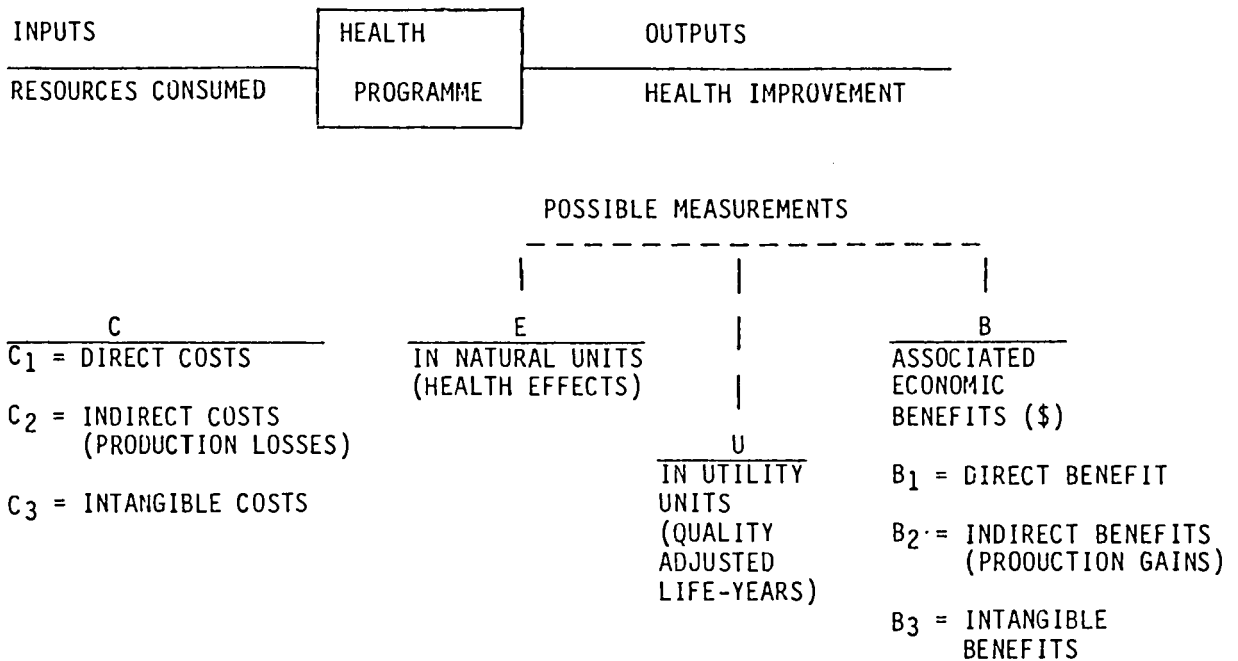
(b) studies which analyse the delivery of these essential components in or near peoples' homes; and

(c) studies which explicitly consider the costs and benefits of PHC components.

### 1.3 Introduction to the methods of economic evaluation

The main justification for economic evaluation of health programmes is that the resources for the provision of health and health related services are scarce, in that there are not, and never will be, enough resources to satisfy human wants completely. Therefore, in choosing to use resources in a given health activity, the community forgoes the opportunity to use the same resources in another competing activity. Hence the economist's notion of (opportunity) cost; that is, the cost of using resources in a given health programme is their value in their best alternative use. For example, one might argue that the real cost of overuse of high technology diagnostic aids such as CT scanners is not the money expenditure on equipment and staff, but the forgone benefits of the primary health care programmes that have not been given funds to expand. Thus the logic is that, given scarcity of resources, health programmes should be compared in terms of their relative costs and benefits.

There are a number of forms of economic evaluation, but they have the common feature that some combination of the inputs to a health programme are compared with some combination of the outputs. (See Figure 1.1) An exception to this is cost analysis, which considers only inputs. This approach can only be used in situations where it can be assumed that the outputs from the alternative programmes are identical (e.g. as in the study by Lawson et al (1981) on methods of delivering long-term domiciliary oxygen therapy in Britain). The inputs

**FIGURE 1.1 COMPONENTS OF ECONOMIC EVALUATION**COMMON FORMS OF ANALYSIS

1. COST ANALYSIS:  $C_1, C_1 + C_2$
2. COST-EFFECTIVENESS ANALYSIS (CEA):  $(C_1+C_2)/E; (C_1-B_1)/E; (C_1+C_2-B_1-B_2)/E$
3. COST-UTILITY ANALYSIS (CUA):  $(C_1+C_2)/U; (C_1-B_1)/U; (C_1+C_2-B_1-B_2)/U$
4. COST-BENEFIT ANALYSIS (CBA):  $B_1+B_2-C_1-C_2; (B_1+B_2)/(C_1+C_2)$

ALSO SOMETIMES INCLUDES CONSIDERATION OF  
 $C_3$  AND  $B_3$

include the direct costs (in medical care expenses) to the health sector and individuals and the indirect costs (in production losses) resulting from the removal of individuals from the workforce in order to be given therapy. (There may also be intangible costs associated with therapy, such as pain and suffering.)

The outputs of health programmes can be assessed in a number of ways. First, they can be measured in the most convenient natural units, such as 'number of cases prevented' or 'years of life gained'. A study measuring effects in this way would be called a cost-effectiveness analysis.

Secondly, they can be measured in quality-adjusted life-years, where the life extension gained is adjusted by a series of 'utility' weights reflecting the relative value of one health state compared to another. This approach is particularly useful where the success of a health programme is more appropriately assessed in terms of the quality, not quantity, of life gained. There are few examples of this approach in the primary health care field. See, for example, the study by Torrance and Zipursky (1984) on antepartum prevention of Rh immunization in Canada. In the developing Commonwealth countries, the nearest example is the study by the Ghana Health Assessment Team (1981) which assessed the impact of disease on the community in terms of 'the number of healthy days of life lost'. A study measuring the outputs in quality-adjusted life-years would be called a cost-utility analysis. (Some authors prefer to consider such studies merely as a special form of cost-effectiveness analysis.)

Finally, the outputs can be measured in money terms. Some categories of benefit are fairly easy to assess in this way, such as the savings in direct medical care costs resulting from improved health, or the production gains from earlier return to work. Production gains

in a subsistence economy are more difficult to assess, as are other less tangible benefits, such as the value to patients of feeling healthier. Such benefits are obviously more difficult to express in money terms, although measurements are sometimes attempted. A study measuring outputs in money terms would be called a cost-benefit analysis.

The precise form of economic evaluation depends on the question being addressed. Some of the formulations are given in Figure 1.1, along with the labels they are commonly assigned. In principle, cost-benefit analysis is the broadest form since it allows a direct comparison of all the costs with all the benefits. However, the intangible benefits are rarely estimated and the analysis is often reduced to a comparison of items that can easily be expressed in money terms. See, for example, the study by Hagar et al (1976) on screening for spina bifida cystica in Britain. A particular feature of many cost benefit analyses, on which we shall comment critically later, is the practice of valuing life by the 'human capital' method, where reductions in disability, debility or mortality are valued in terms of the increased production made possible through individuals working longer or better. Because of the measurement problems of cost-benefit analysis, analysts are increasingly turning to cost-effectiveness or cost-utility analysis.

Economic evaluation has been widely applied in the health care field (Drummond 1980; Warner and Luce, 1982; Mills and Thomas, 1984). The main forms of analysis, and a number of simple examples, are discussed further in Appendix 2.

## **2. REVIEW OF LITERATURE RELATING TO ECONOMICS OF PHC ACTIVITIES IN COMMONWEALTH COUNTRIES**

In this section the existing literature is reviewed and several general analytical points discussed. Studies are classified according to the eight essential elements of primary health care discussed in Section 1.2 above.

### **2.1 Main topics covered in the literature**

#### **2.1.1 Developing Commonwealth**

##### **Education concerning prevailing health problems**

Very few economic studies have been undertaken of health education, and of those that exist, virtually all evaluate distance learning and mass media methods. Even these rarely measure health effects, though a few have measured behavioural changes (Wells and Klees, 1980). No studies have been identified of the cost-effectiveness of health education strategies delivered as part of PHC.

A cost-effectiveness study is available, however, of a mass media and health practices intervention in the Gambia, aimed mainly at introducing home-based oral rehydration therapy (ORT) (Applied Communication Technology, 1985). The campaign consisted of radio programmes, distribution of printed materials and promotion through health care providers at clinic and community levels. The evaluation indicated that the campaign achieved a use rate for ORT of 56%, at a cost per child under 5 years of \$1.56 (1985 prices). The estimated cost per death averted was \$224.

##### **Nutrition**

Economic evaluation studies of nutrition activities fall into three main categories. The first considers the economic consequences of malnutrition and thus produces useful information on the likely benefits of interventions

to reduce malnutrition, although studies in this category often do not include consideration of possible interventions. The second category of studies considers interventions within the health care sector to prevent or treat childhood malnutrition, such as nutrition education and supplementary feeding. The third category evaluates interventions in non-health care sectors that are intended to improve nutrition, for instance food fortification.

The majority of studies in the first category, examining the economic consequences of malnutrition, concentrate on the relationship between parasitic infections, anaemia and low productivity. For instance in Kenya a study considered the relationship of nutrition and health to worker productivity in road workers (Brooks et al, 1979). The results of the analysis showed a consistent and highly significant relationship between low weight for height (used as an indicator of under-nutrition) and low productivity. A review of all studies on the relationship of anaemia to productivity concluded that an increase of 10% in haemoglobin level is associated with an increase in work output of 10-20%. (Levin, 1985).

More general studies of the economic effect of malnutrition can only make crude estimates of economic losses. For instance, a paper on the annual cost of malnutrition in Jamaica made rough estimates of (i) the annual cost of hospital inpatient treatment for malnutrition in children, (ii) the cost of child life wastage resulting from annual deaths of children aged 0 to 4 years from malnutrition (through waste of resources spent on food, etc during the child's lifetime) and (iii) the annual loss of production due to under-nutrition amongst adults (Cook, 1971). The estimate for (i) and (ii) was US \$1.5m, plus approximately US \$4m for (iii).

Studies in the second and third categories are rare. Supplementary feeding as an intervention to reduce

malnutrition has, however, received some attention. For instance, Knudsen (1981) calculated the value of the costs and benefits of a proposed supplemental feeding programme using community nutrition centres in Tamil Nadu State, South India. The economic rate of return was calculated to be 14%, or 21% if the value of the project in assisting the poorer sections of the population was taken into account.

Only one study could be found that evaluated a nutritional intervention that was clearly part of a PHC programme. Part of the Narangwal project in India was designed to test whether a programme which combined nutrition and health care for mothers and children would be more cost-effective than nutrition and health care programmes conducted separately (Kielmann and Associates, 1983). Cost per perinatal death averted was lowest in nutrition only villages, but costs per infant death and per 1 to 3-year-old child death were lowest in health care villages. Costs per day of illness averted were also lowest in health care villages. (This study is discussed in greater detail in Section 3).

### **Water and sanitation**

Economic studies of water supply are considered here insofar as they relate to rural water supplies. A variety of possible benefits from water supply facilities have been identified: increased cash income, greater or diversified subsistence farming production, increased employment and greater leisure (Carruthers and Browne, 1977). Most attention has, however, concentrated on health benefits - particularly the reduction in diarrhoeal diseases, shigella, cholera, trachoma, schistosomiasis and malnutrition. (See McJunken (1982) for a recent, thorough review.)

Attaching monetary values to these effects is extremely difficult. Valuation of the benefits of the added convenience of water supplies closer at hand has been

attempted by translating time savings into productivity and wage gains. For instance, in a study in south-east Ghana (Dalton and Parker, 1973), women were asked how they would allocate their time if a new water supply system saved them about twelve hours per week. On average, it was estimated that 57% of the saved time would be spent on directly productive work.

An alternative approach is to calculate the reduced calorie requirements associated with the reduction in effort required to obtain water, and then to translate these into food and money equivalents. This was attempted in a study of water use in East Africa (White et al, 1972). On average it was estimated that most carriers would use 12% or less of their daytime energy in fetching water, though in a steep or dry area, this could rise to 27%.

There are severe methodological problems in trying to value more comprehensively the benefits of improved water supply. Even measuring the health consequences without attempting to value them is difficult, and for this reason some studies have explored the use of intermediate variables such as water quality, quantity, accessibility and reliability as proxy measures for health consequences. For instance, a study in Lesotho (Feachem et al, 1978) assessed health and economic benefits from improved water supplies, and concluded that the criteria of water quality, quantity, accessibility and reliability can help to guide project design since they are likely to be associated with health and economic benefits.

Because of the difficulties of linking the provision of water supplies with its effects, an alternative approach to economic evaluation of water supplies is that of cost-minimization: that is, to take the desirability of water supplies as given and to seek to minimize the cost

of provision. For instance, the Lesotho study cited above showed how average costs can vary in relation to factors such as size of population served, type of source and methods of storage, treatment, transmission and distribution (Feachem et al, 1978).

Evaluating the provision of sanitation facilities presents many problems similar to those in the evaluation of water supplies. Improved health is generally considered to be the major benefit of improved sanitation, but has proved extremely difficult to evaluate (Kalbermatten et al, 1980). It has therefore been argued that evaluation of sanitation involves choosing the technology which maximises the health benefit that can be achieved with the available funds. Three steps are involved: costing alternative systems, maximising the health benefit from each alternative through appropriate design, and determining the preferences of users. Extensive information on the cost of alternative sanitation technologies is provided in Kalbermatten et al (1980).

### **Maternal and child health care including family planning**

Economic evaluation studies of maternal and child health care are largely lacking, except for two cost analyses, the Narangwal study (Taylor and Faruquee, 1983) discussed in depth later and the two areas of immunization and family planning. Immunization is considered separately below, so this section concentrates on family planning. First, however, the two cost analyses are considered.

In 1974, two studies were published of the relative costs of mobile and static under-five clinics. One study, from Ghana, compared the average cost per visit in a hospital clinic and in satellite clinics run by a mobile team from the hospital (Van der Mei and Belcher, 1974). The aim was to see how successful a mobile clinic would be in attracting patients. The conclusion was that the satellite clinics attained the

same percentage of young children with diphtheria, pertussis and tetanus (DPT) and measles vaccinations as did the hospital clinic in its local community, at a slightly lower cost per patient. Unfortunately, no information was given in the published studies on how costs were calculated - for instance it is unclear whether vehicle depreciation was allowed for - and the option of establishing local static centres was not considered.

The second study (Korte and Patel, 1974) examined the cost in a district in Tanzania of an existing network of mobile child clinics, making full allowance for all costs, and compared this with the cost of integrating child health services with an existing network of static dispensaries. The cost of integration included additional staff for the dispensaries, plus the cost of mobile supervisory teams. The integrated child care service cost about half that of the mobile services which would be required for an equivalent area. Based on an experiment at static clinics that had replaced a mobile clinic, it was estimated that attendances would double. Thus the cost per attendance in the integrated system would be a quarter that of the mobile system. In passing, it can be noted that in Narangwal, India, Kielmann and Associates (1983) also found that integration, in this case of nutrition and health care for young children, was cost-effective.

A very useful starting point for consideration of the family planning literature is provided by a recent book by Sirageldin et al (1983), which reports the papers presented at a workshop convened to examine the state of the art of cost-benefit and cost-effectiveness techniques as applied to population programmes. An early emphasis on cost-benefit analysis has given way to cost-effectiveness analysis. Gillespie et al (1983) report 73 studies of family planning programmes in developing countries which included a cost-effectiveness ratio - a large number in comparison to other PHC components. The great majority of

these reported on Asian programmes, many fewer on Latin American programmes, and very few on Africa and the near East. Commonwealth countries represented (some by a number of studies) were India, Bangladesh, Sri Lanka, Malaysia, Singapore, Tanzania, Nigeria, Ghana, Jamaica and Barbados.

Some of the cost-effectiveness studies evaluate alternative types of family planning programme, for instance choice of public or private sector for the delivery of contraceptives; choice of target group; choice of contraceptive method; choice of delivery strategy; and choice of location of services. A study undertaken in the Danfa region of Ghana, for example, investigated how free-standing family planning programmes compared in cost-effectiveness terms with family planning services delivered within the context of general health services (Blumenfeld, 1983). The tentative conclusion was that integration achieved greater effectiveness at lower cost in terms of couple-years of protection.

### **Immunization**

Immunization has been one of the most popular components of PHC to be the subject of economic evaluation studies. Immunization lends itself more than other health programmes to the assessment of effectiveness since the link between inputs (immunization) and effects (prevention of disease) is reasonably well understood for many vaccines.

A few cost-benefit studies of immunization have been performed, assessing benefits primarily in the traditional human capital way, in terms of changes in national production. For instance, a study of measles immunization in Zambia calculated a cost-benefit ratio of 1:1.8 (Ponnighaus, 1980). Other studies have similarly suggested that immunization is a good investment (Creese, 1983).

The majority of studies, however, undertake either a cost analysis (comparison of costs per fully immunized child

between health centres or delivery strategies, for example) or cost-effectiveness analysis (comparing cost per case of disease averted by various immunization strategies). For example, a cost analysis of the Expanded Programme on Immunization (EPI) programme has been undertaken in The Gambia, Nigeria, Ghana and Kenya. The Gambian study (EPI, 1982) is reviewed in detail in Section 3.

An important question in an immunization programme is choice of delivery strategy, especially the choice between relying mainly on fixed centres to immunize, or employing a mass (mobile) campaign. For example, in Ghana the financial cost per fully immunized child was 41 cedi for a strategy involving limited outreach activities from a fixed centre, and 12 cedi for a fully mobile campaign (Litvinov *et al*, 1979). Other studies support the conclusion that mobile strategies are less costly per fully immunized child (Creese, 1984), although the integration of immunization with other services at a fixed centre may bring benefits that are not taken into account in these studies. This evidence conflicts with that presented earlier on static and mobile MCH care, perhaps because some mass immunization campaigns have been able to mobilize large numbers of children, thus spreading the costs of the campaign over many units of output. Mobilization is less easy when regular attendance is required, as in MCH care.

Another choice, considered in a study in Kenya, was that of target group. Here the question was whether a new immunization programme should immunize only newborns or also the back-log of older children (Barnum, 1980), the former being recommended.

### **Prevention and control of locally endemic diseases**

Some of the earliest economic studies in the health field were concerned with the economic impact of diseases such as malaria. Very few studies, however, have included consideration of the feasibility and cost of interventions to control diseases, and even fewer have considered interventions that could be considered part of PHC.

The early economic studies of tropical diseases were predominantly on malaria and attempted to calculate - with varying recourse to empirical data - the economic effects of diseases. They adopted the traditional 'human capital' approach to benefit measurement and valuation, where benefits are defined as the increased production made possible by reducing mortality, disability and debility caused by the disease. Other consequences mentioned, and in a very few studies investigated in some detail, were the effects of disease control on population growth, on enabling new land to be brought into cultivation, and on reducing medical care costs.

The earliest developing country study on the benefits of malaria control was published in 1935 on India (Sinton 1935-1936), and further studies have been done since (Prescott, 1979a). Most studies, however, work with extremely sketchy information on the association between disease and productivity, one exception being a study of the effects of malaria eradication in Ceylon which used a detailed macro-economic model to work through the effects of eradication (Barlow, 1969). Its conclusions were that the initial benefits were eventually over-ridden by the population growth consequences which, the model indicated, would eventually produce a per capita income below the level that would be reached without the policy of eradication.

The only other communicable disease to be the subject of a number of economic impact studies is schistosomiasis. A pioneering study in St. Lucia attempted to measure quantitatively the effects of five parasitic diseases on school attendance and academic performance and on labour productivity (Weisbrod et al, 1974). Little or no effect was found. In contrast, a study in Zanzibar (Cohen, 1974) reviewed existing evidence and concluded that schistosomiasis was the cause of approximately 18% of adult mortality. Cohen then estimated and valued the gain in life

years possible through eliminating mortality due to schistosomiasis. He concluded that the per capita benefit was of the same order of magnitude as the per capita expenditure of the Government of Zanzibar on health.

In recent years there have been two new trends in economic studies of the control of communicable diseases. Firstly, because the evidence of the association between disease and productivity is so weak, there is now an emphasis on small-scale micro studies which compare the productivity and/or work capacity of infected and non-infected individuals (or highly infected and less infected). Secondly, cost-effectiveness studies have become increasingly popular, though few evaluate strategies that might be delivered through PHC. For instance, a study of schistosomiasis control in St. Lucia reported the cost per case-year prevented to be \$33.81 for chemotherapy plus water supplies, \$8.95 for chemotherapy alone, \$41.90 for water supplies alone, and \$84.23 for molluscicides (Rosenfield, 1979). (Figures are in 1984 prices, updated by Barlow and Grobar (1986).) (See Section 3 for further discussion of schistosomiasis studies.)

A recent paper has reviewed the costs and benefits of control programmes designed to combat major parasitic diseases (Barlow and Grobar, 1986). Its main findings were that substantial gaps in knowledge exist about the cost-effectiveness and cost-benefit ratios of parasitic disease projects; that there are large differences in cost-effectiveness between alternative techniques of control; and that a given control measure may have widely varying cost-effectiveness ratios. It concluded that the costs of a given degree of control are affected by a large number of biological, environmental, social and administrative factors which vary markedly from place to place.

### **Appropriate treatment for common diseases and injuries**

Appropriate treatment patterns would appear at first sight to be a logical subject for economic evaluation, but few studies could be located. The three studies found all consider the choice of location of a service. In Bangladesh, a comparison was made of hospital and clinic-based services for the treatment of diarrhoea (Horton and Claquin, 1982). The clinic was considerably cheaper, and was thought to be equally effective at treating dehydration. However, the cost of even clinic care was high relative to the resources available in a country such as Bangladesh. Unfortunately the further alternative of home-based rehydration was not examined.

Walker and Gish (1977) compared the costs and effects of delivering services from fixed clinics and from mobile clinics using air or land transport in Botswana. They concluded that mobile services (especially air) were far more costly (per likely effective patient contact) than fixed clinics.

A more recent study, in Kenya, examined the saving in time and money costs for users resulting from a decentralization of health services from health centres to village health posts (Wang'ombe, 1984). The average cost to the consumer after project implementation (covering use of both health centre and health post) was about one quarter of the average cost before the project, because considerable use was made of the much nearer health post facility.

There have been a few studies which have looked only at the costs of providing treatment. For example, Vogel et al (1976) analysed the cost of out-patient services at Kiambu district hospital, Kenya. The cost per patient (K Sh. 3.13 per visit and 5.63 per case) was considered high relative to costs reported elsewhere, and the average number of drug

prescriptions given to each patient (1.66) was considered excessive. They concluded that savings were possible through better organisation and management of the services.

The studies reported above (except the first Kenyan study) have largely confined themselves to a consideration of the means of delivering curative services. In addition, however, a number of studies have evaluated the cost, and sometimes effectiveness, of delivering a package of PHC services. These are considered next.

Those studies which have undertaken a cost analysis of PHC usually express the cost as per capita of the population covered, or as a percentage of national per capita income. For example, Gwatkin et al (1980) assessed the results of ten primary health care projects, including four from Commonwealth countries. On the basis of what they considered to be poor cost data, they argued that significant reductions in infant and child mortality could be achieved at a cost of less than 2% of annual per capita GNP.

Grosse and Plessas (1984) reviewed a number of primary health care systems, comparing their costs and coverage. Three of these were in Commonwealth countries (Tanzania, Danfa in Ghana, Narangwal in India). The authors concluded that the large-scale programmes (e.g. Tanzania) were substantially less costly, annual operating costs being US \$0.6 to \$2.7 per capita, than the demonstration projects (e.g. Danfa and Narangwal).

A more detailed report on the cost and coverage of government financed primary health care services in Tanzania is given in de Vries et al (1983). They concluded that it is possible for Tanzania to implement a relatively effective, well-organized rural health care system at recurrent costs of roughly US \$1.50 per capita per year (1977 prices) and investment costs of slightly over US \$5 per capita.

These studies are important in giving an assessment of 'affordability' - whether countries can afford the costs of the proposed health care infrastructures. It is also important, however, to consider the effectiveness of these infrastructures. Yet assessment of the cost-effectiveness of PHC has proved extremely difficult since PHC has many objectives and provides a complex mix of services. Its effects cannot therefore be easily reduced to a single measure and thereby the cost-effectiveness of PHC compared with other investments in the health sector. The Narangwal project, reviewed in Section 3 below, is one of the few that has been able to evaluate rigorously the cost-effectiveness of a mix of services.

A useful survey of existing evidence on the costs and impact of health and related projects in India is given in Faruquee and Johnson (1982). The paper surveys fourteen experiments and special projects of the Indian government and voluntary organizations providing health, nutrition and family planning services. It investigated a number of questions, including whether integrated services were more cost-effective; whether outreach and targeting of services were beneficial; and whether special projects or government services were the more expensive. The report's main conclusions were that integrated services were more cost-effective than single services; that emphasis on outreach led to better use and better coverage for the population at risk; that the per capita investment of special projects was low but higher than that of the government services; and that nutrition projects were the most expensive. The report also concluded that cost-benefit analysis was an inappropriate form of evaluation and that cost-effectiveness analysis was potentially more useful.

### **Essential drugs**

There is a small but increasing number of economic studies evaluating the cost of alternative drug therapies

or alternative drug supply systems for PHC. For example Speight (1975), using Tanzanian examples, argued that considerable savings could be made in drug expenditure by avoiding recently introduced, brand name drugs and relying instead on the widely used, cheap, generic products. In Ghana, a study of drug usage in dispensaries concluded that there was considerable inappropriate prescribing and thus inefficiency in prescribing practices which, if corrected, could produce considerable savings (Barnett et al, 1980). In a sample of patients at a health centre, 'appropriate' prescribing would have saved 70% of the cost of the drugs actually prescribed.

Another interesting study documenting potential savings in drug and treatment costs (and also increased effectiveness of treatment) is that by Barnum in Botswana (Barnum, 1986). He compared the cost-effectiveness of a short course tuberculosis treatment regimen using Rifampicin or Ethambutol with long course regimens based on Thiacetazone and Isoniazid. Short course regimens were more costly per case treated, but were half the cost per person effectively treated of Isoniazid-based regimens because of higher patient compliance. In addition, outpatient treatment was much cheaper than a combination of inpatient and outpatient care. Barnum estimated that treating 80% of patients through an outpatient-based short course regimen would have cost one-third of the pre-1984 treatment pattern of combined inpatient and outpatient care and a long course regimen. Furthermore, the number of people complying and covered by the programme would have doubled.

In the last few years, there has been considerable interest in improving drug supply systems, with Kenya being one of the first countries to implement a new system. Steenstrup (1984) has described the Kenyan system and estimated its costs. The system of supplying pre-packed ration kits of generic drugs resulted in higher total costs, but treated approximately 30% more patients and covered approximately a 12% greater population. The cost per patient was US \$0.23 in the old system, and US \$0.20 in the new.

### 2.1.2 Developed Commonwealth

#### **Education concerning prevailing health problems**

At the current time there are few economic evaluations of health education programmes in the developed Commonwealth. This is perhaps surprising given the emphasis that has been placed of late on the maintenance of a healthy lifestyle. One possible explanation for the lack of economic evaluation is the lack of controlled clinical or epidemiological studies in the health education field and there is no doubt that these are more difficult to mount than equivalent studies in clinical fields (Drummond et al, 1986). Few examples exist, one such evaluation being that of a physical fitness programme in Canada (Shephard, 1985). Although mostly concerned with assessing health improvements, Shephard argues that in a prospective study of a large scale employee fitness programme, health care costs increased more steeply at the control company (difference Cdn. \$28.50 per employee). Moreover, the hospital usage of those employed at the experimental company decreased from 0.27 to 0.09 days per worker-year, while that of the control company increased from 0.13 to 0.51 days per worker-year (net advantage of programme 0.56 days per worker-year, cost about Cdn. \$56 per worker). It had been anticipated that the fitness programme might generate some additional medical costs, but a detailed analysis of Ontario Health Insurance Plan records showed no evidence of increased claims for either electrocardiographic or orthopaedic services at the experimental company.

For examples of comprehensive economic evaluations of health education programmes in developed countries one has to look outside the Commonwealth. Berwick et al (1981) assessed alternative ways of increasing life expectancy by controlling cholesterol levels in children in the USA and concluded that the most cost-effective programme was community-wide intervention through mass media. In addition, Puska et al (1979) evaluated a range of health education interventions as part of the North Karelia

project in Finland. However, Engleman and Forbes (1986) argue that a number of opportunities to undertake a sound economic evaluation were missed in this project.

### **Nutrition**

There are no economic evaluations to report under this heading for developed countries. Diet is, of course, considered an important determinant of health but it is not seen in the main as an area for major primary health care initiatives requiring evaluation from an economic viewpoint. In the past few years in Britain there has been interest in vitamin supplements in pregnancy but not, so far, any economic evaluation of vitamin supplementation programmes.

Some argue that governments should take a more active role in influencing diet through their agricultural policies, e.g. why give subsidies to farmers to produce unhealthy foods? However, there are few evaluations in this area. In Britain, Cohen (1982) has assessed the costs and benefits of pasteurized milk, but the interventions examined were not intended to be part of a PHC strategy.

### **Water and Sanitation**

Not surprisingly, there has been little work by health economists in this field in developed countries. The only economic evaluations concerning the water supply are those relating to fluoridation to reduce dental caries. This has been a particular preoccupation in Britain where there have been three studies (Davies, 1974; Dowell, 1976; Fidler, 1977). There have also been studies in Australia (Doessel, 1979; Carr *et al*, 1979). The main result of all studies in this area is that the costs of fluoridating water supplies, with the possible exception of some small sources, is far exceeded by the savings in dental care costs owing to fewer restorations being required. However, one problem in interpreting this result relates to whether such cost savings are actually realized. In essence dentists' time is

being freed for other uses and the value of this will depend on the benefits derived from the extra services they can then perform e.g. providing more prophylactic care, or dental care for the elderly. Of course in the long run it may mean that fewer dentists are required. Koplan (1985) argues that this has been one impact of fluoridation of municipal water supplies in the USA.

The major problem in Britain has not been that of establishing the economic benefits of fluoridation of water supplies, but of implementing the policy. Fluoridation is the responsibility of the water authorities rather than the health care system and public objections have been caused by fears about the risks, most of which are unfounded on epidemiological grounds.

#### **Maternal and child health, including family planning**

Most of the economic evaluations in the maternal and child health field relate to screening programmes. There have been evaluations of screening programmes for phenylketonuria in neonates in Canada, New Zealand and Britain (Webb et al, 1973; Veale, 1980; Komrower et al, 1979). All these found the programme to be worthwhile in economic terms, owing to the high cost of institutionalization of handicapped children, although Veale warned against the tendency to add other elements (such as screening tests for other rarer conditions) to such programmes without considering whether the extra benefits justified the extra costs. In a recent paper (Dagenais et al, 1985) a group of Canadian researchers have examined the costs and benefits of the Quebec Network of Genetic Medicine.

There have also been a number of studies concerned with prenatal diagnosis of congenital conditions, particularly in Britain. (See, for example, Hagard and Carter (1976) on Down's syndrome; Hagard et al (1976), Henderson (1982) and Hibbard et al (1985) on open neural tube defects and Henderson et al (1984) on congenital toxoplasmosis.)

Although the conclusion of such studies is often that the savings from the extra costs of caring for handicapped children exceed the cost of mounting the screening programme, ethical issues are raised where the programme involves termination of the pregnancy, as is the case for Down's syndrome and spina bifida. Interpretation of the results of these studies therefore presents extra difficulties. A recent development is the interest in evaluating chorion villus sampling in Canada and the U.K. (Fuller et al, 1985; Henderson and Mugford, 1986).

Other evaluations of programmes for pregnant women are those by Torrance and Zipursky (1984) and Williams (1985). Torrance and Zipursky considered the cost-effectiveness of antepartum prevention of Rh immunization. Previously it had been suggested that an antepartum programme, involving the administration of anti-D gamma-globulin during pregnancy, was not sufficiently cost-effective to warrant its use, since the majority of cases of Rh immunization can be prevented by postpartum or postabortion treatment of Rh-negative women. However, the study showed that in 1983 the net costs of an antepartum programme to the health care system in Canadian dollars were \$2700 per Rh immunization prevented, \$3700 per case of Rh disease prevented, \$29500 per life saved and \$1500 per year of life gained (or quality-adjusted life-year gained). The authors conclude that in comparison with other health care expenditures a comprehensive antepartum prophylaxis programme for primiparae and multiparae in the Province of Ontario is economically efficient and warrants support.

In the paper by Williams (1985), screening for syphilis during pregnancy in Britain is examined. He found that although the incidence of syphilis, especially in women, in Western countries has declined since 1945, there is still a strong economic argument for continuing to screen routinely for syphilis in pregnancy. Under various assumptions the total cost savings from discontinuing screening ranged from around £170,500 to £325,500 per

annum, with a 'best estimate' of £252,713. However, the benefits in terms of cost savings to the NHS resulting from the screening programme were an order of magnitude higher, with a 'best estimate' of £5,122,000. When other societal benefits were included, such as those to other public sector agencies and to relatives, the difference between benefits and costs was even greater.

Screening for disease is discussed further in one of the case studies presented in Section 3.

In the field of family planning there are two studies, both from Britain. In an early study Laing (1972) found that the benefits to public authorities from investing in family planning outweighed the costs. Chamberlain (1980) compared a coordinated community-based family planning service (including specialist FP clinics) with 'other sources' such as retail pharmacies (which would be used if FP services were not available). She found that, depending on the assumptions made, the cost per pregnancy averted was between £264 and £396, and the cost per unwanted birth avoided between £324 and £486. The author concludes that these cost figures 'seem low when compared to the magnitude of the costs which would have been incurred by society and the female (and her family) had the unwanted pregnancy gone to term'. The paper also reports the relative costs of alternative sources of provision. These were £10.74 per attender per annum for GP services, £10.22 for a specialist FP clinic and £7.87 for provision in multi-purpose clinics, although these figures would be sensitive to throughput rates.

### **Immunization**

Although immunization programmes have been extensively investigated by economists in developed countries in general, notably the USA, there are relatively few examples of economic evaluation from the developed Commonwealth countries. Stilwell (1976) examined the benefits and costs of the schools' BCG vaccination

programme, comparing it with treatment for tuberculosis at the symptomatic stage. He argued that by the mid-1980s the schools' BCG vaccination programme would be uneconomic, costing about £5500 (1975 prices) to prevent one case of tuberculosis, the average total cost of which would only be between £400 and £1300 depending on medical policy about the degree of illness for which hospital admission is necessary. Alternatively one could view this cost difference as the price being paid to avert any pain or distress associated with the condition. This study, and many in the prevention field, illustrates the uncertainties in evaluation. It would be interesting to ascertain whether Stilwell's assertions were correct based on current incidence rates of TB and the current medical options for treating it at the symptomatic stage.

In a more recent study, Helliwell and Drummond (1987) have examined the costs and benefits of immunizing Ontario's elderly against influenza. They found that the costs of the programme to the Ministry of Health in 1982 were \$1,337,770, comprising vaccine production, distribution, administration and the treatment of side effects. However, the benefits of the programme, in averted hospitalization, physician billings and prescription costs were Cdn. \$2,021,300, giving a net benefit of \$683,600. In keeping with many evaluations of vaccination programmes, the estimates obtained were subject to uncertainty with respect to estimation of many key parameters, notably the annual attack rate and the vaccine efficacy. Therefore the authors investigated the impact that different assumptions had on the cost and benefit estimates, through a sensitivity analysis. Under most assumptions the analysis showed a net benefit from vaccination, even when only the Ministry of Health's costs were considered. Inclusion of a wider range of social costs and benefits would only serve to reinforce this conclusion. However, the authors were less certain about the costs and benefits of expansion of the programme to cover a higher percentage of the population at risk.

For more comprehensive evaluations of vaccination programmes one has to look outside the Commonwealth. In the USA vaccination programmes for pertussis, hepatitis B and pneumococcal pneumonia have been examined (Koplan, 1979; Mulley et al 1982; Willems et al, 1980). Particularly interesting features of these studies are that Mulley et al examine a wide range of different vaccination strategies and Willems et al use the quality-adjusted life-year as their benefit measure.

### **Prevention and control of locally endemic diseases**

One of the earliest economic evaluations of health care programmes carried out in the Commonwealth was that by Pole (1971) on mass miniature radiography in Britain. He argued that not even on the most favourable assumptions did the benefits from screening to detect tuberculosis at the asymptomatic stage amount to more than 50% of the costs, and that therefore mass screening for pulmonary tuberculosis should be discontinued.

Since Pole's study there have been a number of economic evaluations of secondary prevention strategies, the major diseases of interest being, as one might expect, cancer and cardiovascular disease. These studies will only be mentioned briefly below, since screening for disease is examined in more detail in one of the case studies in Section 3.

In the cancer field there have been studies by Thorn et al (1975) and Medley and Drake (1980) on screening for cervical cancer in Britain and Australia respectively. Also, Simpson et al (1978) and Gravelle et al (1982) have evaluated screening for breast cancer in Britain. In addition, further work is being undertaken in the breast cancer field, funded by the DHSS in England. In relation to cardiovascular diseases, the study by Logan et al (1981) examines different options for mounting screening and treatment programmes for hypertension in Canada. In a

controlled study they found that the average cost per patient per annum for worksite-based care using nurses was \$243, compared with \$211 for regular community care, where hypertensives were treated by their own physician. However, owing to the higher effectiveness (in terms of lowered blood pressure) of worksite care, the authors argued that the extra benefits justified the extra costs.

Again there are many examples of studies from countries outside the Commonwealth. In the fields of cardiovascular disease and cancer respectively, good studies to consult are those by Weinstein and Stason (1976) and Eddy (1980).

#### **Appropriate treatment for common diseases and injuries**

There are many economic evaluations in the developed Commonwealth in this category and, for ease of discussion, they will be divided into three categories: 'acute' or short-term periods of care for common diseases and injuries; long-term care for the elderly; and community care for the mentally ill and mentally handicapped.

Considering first the treatment of short-term periods of illness, there have been evaluations in Canada of the use of nurse practitioners alongside physicians in primary care practice (Batchelor et al, 1975). It was found, in a randomized controlled trial, that initial treatment by a nurse practitioner was cost-effective from society's point of view. However, lack of funding was one of a number of difficulties that prevented the spread of nurse practitioners in family practice; that is, the practices employing nurse practitioners could not generate enough extra income to cover the nurse's salary. Paradoxically, Denton et al (1982) estimated that the nurse practitioner could potentially cut health care costs by a significant amount.

Also in Canada, there has been interest in evaluating a different system of primary health care delivery, called the pre-paid group practice. This system, akin to the health maintenance organization (HMO) in the USA, appears to be more efficient than fee-for-service practice (Hastings et al, 1973; Barer, 1981). Under the pre-paid group practice there are strong incentives to reduce the level of diagnostic testing and hospital admission (which are charges on the practice), to promote the level of health of the patients under one's charge and to use non-physician manpower efficiently. A study of a similar change in general practice funding, from payment for an item of service to funding on a capitation basis, has been undertaken in New Zealand (Daldy et al, 1984). One of the main conclusions was that 'this form of primary medical care, with its markedly reduced costs, produced uniformly high measures of satisfaction'. However, it was also pointed out that 'only when health status measures are devised can various ways of health care delivery be evaluated'.

Finally, it is well known that in many countries hospital accident and emergency (A and E) departments are used as substitutes for general practitioner care at certain times of the day. There are few economic evaluations of activities in A and E departments, but the Royal College of Radiologists in Britain has carried out an analysis of the costs and benefits of routine skull radiography for head injury (Royal College of Radiologists, 1981). This study concluded that the use of routine skull radiography would increase rather than decrease NHS expenditures as the radiological cost would only be partly offset by the savings in hospitalisation of those patients who would otherwise be admitted in the absence of radiography.

Turning to long-term care of the elderly, there have been a number of economic evaluations considering the overall balance of care, between care in own homes and care in institutions. The general conclusion of all the studies carried out in Britain (Wager, 1972; Mooney, 1978; Wright et al, 1981) is that a shift in the balance of care

towards community care would be economically justifiable, even when costs falling outside the health sector, on other public sector agencies and the family, are considered. Some critics of community care argue that one reason for its cheapness is its sparcity. Therefore, there have been other evaluations of more intensive home nursing (Gibbins et al, 1982; Mowat and Morgan, 1982; Kyle, et al, 1986), provision of incontinence advice (Badger et al, 1983), and of increased provision of day hospitals (McFarlane et al, 1979) in support of the regular community services such as district nursing, general practitioner and home help. In general, these studies are supportive of the view that expansions in community care provision would represent good value for money when compared to increasing institutional care provision.

Turning to the third category, community care for the mentally ill and mentally handicapped, there have been studies both in Canada and Britain. Fenton et al (1982) compared, in a randomized controlled trial, a community-based treatment for mental illness patients (outpatient care plus treatment in own home) with a more traditional hospital-based alternative. They found that the hospital-based treatment was more expensive to the health care system than the community alternative (Cdn \$3250 versus \$1980) without significantly higher costs being borne by patients or their families. In Britain, Mangen et al (1982) compared the costs and effectiveness of care by community psychiatric nurses (CPNs) with that of routine out-patient psychiatrist follow-up. In a randomized controlled trial they found no statistically significant difference in public expenditure for the two models of care. Clinical and social outcomes were also comparable but consumer satisfaction was significantly greater among the CPN patients. Finally, and also in Britain, Cohen and Dick (1984) have examined the costs and

benefits of day hospitals for psychiatric patients and Wright and Haycox (1985) have compared the costs of care for mentally handicapped patients in community and institutional care settings.

### **Essential drugs**

There are very few studies in this category. One could, perhaps, include the study of hypertension therapy mentioned earlier (Logan et al, 1981). In addition, there has been another study in Canada examining the cost-effectiveness of a strategy to improve compliance with antihypertensive therapy (Mitchell et al, 1983).

The other main topic examined so far is the treatment of duodenal ulcer with cimetidine, an H<sub>2</sub>-receptor antagonist, where it is argued that drug therapy obviates the need for surgery. In a British study, Culyer and Maynard (1981) compared a hospital-based surgical treatment (vagotomy) with cimetidine delivered in a community care setting. Although there were deficiencies in the medical evidence at the time of the study, Culyer and Maynard argued that from the perspective of the community as a whole, cimetidine was the more cost-effective alternative. However, from the more limited perspective of the National Health Service, surgery would be preferred on cost grounds.

One of the interesting features of new drugs like cimetidine is whether use would be restricted to clinical indications where there was proven higher effectiveness or cost-effectiveness (e.g. for confirmed duodenal ulcer), or whether general practitioners would prescribe the drug more widely for indications where cheaper treatments are available (e.g. for ulcer-type pain). Therefore there is also a need for studies which explore the total economic

impact of new technologies like cimetidine, examining the costs resulting from both appropriate and inappropriate uses.

## 2.2 Major methodological issues arising

It is not proposed to discuss the methodological issues raised by economic evaluations of health programmes in the main body of this report. (Those keen to explore methodological questions should consult the technical appendix.) However, there are a few key points that policy makers should bear in mind when consulting this literature. They are discussed briefly below.

### **Should one adopt a health sector or societal perspective?**

A critical feature of studies that are undertaken is whether they consider only costs and benefits falling on the health sector (or public sector generally), or whether they consider also costs and benefits falling on patients, their families and other agencies. A true economic evaluation should adopt the wider perspective, although it is obvious that policy makers may have the greatest concern for their own budgets. This issue is particularly important in evaluating primary health care programmes, since some of the options may impose more costs on patients and their family than the alternatives, e.g. they may require time to travel to, or waiting at, primary health care facilities. Alternatively, they may require informal nursing in the home by family members. These costs are very real and ought to be considered; indeed, access costs are one reason why attendance at antenatal care clinics is often poor.

The valuation of lost work time raises further issues. In developing countries one may have to form a judgement on whether lost work time has an opportunity cost in a subsistence agricultural community. To some extent the

same issue arises in a developed country when there is permanent unemployment. However, the fact that some costs may have a value close to zero is not a reason for ignoring them in principle, although their empirical impact on the analysis may not be large.

### **Is the medical evidence good enough?**

It will be clear from the discussion in Section 1.3 above that economic evaluation builds on the underlying clinical or epidemiological evidence of the effectiveness of health programmes. Often such evidence is lacking, or hard to assemble, particularly for programmes that are far-reaching in their effects e.g. public health programmes. Thus it is crucial to consider whether the medical evidence is good enough for the study in question.

The importance of building economic evaluations on good medical evidence suggests that multidisciplinary working should be encouraged. This point is discussed further in the case studies and in the discussion of policy implications. Where controlled medical studies cannot be mounted, and where policy makers need advice on the economic consequences of particular decisions, economists often undertake a sensitivity analysis, examining the sensitivity of the study results to key assumptions. These might include assumptions about the likely effectiveness of interventions, the level of compliance by patients or the level of costs. While this approach does not remove uncertainty, it may give decision makers a feel for the likely range of outcomes. A number of studies reviewed in Section 2.1 use this approach. (See, for example, Helliwell and Drummond (1986), Henderson (1982) and Wang'ombe (1984).)

### **What are the relevant economic benefits of health care programmes?**

It was pointed out in Section 1.3 that there are a number of ways in which the economic benefits resulting from improved health can be estimated (See Figure 1.1). In

particular it should be noted that the economic benefits of health programmes are not restricted to the potential resource savings (in averted medical care costs) or the gains in productivity (from the extension of useful working life). The more intangible benefits, such as reduced pain and suffering, are also economic benefits in that individuals value health for its own sake. Indeed, economic evaluation has as much to do with improving the quality of life as it has to do with containing health care costs.

For this reason policy makers should treat with caution those studies which restrict themselves to consideration of the so-called but more narrowly defined 'economic benefits', or which value life by the human capital approach. This method takes future earnings, discounted to present values (see below), to produce a money value of the years of life gained by the health programme. Not only does this approach undervalue life itself, it can lead to biases in health care priority setting. For instance, it would place emphasis on those programmes that are directed towards high wage-earners, as opposed to those for the elderly and the poor.

That is not to say that increased productivity is unimportant, particularly in low income countries. However, it would be better to consider these items alongside a measure of the quantity and quality of life gained by the health programme, as in cost-effectiveness and cost-utility analysis. (See Figure 1.1).

### **What are the main issues in estimating costs?**

A detailed discussion of methodological issues in the measurement and valuation of costs can be found in Appendix 2. However, a number of issues that are particularly pertinent to the costing of PHC programmes are discussed here.

First, problems arise when resources are used jointly to provide more than one PHC component. A good example is in the provision of immunization programmes. When vaccines against a number of diseases are being provided simultaneously, how does one apportion the common costs, such as the maintenance of the cold chain? One approach would be to argue that there is one prime disease that is the focus of the programme and that any additions to the programme should be considered by comparing the incremental or marginal costs (of adding the extra vaccine to the existing one) with the marginal benefits (of the extra cases of disease averted). (Of course, this approach assumes that adding the extra vaccine does not affect the cost or effectiveness of existing provision.)

In cases where one cannot argue that there is a prime disease to be tackled it is meaningless to make arbitrary apportionments of common costs. The only sensible way to proceed would be to examine different mixes of vaccination strategies and to compare these with the option of 'no programme'. Then one would be implicitly considering the incremental costs and effects of one mix over another (see Table 2.1).

The central concept in the example given above is the consideration of costs and benefits at the margin. That is, the relevant costs and benefits for decision making purposes are those that relate to the extra unit of service, or next sensible expansion in the programme, not the average cost (per case prevented) for the whole programme. Essentially, when economists talk about the margin they are arguing that the relevant question is not whether services should be provided, but how much of them should be provided. The same issue arises when considering the expansion of programmes to cover a wider population, to cover a wider geographical group or to allow more frequent contact with clients (e.g. more frequent screening for disease). In each case it is important to consider what is added (in benefits) and to compare these with the extra costs.

Table 2.1 Hypothetical Comparison of alternative vaccination strategies for diseases A and B

<u>Strategy</u>	<u>Costs</u> (in thousands \$)	<u>No. of Cases Occuring with each Strategy</u> (in thousands)
No programme	0*	100 A 50 B
Vaccinate against A	110	10 A 50 B
Vaccinate against B	90	100 A 10 B
Vaccinate against A & B	150	10 A 10 B

<u>Policy Question</u>	<u>Correct Comparisons</u> (in thousands)
a) Is it worthwhile vaccinating against disease A?	Is prevention of 90A worth \$110?
b) Is it worthwhile vaccinating against disease B?	Is prevention of 40B worth \$90?
c) Is it worthwhile adding vaccination against B to existing strategy against A?	Is prevention of 40B worth \$40?
d) Is it worthwhile adding vaccination against A to existing strategy against B?	Is prevention of 90A worth \$60?
e) Is it worthwhile vaccinating against A and B?	Is prevention of 90A and 40B worth \$150?

\*For simplicity it has been assumed that the cost of 'No Programme' is zero. This may not be the case if some vaccinations are done outside the formal programme. Also, the costs of treating cases of diseases A and B are considered, for simplicity, as part of the 'worth' of preventing A and B.

The other main point to consider in the estimation of costs is the calculation of these for items for which there is no market price (e.g. volunteer time) or for which the market price is thought to underestimate or overestimate the price of the resource. In developing countries there are particular pricing problems of this nature. These are discussed further in Section 2.3 below and in Appendix 2.

### **Does it matter when costs and benefits occur?**

One of the features of many health programmes, particularly those of a preventive nature, is that many of the resource outlays are now, whereas the benefits occur in the future. Economists argue that the community is not indifferent to the timing of costs and benefits, and have developed a technique, known as discounting to present values, to allow for this in economic evaluations. Discounting is discussed in detail in Appendix 2. It raises a number of complex technical and moral issues that are beyond the scope of this report. However, all that is required for the moment is to note that the timing of costs and benefits is an important policy issue and that some governments, such as in Britain, give formal notification of the public sector discount rate to be used in evaluations of this type (HM Treasury, 1982). In essence this is the government's judgement on the extent to which the future should be discounted in favour of the present.

### **Is efficiency the only objective in health programmes?**

It has to be recognized that public policy making is a complex business, where many factors (economic, cultural, social and political) must come into play. Economic evaluations, rightly in our view, concentrate on estimating the costs and benefits to society of alternative programmes and seek to present this information in a form relevant to decision makers.

However, there are cases where the economic analyst needs to recognize other factors, since exclusion of them may seriously mislead the policy maker. An important concern is often the equity of health care provision, between geographical locations or between socio-economic groups. Therefore, whereas the most efficient policy may be one that (say) restricts vaccination against measles to urban areas having a reliable electricity supply (Ponnighaus, 1980), equity considerations may suggest that there should also be provision in rural areas.

In addition it should be recognised that primary health care programmes, particularly those in developing countries, may have as much to do with community and social development as they do with immediate improvements in health. Of course, improvements in these two other dimensions may also have a positive impact on health in the long run. Where possible it is important that economic evaluations recognize these broader aspects of public policy.

### **How does one assess the overall quality of a published study?**

As stated earlier it is beyond the scope of this report to discuss methodological issues in detail and the reader should consult Appendix 2. However, a group at McMaster University (Canada) has developed a useful checklist for assessing the methodological quality of published economic evaluations. This is presented in Table 2.2.

### **2.3 The problems of international comparisons**

A review of PHC projects and programmes requires that comparisons be made between countries of the costs and effectiveness of different PHC programmes and of the various components of PHC. Such comparisons, however, have their difficulties and dangers.

Source: Department of Clinical Epidemiology  
and Biostatistics, McMaster University  
Health Sciences Centre (1984)

1. Was a well defined question posed in answerable form?
  - (a) Did the study examine both costs and effects of the service(s) or program(s)?
  - (b) Did the study involve a comparison of alternatives?
  - (c) Was a viewpoint for the analysis stated or was the study placed in a particular decision-making context?
2. Was a comprehensive description of the competing alternatives given (i.e., can you tell who did what to whom where and how often)?
  - (a) Were any important alternatives omitted?
  - (b) Was (should) a "do-nothing" alternative (have been) considered?
3. Was there evidence that the programs' effectiveness had been established? Was this done through a randomized, controlled clinical trial? If not, how strong was the evidence of effectiveness?
4. Were all important and relevant costs and consequences for each alternative identified?
  - (a) Was the range wide enough for the research question at hand?
  - (b) Did it cover all relevant viewpoints (e.g., those of the community or society, patients and third-party payers)?
  - (c) Were capital costs as well as operating costs included?
5. Were costs and consequences measured accurately in appropriate physical units (e.g., hours of nursing time, number of physician visits, days lost from work or years of life gained) prior to valuation?
  - (a) Were any identified items omitted from measurement? If so, does this mean that they carried no weight in the subsequent analysis?
  - (b) Were there any special circumstances (e.g., joint use of resources) that made measurement difficult? Were these circumstances handled appropriately?
6. Were costs and consequences valued credibly?
  - (a) Were the sources of all values (e.g., market values, patient or client preferences and views, policymakers' views and health care professionals' judgements) clearly identified?
  - (b) Were market values used for changes involving resources gained or used?
  - (c) When market values were absent (e.g., when volunteers were used) or did not reflect actual values (e.g., clinic space was donated at a reduced rate) were adjustments made to approximate market values?
  - (d) Was the valuation of consequences appropriate for the question posed (i.e., was the appropriate type, or types, of analysis — cost-effectiveness, cost-benefit or cost-utility — selected)?
7. Were costs and consequences adjusted for differential timing?
  - (a) Were costs and consequences that occurred in the future "discounted" to their present values?
  - (b) Was any justification given for the discount rate used?
8. Was an incremental analysis of costs and consequences of alternatives performed?
 

Were the additional (incremental) costs generated by the use of one alternative over another compared with the additional effects, benefits or utilities generated?
9. Was a sensitivity analysis performed?
  - (a) Was justification provided for the ranges of values (for key parameters) used in the sensitivity analysis?
  - (b) Were the study results sensitive to changes in the values (within the assumed range)?
10. Did the presentation and discussion of the results of the study include all issues of concern to users?
  - (a) Were the conclusions of the analysis based on some overall index or ratio of costs to consequences (e.g., cost-effectiveness ratio)? If so, was the index interpreted intelligently or in a mechanistic fashion?
  - (b) Were the results compared with those of other studies that had investigated the same questions?
  - (c) Did the study discuss the generalizability of the results to other settings and patient/client groups?
  - (d) Did the study allude to, or take account of, other important factors in the choice or decision under consideration (e.g., distribution of costs and consequences or relevant ethical issues)?
  - (e) Did the study discuss issues of implementation, such as the feasibility of adopting the "preferred" program, given existing financial or other constraints, and whether any freed resources could be used for other worthwhile programs?

First, there are problems associated with the comparison of costs between countries and between years. In order to compare the costs of programmes in different countries, the costs need to be translated into a common currency. However, exchange rates do not necessarily reflect the purchasing power of currencies and may be particularly misleading when used to convert the values of goods and services which are not internationally traded. To give an example, in low income countries manpower tends to be cheap relative to internationally traded health service inputs such as drugs (Cumper, 1981). When manpower costs are converted using exchange rates which reflect the price ratios of traded goods, expenditure on low income country health services appears lower than if the quantity and quality of services that the expenditure can purchase are taken into account. A further complication is that over-valued exchange rates will exaggerate domestic expenditure when expressed in terms of a foreign currency. In addition, price indices need to be used to convert costs to a common year. Such price indices are usually only an approximation of the changing price levels for health service inputs.

Secondly, both costs and effectiveness are affected by local influences on the programme. For example, the effectiveness of a programme depends on factors such as delivering an effective drug or vaccine, patient compliance and population coverage. These can vary considerably between different social, cultural and organizational settings, resulting in different levels of effectiveness for the same intervention. The costs of a programme also depend on a number of factors, such as the scale of the programme, population density, and whether a new programme can be added to an existing infrastructure and can take advantage of existing under-utilized resources. This is obviously cheaper than setting up a completely new service.

Undue emphasis should not be placed, therefore, on small differences in costs and effectiveness between countries. Comparisons can, however, be useful when costs are converted to a common currency and time period, and the programmes being compared are similar. For example, costs per capita, or as a percent of GNP, can give an indication of the affordability of a particular programme. Costs per case or per death averted can be used to separate different interventions into those which appear relatively attractive and those which are relatively less attractive. Section 4 reviews available evidence on such cost estimates and cost-effectiveness ratios for PHC programmes.

### 3. CASE STUDIES OF MAJOR PHC PROJECTS

#### 3.1. Child and maternal health services in rural India: The Narangwal Experiment. Integrated nutrition and health care (Kielmann and Associates, 1983)

The debate over whether various health programmes should be delivered separately, as vertical programmes, or integrated through a general health service delivery system has continued for at least the last 30 years (Mills, 1983). It continues to be in the forefront of policy debates, with arguments over the integration within PHC of programmes such as malaria control, family planning, nutrition and immunization. In the late 1960s, the Narangwal project was set up to examine this and other issues. Since it is also one of the most carefully researched studies of the effectiveness of PHC-type services, and had explicitly a focus on cost-effectiveness, it is an appropriate study to review here.

The questions relevant to economic evaluation posed in the Narangwal study were, "Is there a synergism in programme effects so that a combined programme of nutrition and infection control will have greater impact in cost-effectiveness than would be expected from each programme alone?", and, "Can better field programmes be developed to combine the most cost-effective malnutrition and infection control measures so that they can be implemented within the personnel and financial constraints of developing countries?".

The study was based on an experimental project designed to measure the health effects of interventions targeted at mothers and children. The project area was divided into three, one receiving a package of nutrition care, another health care (mainly infection control) and the third integrated services. The integrated services package was

not just the sum of the separate health care and nutrition packages, since the aim was to compare cost-effectiveness when inputs into each programme were approximately equal. A fourth area with no intervention provided a control. Comparison of the areas was confused by rapid socio-economic development that occurred in the area (the Punjab) during the research; therefore it was stressed that the research findings needed to be adapted and applied in demonstration projects elsewhere.

For the main body of the research a large number of health indicators were monitored. For the cost-effectiveness ratios four indicators of effectiveness were selected, disaggregated by age-group where relevant (Table 3.1). No attempt was made to combine these indicators into one index such as 'healthy days of life added'.

Costs were calculated through a detailed 'functional' analysis which provided information about the cost of each service component and which included as many as possible of project service costs, including donated drugs, food, buildings and land. Capital expenditures were converted to an equivalent annual cost using a discount rate (see Appendix 2). Research and development costs were excluded when considering service provision. Individual and family costs were not taken into account in the cost-effectiveness figures, although use of private practitioners was monitored. In the experimental villages, contacts of small children with private practitioners was about one third of the level in the control villages. The project thus appears to have caused a switch in demand and reduction in household expenditure on private practitioners, though this is not discussed in the study or included as a resource saving accruing to society as a whole.

Average annual cost of services provided per child under 3 years old was about US\$23 in nutrition villages, US\$21 in

TABLE 3.1

Cost-effectiveness ratios for the three experimental groups, Narangwal

Cost-effectiveness ratio	Experimental group		
	Nutrition plus health care	Nutrition	Health care
	\$	\$	\$
1a Cost per death averted <sup>(a)</sup>			
Perinatal	9.85	7.75	14.15
Infant	37.35	36.40	25.35
1-3 years	101.45	71.75	30.65
1b Cost per day of illness averted <sup>(b)</sup>			
Infant	0.56	(c)	0.40
1-3 years	0.39	(c)	0.35
2a Cost per extra cm growth at 36 months <sup>(d)</sup>	26.25	30.40	(c)
2b Cost per additional percentage point increase in psychomotor development scores over first 3 years of life <sup>(d)</sup>	5.05	13.60	(c)
(a)	Using a proportion of total programme costs equal to the age-specific mortality rate		
(b)	Using all health care costs minus costs apportioned to mortality		
(c)	Small or zero effects produced large or infinite cost-effectiveness ratios		
(d)	Using all nutrition costs minus costs apportioned to mortality.		

**Source:** Adapted from Table 9.5 in KIELMANN, A.A. & ASSOCIATES. Child and maternal health services in rural India. The Narangwal experiment. Vol 1. Integrated nutrition and health care. Baltimore, Johns Hopkins University Press, 1983.

nutrition and health care villages and US\$9 in health care villages. (The price year for costs is unclear, but approximately 1970-73.) The nutrition villages were the most costly per child primarily because a higher average number of child feedings was provided. In addition, integrated services benefited from joint delivery of the two programmes, producing savings in the use of staff time, transport, facilities, drugs and supplies when compared to the cost of providing the two programmes separately.

In order to investigate the cost-effectiveness of different service packages, the costs of service packages in the experimental villages were related to differences in effectiveness measures between experimental and control groups. In order to avoid averaging all costs over the change of each health indicator (resulting in double counting) costs were divided between objectives. (However, the method of doing this was not clearly explained.) A proportion of nutrition and health care costs were allocated to prevention of deaths according to age-specific mortality rates in the control villages. The balance of health care costs was attributed to morbidity reduction, the balance of nutrition costs to improvement of physical growth and psychomotor development. Nutrition costs could not be divided between the two nutrition measures and thus entered into both the nutrition cost-effectiveness ratios.

The cost-effectiveness ratios are shown in Table 3.1. In summary, mortality in infants and children from 1 to 3 years old was decreased with least cost by health care alone, but perinatal mortality was lowered with the least cost through nutrition services. Only health care had an effect on morbidity, and integrated services were most cost-effective for improving growth and development. While a common measurement of benefit could not be found (referred to as the 'unsolved methodological problem'), it was concluded that integrated services produced almost as much nutritional

impact on growth and development as nutrition services, and almost as much impact on morbidity and mortality as health care, for much less than the combined cost of the separate packages. Integration of nutrition and health care services was thus considered to be justified in cost-effectiveness terms.

Given the difficulty of attributing costs to different objectives, it is unfortunate that there was no discussion of whether a change in the method of apportionment might affect the comparison between the objectives or between the service packages. In addition, use of an index such as 'healthy days of life added' might have helped to clarify the comparison between the service packages, even if it would have inadequately reflected nutritional objectives.

To what extent might the results of the study apply elsewhere and could its interventions be afforded elsewhere? While the cost per head of the population was three times as high as the average expenditure of a primary health centre in the Punjab (and the project was targeted only at children under 3 years old), the cost per contact was not dissimilar. The difference in per capita cost was therefore largely due to the higher coverage of the population and the more frequent contacts. The authors of the study suggest that a relatively intense concentration of resources may be required to affect health status, and that the dilution of effort in government services is probably below the threshold level where they can be expected to have any significant effect on health. If project expenditures are compared with total health expenditure elsewhere (public plus private) the discrepancy is somewhat reduced, and the type of health programme of Narangwal is considered realistic if government and community resources could be combined. However, the Punjab is wealthier than many other parts of India and much of the developing world, and more highly trained staff were used (e.g. family health workers with over 2.5 years' training for the home-visiting) than

are likely to be available or affordable elsewhere. There is thus some doubt about the extent to which the Narangwal results suggest PHC strategies which can be afforded elsewhere.

A further question arises over whether the study itself can be replicated. The Narangwal experiment lasted between 1965 and 1973 and the research and evaluation costs were very considerable. Moreover, analysis of the results proved complex, and the final results were not published in book form until 1983. There is an urgent need for methodologies for measuring health impact that are less time-consuming and less expensive. However, the Narangwal study has had a considerable effect on international thinking on PHC, by showing firstly a clear health impact from village-level interventions, and secondly increased cost-effectiveness from integrated services.

3.2. Cost-effectiveness of immunization in the Gambia  
(Expanded Programme on Immunization, 1982; Robertson et al, 1984; Robertson et al, 1985)

Economic evaluations of immunization strategies are now fairly numerous, and have the advantage that costs and effects are often more easily quantified than in other health programmes. A number of the studies have been performed under the aegis of the Expanded Programme on Immunization (EPI) of WHO and one of these, for the Gambia, has been selected for consideration here. The Gambian study has been selected because the country is a member of the Commonwealth, the medical evidence on the health effects of immunization in the Gambia is relatively good, and there is some helpful information on how costs vary with the level of output.

Immunization services in the Gambia are integrated with the maternal and child health services. Combined services are delivered by teams that work full-time on certain days at

fixed centres and on other days travel to outlying villages and health posts. The immunization schedule includes 4 doses of diphtheria, pertussis, tetanus (DPT) and polio vaccines, single doses of BCG, measles and yellow fever, and four doses of tetanus toxoid for women. The cost-effectiveness evaluation excluded consideration of BCG and yellow fever.

In the cost-effectiveness study (Robertson et al, 1985), the 'effects' were considered to be the cases and deaths averted by each vaccine, and 'costs' the cost to the government of delivering each vaccine. Incidence and case-fatality rates before immunization were estimated on the basis of a number of epidemiological studies, mostly from the Gambia itself. Similar evidence, when available, was used to calculate 'with immunization' incidence and case-fatality rates, supplemented by evidence from cluster surveys of EPI coverage. The difference between cases and deaths with and without the EPI programme constituted the effects of the programme (see Table 3.2).

Costs were estimated in the following way. First, the EPI's share of maternal and child health (MCH) expenditure was calculated, using national data and evidence from visits to a sample of 13 delivery points. Secondly, EPI expenditure (excluding vaccines) was apportioned between diseases on the basis of the number of contacts required for each disease, and the vaccine cost for each disease then added. If multiple vaccines were given at the same contact, delivery costs were divided equally between the vaccines.

The resulting cost-effectiveness ratios are shown in Table 3.3. Measles and pertussis showed the lowest cost per case and death prevented, with neonatal tetanus ranking third, then poliomyelitis and finally diphtheria. Measles, diphtheria and pertussis had very similar costs but radically different cost-effectiveness ratios because diphtheria caused very few cases or deaths in the absence of immunization.

TABLE 3.2

ESTIMATED 1982 DISEASE SPECIFIC MORBIDITY AND MORTALITY  
IN THE GAMBIA WITH AND WITHOUT IMMUNIZATION

<u>DISEASE</u>	<u>IF NO IMMUNIZATION</u>		<u>WITH IMMUNIZATION</u>		<u>PREVENTIVE EFFECT</u>	
	<u>CASES</u>	<u>DEATHS</u>	<u>CASES</u>	<u>DEATHS</u>	<u>CASES</u>	<u>DEATHS</u>
Neonatal Tetanus	1,333	1,200	414	373	919	827
Measles	25,500	1,224	9,387	451	16,113	773
Diphtheria	30	3	5	1	25	2
Pertussis	24,000	312	6,864	89	17,136	223
Poliomyelitis	100	10	0	0	100	10

Source: Robertson et al (1985)

TABLE 3.3

ESTIMATED COSTS TO PREVENT CASES AND DEATHS  
FROM DISEASES PREVENTABLE BY IMMUNIZATION IN THE GAMBIA

(Costs in U.S. Dollars)

<u>DISEASE</u>	<u>COST</u>	<u>CASES PREVENTED</u>	<u>COST PER CASE PREVENTED</u>	<u>DEATHS PREVENTED</u>	<u>COST PER DEATH PREVENTED</u>
Neonatal Tetanus	\$125,315	919	\$ 136.36	827	\$ 151.53
Measles	31,561	16,113	1.96	773	40.83
Diphtheria	22,266	25	890.64	2	11,133.00
Pertussis	22,266	17,136	1.30	223	99.85
Poliomyelitis	65,554	100	655.54	10	6,555.40

Source: Robertson et al (1985)

A number of comments can be made on these findings. First, any resource savings resulting from the EPI programme were ignored. For instance, immunization is likely to have resulted in a reduction in curative treatment. Secondly, the measure 'cases prevented' disguises considerable differences in the nature of the illness episode prevented. This ranges from severe illness with a risk of continuing disability and thus continuing costs of care (e.g. poliomyelitis) through illness which in the Gambia appears to increase the risk of dying from other causes for those children who survive (e.g. measles) to illness which is relatively less severe (e.g. pertussis). Finally, the apportionment of costs between diseases is to some extent arbitrary. Diphtheria appears expensive, but is given as a combined dose (DPT) and its removal from the programme would not result in any significant cost saving. A more relevant approach might have been to assume reduction in tetanus and pertussis to be the main justification for the DPT vaccine, and to distribute costs to these two diseases, regarding reduction in diphtheria as an incidental effect. Looked at this way, the prevention of diphtheria cases and deaths is a 'free' additional benefit, rather than being gained at a high cost.

A more general point concerning the policy implications of the results is that the average cost figures presented do not necessarily provide good estimates of the resources that might be released if one or more vaccines were removed from the schedule. In an immunization programme there are often large shared costs between the vaccines, such as travel by the vaccination team to a health post. Removal of a vaccine is likely to save only the additional variable costs attributable to that vaccine.

The cost-effectiveness ratios presented indicate the ranking of the EPI diseases in terms of cost-effectiveness, but they do not indicate whether it is worth, for instance, spending \$6555 per poliomyelitis death averted in comparison to what

might be achieved by using those resources in another programme. This is a general limitation of cost-effectiveness studies, which will be discussed further in Section 4. A rough comparison of the Gambian results with similar results for EPI from other countries, and with results from other programmes, suggests that EPI is cost-effective in terms of cost per death averted when compared with many other health interventions.

The Gambian study thus adds to the evidence that immunization is a 'good buy'. In addition, it provides interesting information on how costs vary with the volume of immunizations provided. The cost per dose and per fully immunized child were calculated for the 13 delivery points investigated (Robertson et al, 1984; Expanded Programme on Immunization, 1982). In general, the cost per dose was inversely related to the average number of doses per session, as shown in Figure 3.1, with no evidence that a minimum average cost point had been reached. The main explanation for this finding is that a substantial proportion of EPI costs are fixed; that is, they do not change as the volume of work increases. Thus the greater the number of doses, the lower are these fixed costs per dose.

These results suggest that steps to decrease the level of fixed costs or increase the volume of immunizations would increase efficiency. Robertson et al (1984) suggest making better use of staff, reducing the frequency of EPI sessions, redistributing catchment areas, and replacing outreach activities by peripheral units. They recognize the dangers of discouraging attendance by requiring users to travel further, but place insufficient emphasis on obtaining information on user time and travel costs. The larger the immunization unit, the larger will be its catchment area and the higher the average time and travel costs to users. When these are taken into account, the optimum volume of

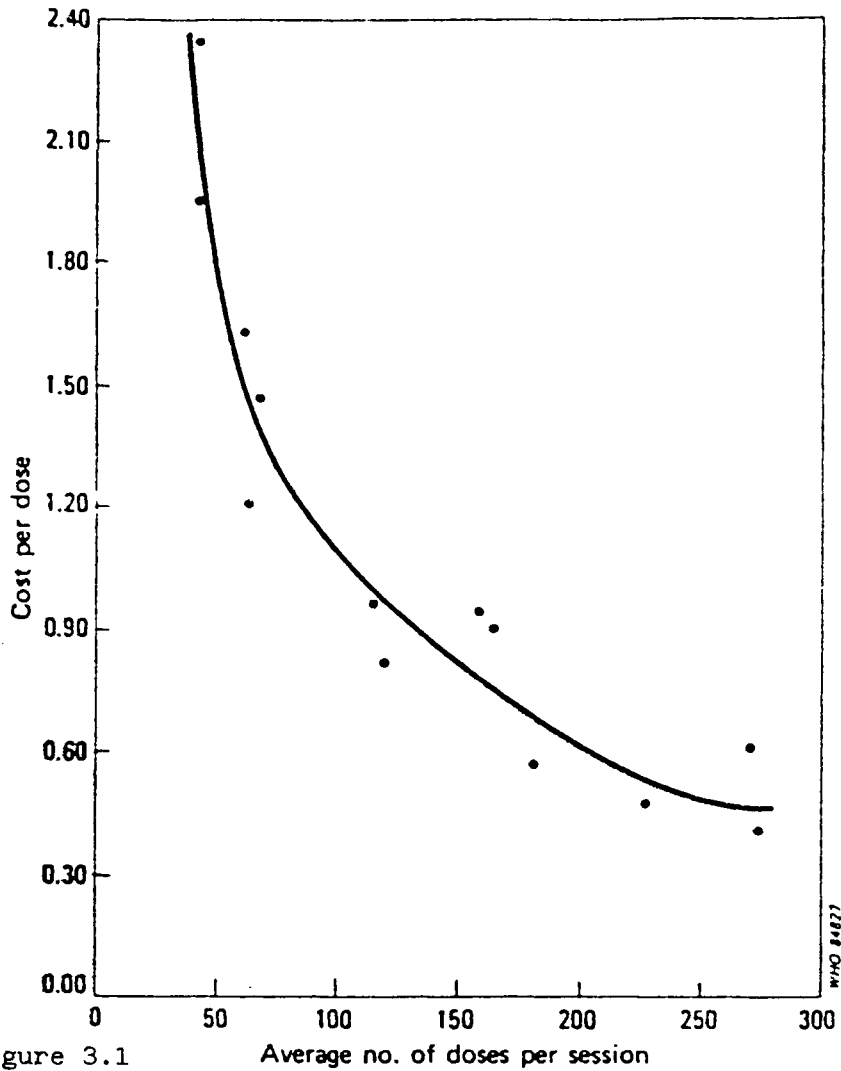


Figure 3.1

Average no. of doses per session

Average cost in US dollars per dose, excluding cost of expatriate personnel, in relation to the average number of doses per session (service volume) for the 13 field units, from 1 July 1980 to 30 June 1981.

Source: Robertson et al (1984)

immunizations will be lower than if only provider costs are considered. Robertson et al do not attempt to compare the cost of immunization at a static unit with the cost of the mobile outreach activities from health centres. Their discussion of increasing efficiency through enabling peripheral units to provide immunizations and through saving on the costs of sending health centre staff to these units implies that they expect immunization from fixed peripheral units to be cheaper than mobile outreach activities. This is the reverse of what has been found elsewhere (see, for instance, Creese 1984) and evidence on this issue is required in order to determine appropriate delivery strategies.

### 3.3 Control of schistosomiasis in St Lucia

The schistosome parasite enters the body of its human host after a period of development in its intermediate host, the water-snail. Humans therefore contract the disease by coming into contact with water inhabited by the snail. In the earlier stages symptoms include lethargy, headache and diarrhoea. More serious organ damage can develop as the infections build up, but the disease is not often a direct cause of death. The parasite's eggs are expelled in the urine or faeces and if this takes place in the snail's habitat the life cycle continues, infecting new individuals and increasing the severity of the disease in those who are already infected.

The economic impact of schistosomiasis has been studied both in Tanzania (Cohen, 1974) and St. Lucia (Weisbrod et al, 1974), where there has been extensive evaluation of control mechanisms through a project financed by the Rockefeller Foundation. Cohen (1974) calculated the per capita benefit from eliminating mortality due to schistosomiasis by using discounted future earnings to value the gain in productive output through extension of working life. Using the assumption (based on an earlier study) that schistosomiasis

reduces life expectancy at birth by 1.8 years, he calculated that the potential benefits were of the same order of magnitude as the per capita expenditure on health of the Government of Zanzibar in 1960. He did not go on to evaluate any particular control strategies, however.

In contrast, Weisbrod et al (1974) argued that there was little evidence that schistosomiasis and the other parasitic diseases studied in St. Lucia were having an effect on birth and death rates, performance of children in school and productivity of adult workers. They found that although schistosomiasis had a debilitating effect which reduced the productive potential for males (as measured by earnings) by a rather substantial 30 per cent, it was having essentially no effect on actual market output as individuals worked more days to minimize the effect of debility on their total weekly earnings.

Weisbrod et al's analysis (of 466 workers on one banana plantation) has been criticized on the grounds that their sample did not include the most seriously debilitated people (who would not have been at work) and that the whole productive environment changes when nearly everyone is sick to some degree. A further deficiency of the initial study, that workers may not have been infected (and reinfected) long enough to display adverse effects, was investigated in a follow-up study (Weisbrod and Helminiak, 1977). Little evidence was found that the debilitating effects of parasitic infection depend on the duration of the infection, although because of migration of workers the sample size was becoming small. Prescott (1979b), in an excellent review article, has outlined the major difficulties in establishing that schistosomiasis seriously impairs labour productivity and the methodological problems with the existing studies.

Despite the uncertainty about the precise social and economic impact of schistosomiasis, in particular its

impact on productivity, its debilitating effects have been considered important enough to institute control measures. In 1965 the Rockefeller Foundation and Government of St. Lucia began a research and control project in which many strategies were evaluated. Most evaluations of effectiveness and cost were of the before-and-after design and were carried out in a number of distinct locations on the island.

The three main options for controlling schistosomiasis examined in St. Lucia were molluscicide programmes to prevent the transfer of the disease, improvement of water supplies to prevent humans from coming into contact with contaminated water and chemotherapy for infected individuals. (In other locations engineering measures, to make drainage and irrigation ditches less hospitable habitats for snails, have been examined.) Clearly these options are not mutually exclusive. In particular, chemotherapy could be used as an adjunct to the other methods of control, and health education could also feature as a component of each. Furthermore, there are choices within the options; for example, a molluscicide programme could be aimed at all snail habitats or at a few 'focal' sites where transmission of the disease is most likely to take place; mollusciciding could also take place more or less frequently. Similarly chemotherapy could be confined only to those found to be infected or could be given to a wider group of the population. In the St. Lucia study mollusciding programmes were concentrated in Cul-de-Sac Valley, provision of improved water supplies in Riche Fond Valley and chemotherapy in Marquis Valley.

The results of the evaluations carried out are shown in Table 3.4. It can be seen that results are reported in terms of annual cost per person protected and cost per case year prevented. The 'case years prevented' is calculated by comparing cases that would occur without control (as

Table 3.4 Economic Evaluations of Schistosomiasis Control Programmes in St. Lucia

(Source: Barlow and Grobar, 1986)

<u>AUTHOR (DATE)</u>	<u>AREA STUDIED</u>	<u>CONTROL METHODS EVALUATED</u>	<u>RESULTS OF ECONOMIC EVALUATION</u> (1984 US \$)
Cook <u>et al</u> (1977)	Villages in Marquis Valley, 1974-75	Chemotherapy	Annual cost per person protected: 1974: \$2.65 1975: \$1.45
Jobin (1979)	Cul-de-Sac Valley	Molluscicides	Annual cost per person protected: \$11.14
Jordan (1977)	Cul-de-Sac, Riche Fond and Marquis Valleys, 1973-74	Molluscicides(M) Water Supplies(W) & Chemotherapy (C)	Cost per case-year prevented: \$63.02(M) \$68.13(W) \$14.99(C)
Jordan <u>et al</u> (1978)	7000 people in Cul-de-Sac Valley	Molluscicides	Annual cost per person protected: \$5.76
Jordan <u>et al</u> (1982a)	5 villages, Riche Fond Valley, 1977-78	Household water supplies (after transmission reduced by chemotherapy)	Annual cost per person protected: 1977-8: \$8.05 1978-9: \$9.72 1970-80: \$12.35 1980-1: \$12.61
Jordan <u>et al</u> (1982b)	10 villages, Marquis Valley	Chemotherapy until 1976	Annual cost per person protected: 1973: \$2.91 1974: \$1.60 1975: \$1.42 1976: \$1.45
Prentice <u>et al</u> (1981)	5 communities with total population of 1250, Soufriere River Valley, 1976-80	Monthly application of molluscicides (focal sites)	Annual cost per person protected: \$3.75  Cost per case-year prevented: \$20.81
Rosenfield (1979)	St Lucia 1970-77	Chemotherapy and water supplies(CW), Chemotherapy(C) Water supplies(W) Molluscicides(M)	Cost per case-year prevented: \$33.81(CW) \$8.95(C) \$41.90(W) \$84.23(M)

predicted by a transmission model) with the number of cases that actually occurred over time while the particular control measure or measures were being applied. The difference is the case-years of infection prevented. The general finding is that chemotherapy is the least cost strategy. However, a few critical observations can be made both on study methodology and the results obtained.

First, all the evaluations consider only the direct costs of the control programme to the agency providing it. This means that private costs falling on the local population are ignored and these may differ between options. In particular, most authors note that mollusciciding requires no effort on the part of the local population and therefore does not suffer from lack of compliance.

Secondly, the capital costs of programmes, whilst usually included, are not typically handled in the correct manner by calculating an equivalent annual cost using a discount rate, or by identifying capital and recurrent costs by the year in which they fall and discounting these to present values over the expected lifetime of the project (Rosenfield, 1979). (See Section 2.2 and the Technical Appendix for a discussion of this point.) This may in particular affect the comparison of the provision of improved water facilities with the other options, as would assumptions about the expected length of life of the facilities.

Thirdly, no studies attempt to measure the effect on health status of the disease, nor the changes in productive output. As was mentioned earlier, ideally one would want to assess the reduction in quality of life caused by the disease and therefore the gains that could be made by controlling it. Only in this way could one begin to compare investments in schistosomiasis control programmes with those in other PHC activities.

Fourthly, some of the options, in particular the provision of improved water facilities, confer other benefits on the local population (such as time savings and improved quality of life) which in principle should be considered. This suggests that slightly higher costs may be justifiable for the provision of improved water supplies. Alternatively one might argue that it is wrong to attribute all the costs of providing improved water facilities to the schistosomiasis control programme.

Finally, few of the studies consider mixes of strategies. In fact Barlow and Grobar (1986) only identify one study, an unpublished work by Bekele (1980), which addresses this issue in any depth, although Rosenfield (1979) examines a combination of chemotherapy and improved water supplies.

A major issue is that of the generalizability of results from St. Lucia to other settings. In an interesting paper, Jobin (1979) has compared the cost of molluscicide programmes in a number of countries, including St. Lucia. (The main results are shown in Table 3.5.) The conclusion is that costs are generally related to simple geographical parameters such as volume of snail habitat and distance between habitats. In addition rainfall patterns and the cost of chemicals (which varied widely from one location to another) have an impact.

Similarly, the cost of a chemotherapy programme would be influenced heavily by the prevalence of infection, whereas the costs of a water supply programme depend on topography and location of housing. Jobin points out that the villages in the Gezira (Sudan) are well organised and the water table is only 15 metres below the surface; thus water supply should be much less expensive in the Gezira than in St. Lucia, which is a mountainous area with a dispersed population. In particular, some locations would probably require electricity for pumping rather than relying on gravity feed.

Table 3.5 Comparison of Molluscicide Programme Costs for Ten Schistosomiasis Control Projects

(Source: Jobin, 1979)

Country	Puerto Rico				Brazil				Egypt Kom El-Hirka	Iran Dez Scheme	Tanzania Mtsongwi
	Vieques	Patillas	Guayama Arroyo	St. Lucia Cul-de-Sac	Sao Lourenço	Ribeiro Horizonte	Taquarandi	Irrigation			
Hydrology	Natural	Natural and irrigation	Natural and irrigation	Natural	Natural	Natural and irrigation	Irrigation	Irrigation	Irrigation	Irrigation	Natural
Annual rainfall (cm)	115	179	140	250	150	160	50	30	30	30	100
Controlled area (km <sup>2</sup> )	130	122	207	18	80	200	2.5	52	220	220	100
Population	8,400	17,100	47,000	6,000	4,280	20,000	1,500	17,000	18,000	18,000	4,300
Annual volume of snail habitat treated (m <sup>3</sup> )	65,000	89,000	106,400	182,000	80,000	39,000	15,000	1,354,000	500,000	500,000	200,000
Habitat volume per surface area (m <sup>3</sup> /km <sup>2</sup> )	500	739	514	10,000	1,000	195	6,000	16,000	2,300	2,300	2,000
Population density (persons/km <sup>2</sup> )	64	140	277	333	54	100	600	330	82	82	43
Habitat volume per person (m <sup>3</sup> )	7.8	5.2	2.3	30	18.5	2.0	10	80	28	28	46
Annual cost in 1972 U.S. dollars	\$13,000	\$17,000	\$20,000	\$25,000	\$32,000	\$10,000	\$1,500	\$58,600	\$17,000	\$17,000	\$4,178
Annual cost per 100 m <sup>3</sup> treated	\$20	\$19	\$19	\$17	\$40	\$26	\$10	\$1.40	\$3.40	\$3.40	\$2.10
Annual cost per km <sup>2</sup>	\$100	\$139	\$97	\$1,700	\$400	\$50	\$600	\$1,130	\$77	\$77	\$42
Annual cost per person	\$1.50	\$1.00	\$0.43	\$4.00	\$7.40	\$0.50	\$0.70	\$3.45	\$0.94	\$0.94	\$0.75
Program cost breakdown labor	65%	61%	11%	50%	80%	50%	36%	5%	6%	6%	25%
Molluscicide	3%	6%		12%	10%	11%	40%	85%	19%	19%	25%
Transport and equipment	7%			16%	5%	15%	24%		21%	21%	
Supervision	22%			16%							
Others	3%	33%	89%	6%	5%	24%		10%	54%	54%	75%

It is therefore possible to begin to identify, from the range of published work, the factors which are likely to affect the costs and effectiveness of alternative control strategies in different locations. These are:

- the dispersion of the snail population;
- the dispersion of the human population;
- the nature of the terrain;
- the stability of, and likely co-operation from, the local inhabitants;
- the level of infection of schistosomiasis in the local population;
- the total cost of chemicals, pharmaceuticals and labour.

### 3.4 Screening for disease in the developed Commonwealth

In the developed Commonwealth there are not evaluations of primary health care 'projects' in the same way as in the developing countries. Perhaps the closest example to a 'project' in the primary health care field is the nurse practitioner programme established in some Canadian provinces, which was evaluated from an economic viewpoint (Batchelor et al, 1975). However, the normal pattern in the developed countries of the Commonwealth is for the range of activities in primary health care to expand or change as medical knowledge progresses. Therefore, for the final case study we have selected a topic area, screening for disease, rather than a project, in order to illustrate what can be learned from the economic evaluation of PHC activities in developed countries. Screening has been chosen since there is a

sizeable economic evaluation literature from a number of countries and because this is one area of medicine that the developing countries in the Commonwealth may increasingly consider as their income per capita rises. Indeed, since one of the economic arguments for screening is that it saves more resources than it consumes, it may be one PHC activity that some are actively considering now.

It can be seen from the review of the literature in developed countries (Section 2.1.2) that screening activities have been a popular topic for economic evaluation. The basic choice is between screening and treating the disease at the asymptomatic stage, or waiting until symptoms develop and then employing a curative approach. These were the options examined by Pole (1971) in the case of tuberculosis in Britain. The usual economic logic for screening is that a 'stitch in time saves nine'; that is, the costs of letting the disease progress may far exceed the costs of screening and early intervention. In a recent review, the Health Economics Research Unit of the University of Aberdeen (1985) spells out in more detail the kinds of questions economic studies have sought to answer, namely:

- would screening produce a net saving of health service resources? (and if not, what would be the net cost?)
- would screening produce a net saving of society's resources? (and if not, what would be the net cost?)
- would the value of all the benefits of screening (both tangible and intangible) exceed the value of all the costs (both tangible and intangible)?
- what would be the cost per life year (or per quality-adjusted life-year) gained by screening?

- what would be the least costly method or strategy of screening for some disease?
- what would be the most effective way of spending a given budget on screening for some disease?
- what would be the extra costs of obtaining greater screening effectiveness?

Our literature review has identified 16 economic evaluations of screening programmes undertaken in Commonwealth countries. Many of these were mentioned in Section 2.1.2. above. The main results of the studies are summarized in Table 3.6. In the discussion below a number of general lessons are drawn.

#### **Which individuals to screen?**

One of the main issues in mounting a screening programme is the choice of the population to screen. Most of the literature distinguishes between programmes for the general population and those for people of high risk. The features that delineate high risk individuals will differ from disease to disease, but are usually related to age or sex, previous family history of the disease, or likely exposure due to place of residence or lifestyle.

It is obvious that the costs and benefits of the screening programme will be highly dependent on the prevalence of the disease in the population screened and an economic approach to screening would usually seek to devise guidelines for who should be screened. For example, in Britain the screening of pregnant women for Down's syndrome and screening for cancer of the cervix are both advised for older age groups. However, whereas guidelines may state that screening should be restricted to high risk groups it may be difficult to enforce these in practice.

Table 3.6 Economic Evaluations of Screening for Disease in the Developed Commonwealth

<u>AUTHOR (DATE)</u>	<u>COUNTRY</u>	<u>PROGRAMME(S) EVALUATED</u>	<u>MAIN RESULTS</u>
Pole (1971)	Britain	Mass miniature radiography	Benefits amount to only 50% of costs
Webb <u>et al</u> (1973)	Canada	PKU screening in newborns	Costs of identifying and caring for a child through screening much less than the costs of institutionalization
Thorn <u>et al</u> (1975)	Britain	Screening for cancer of the cervix	Costs of detecting and treating each pre-clinical case were less than that of inpatient treatment of each clinical case
Hagard and Carter (1976)	Britain	Prenatal diagnosis of Down's syndrome	Potential economic benefits were greater than, or equal to, the costs for women aged 35 and over
Hagard <u>et al</u> (1976)	Britain	Prenatal diagnosis of spina bifida	Screening would only be worthwhile on economic grounds in populations where the incidence is high. However, other factors need to be considered
Rich <u>et al</u> (1976)	Britain	Two methods of screening school children for asymptomatic bacteriuria	An unsupervised test was cheaper but did not give good yields for low income groups
Simpson <u>et al</u> (1978)	Britain	Alternative screening test combinations for breast cancer	The choice of test depended crucially on judgements about the value of the screen outcomes and not just on sensitivity, specificity and cost of the tests
Komrower <u>et al</u> (1979)	Britain	PKU screening in newborns	Net health service resource saving
Veale (1980)	New Zealand	PKU screening in newborns	Averted health service costs were greater than the costs of screening under most assumptions
Logan <u>et al</u> (1981)	Canada	Screening and treatment for hypertension	Treatment at the worksite was more cost-effective than treatment by physicians in the community
Henderson (1982)	Britain	Screening for open spina bifida	Tangible benefits of the programme probably exceed the tangible costs by about £1m per 100 births averted per year
Gravelle <u>et al</u> (1982)	Britain	Alternative combinations of screening tests for breast cancer	Mammography (with the result read by a senior radiologist) was the most cost-effective option in terms of net health service cost per life year gained
Mooney (1982)	Britain	Alternative ways of screening for breast cancer	Mammography plus one clinical examination was the most cost-effective option
Henderson <u>et al</u> (1984)	Britain	Screening for congenital toxoplasmosis	Screening would be unlikely to save resources except under the most optimistic assumptions
Hibbard <u>et al</u> (1985)	Britain	Five options for screening for open neural tube defects	Ultrasound plus amniocentesis (where indicated) was the most cost-effective approach. Screening would cost £7000 per birth averted at an incidence of 25/1000
Williams (1985)	Britain	Screening for syphilis during pregnancy	The benefits in cost savings to the NHS were an order of magnitude greater than the costs of the programme
Medley and Drake (1982)	Australia	Screening for cervical cancer	Two avenues can assist in reducing the costs of screening; by reducing the population screened or the frequency of smears; or by simplifying sample collection, through the use of paramedical staff operating from caravans. However, any reductions in cost need to be balanced by effectiveness considerations

For example, in the case of screening for cancer of the cervix in Britain, general practitioners receive payment only for Pap smear tests performed at 5 yearly intervals and on older women. Nevertheless, few doctors are likely to turn away a patient not meeting these criteria but who would like to be screened. Indeed one might argue that reassurance of well women is a legitimate economic benefit; however, since most screening tests have false positives and false negatives associated with them, the reassurance from a true negative result has to be balanced against the distress and further testing which may follow a false positive.

#### **How often to screen?**

The issue of frequency of screening was mentioned above. Clearly an optimum policy would need to consider the likelihood of detecting disease at different intervals, based on what is known about its aetiology. To our knowledge no economic evaluations undertaken within the Commonwealth address this issue. The best work is that by Eddy (1980) in the USA, who has analyzed the question of frequency for a variety of cancer screening tests. For example, using the best clinical information on the natural history, detection and treatment of cervical cancer, he found that administering Pap tests to adult women every three or four years would produce almost as much health benefit, measured in years of life saved, as administering them every year, and at less than a third of the cost. It has been argued that the preclinical course of cervical cancer is so long that, even with tests only every three or four years, the disease can be detected long before it would become clinically apparent (Russell, 1986). It can be seen that the economic conclusions in this field are crucially dependent on the underlying epidemiological data, which are often themselves in dispute. Unfortunately there are few randomized controlled trials of screening programmes. The

study by Cadman et al (1986) on developmental screening of school children in Ontario (Canada) is one of the few examples.

The issues of 'whom to screen?' and 'how often to screen?' illustrate one of the fundamental points in economics, that decisions depend on costs and benefits at the margin. That is, it is often not a question of whether a particular programme is worthwhile, but how much of it would be worthwhile. (For more discussion of this point see the general methodological discussion in Appendix 2).

#### **Which test to use?**

There are often choices among screening tests or the order in which they are applied. For example, should one use a cheaper, less accurate test initially, or go straight to the accurate 'gold standard' test which may be more expensive to apply but which may turn out cheaper in the long run? There are few studies in this field, but Simpson et al (1978) examined 15 alternative screening test combinations for breast cancer in Britain. They considered the health service resource use arising from the different options and the more intangible costs and benefits arising from test results (e.g. true positive, false positive, etc.) The authors did not intend to recommend a particular course of action, but did point out that the choice of test was crucially dependent on judgements about screening outcomes and not just on the conventional criteria such as sensitivity, specificity and cost. This is one area where more work is required and there are plans to investigate the utility to women of test outcomes in the choice between chorion villus sampling and amniocentesis in Canada (Fuller et al, 1985).

Another dimension to the choice of screening test is the possibility that once a basic screening programme has been mounted various kinds of 'add-ons' will be proposed. Veale (1980) warned against this in his economic evaluation of screening for phenylketonuria (PKU) in New Zealand. Whilst concluding that the benefits of screening justified the costs, he stressed that other elements of screening should not be added without economic evaluation. Presumably the fear is that once the first screening programme is mounted the tendency is for health professionals to argue that the marginal costs of adding other components to the programme are small. In many situations this may be the case, as has been shown in some of the evaluations of immunization programmes (see Section 3.2 above). However, policy makers should be alert to these arguments and request empirical evidence to justify the addition. For example, in Britain Hagard et al (1976) argued that ultrasonography should be a component of a screening programme for the antenatal detection of neural-tube defects (such as spina bifida) as it would confirm gestational age in women who were 'unsure of dates'. Subsequent analysis by Glass (1979) questioned whether the additional case finding, which was small, would justify the extra costs.

**Will there be compliance with the screening programme and the subsequent therapy?**

Another 'add-on' proposed by Hagard et al (1976) in their screening programme for antenatal detection of neural tube defects was a publicity campaign to ensure high compliance with the screening programme by women and their family physicians. Compliance is often a major problem in the screening field since the individual is not suffering any discomfort at the time. Certainly Roberts et al (1983) found a much lower compliance rate with their programme as

applied in practice in South Wales, than that assumed by Hagard et al (1976).

In addition there may be problems of compliance with the therapy required after the detection of disease by screening. As mentioned earlier, termination of the pregnancy raises moral issues which will affect compliance. In other fields, such as hypertension, the side effects of therapy may cause patients to discontinue it. Weinstein and Stason (1976) pointed out that in the USA there may be greater economic benefits from developing methods to ensure compliance with therapy in already known hypertensives than further extending screening programmes to discover yet more hypertensives. The cost-effectiveness of a compliance-improving manoeuvre in hypertension using a specially trained member of the lay public has been examined by Mitchell et al (1983) in Canada. They found that the intervention did represent a worthwhile investment, in cost per mmHg of blood pressure reduction, when compared to other similar interventions.

#### **How equitable should screening programmes be?**

The discussion so far has been solely concerned with economic efficiency. However, there are other important dimensions of public policy, such as equity or fairness in the provision of health programmes. For example, is the programme available for all those whom could potentially benefit? Of course, equity may come at a price, in terms of reduced efficiency, and this was illustrated by a study of screening for asymptomatic bacteriuria in schoolgirls in Britain (Rich et al, 1976). They found that the most efficient test (in terms of cost per case detected) did not detect a very high proportion of cases in the lower socio-economic groups. (It was an unsupervised test that required a high level of understanding and cooperation by the children and their parents.) The authors therefore

pointed out this difficulty and suggested to policymakers that if equity criteria were important, perhaps a slightly more costly supervised test should be used. The same basic issue has arisen in the evaluation of some immunization programmes in the developing Commonwealth (Ponnighaus, 1980). On efficiency grounds one would not advise measles immunization in rural areas without a reliable electricity supply. On equity grounds one might be prepared to accept the lower cost-effectiveness of an extension of the immunization programme to such areas.

**What actions can governments take in this area?**

Despite the comments made above about lack of compliance by physicians and the general population, in principle screening programmes lend themselves to government action since they often require a coordinated effort with large resource commitments. The kinds of policies governments can develop mirror the choices outlined above; namely, to issue guidelines on:

- what diseases to screen for;
- which population(s) to screen;
- how frequently to screen;
- which screening test(s) to use?

These guidelines may be backed up by financial measures, such as providing funds to support only those activities in accordance with the guidelines or reimbursing physicians only for screening tests in conformity with the guidelines. As far as we know, the extent to which government policies in this field are based on economic evaluation is slight. There are some indications that in Britain economic analysis had some input to the derivation

of the policies on screening for spina bifida cystica and tuberculosis, although Pole's study of mass miniature radiography was carried out after a decision to discontinue the programme had been taken. More recently, however, the DHSS Working Party on breast cancer screening has economist input and the terms of reference for the Working Party include an obligation to examine the costs and benefits of alternative screening policies.

Our general conclusion is that if health ministries are to obtain more benefit from the economic evaluations that are carried out, they need to ensure that good methodological standards are maintained, that mechanisms exist for interpreting the results of studies for policy makers and that policy instruments exist to enable action to be taken on the basis of evaluation results. These issues are discussed in Section 4 below.

## 4. POLICY ISSUES

### 4.1 Do PHC activities justify their costs?

#### 4.1.1 Developing Commonwealth

The number of economic evaluations carried out in any one country is usually too small for outside observers to draw detailed conclusions on the value of investment in PHC as against investment in other areas of the health sector, though countries themselves can usually go some way towards assessing this issue by examining the relative costs of different interventions, even if they have little data on effects or benefits. Because international and national health policy makers over the last few years have been requiring evidence on the value of investment in PHC programmes and particular PHC activities, a number of reviews have been undertaken which attempt to synthesize the results of studies performed in a number of countries (Gwatkin *et al*, 1980; Grosse and Plessas, 1979; Phillips *et al*, 1985, Barlow and Grobar, 1986; Cochrane and Zachariah, 1983; Applied Communication Technology, 1985).

These comparative reviews encounter the problems discussed in Section 2.3 above, namely those of adjusting the figures to a common exchange rate and price base. In addition, comparison of the value of alternative health investments requires selection of an appropriate measure of effectiveness. Since many economic evaluations choose a measure of effectiveness appropriate for the particular health intervention being evaluated (e.g. number of immunized children for an EPI programme; number of case-years of infection prevented for a parasitic disease control programme) their cost-effectiveness ratios can be difficult to convert to a form appropriate for reviewers attempting a comparison between different health interventions.

Choices concerning the value of PHC can be reviewed at four different levels. One level is that of affordability; what is the cost of extending PHC of a particular pattern throughout the country and can it be afforded? If the answer is no, then consideration turns to whether an alternative pattern of PHC services would be less costly. A second level is that of choice between different PHC activities, to see which activities are most cost-effective and to help countries set priorities within PHC. A third level is that of choice between PHC and other health sector interventions, to consider the value of investing in PHC as opposed to other parts of the health sector. Some reasonable evidence is available on affordability, but evidence is limited on choices at the next two levels, especially the third. Finally, there is the question of the efficient delivery of the chosen set of PHC activities.

In the discussion below, the value of PHC activities is therefore considered in four different ways. Firstly, evidence is reviewed on the per capita cost of PHC programmes, expressed as an absolute sum or as a percentage of per capita national income, to give an indication of the affordability of PHC. Secondly, evidence is reviewed of the cost-effectiveness of two particular activities of PHC, immunization and oral rehydration, since a number of studies have been published in both of these areas. Thirdly, evidence is reviewed of the cost per death averted in a number of somewhat heterogeneous health programmes. The section concludes with a consideration of how to deliver PHC components efficiently.

#### **Can the per capita cost of PHC be afforded?**

Two main sources are available for reviews of the cost of PHC-type programmes, Gwatkin et al (1980) and Grosse and Plessas (1979). Gwatkin et al assessed the results of ten field projects which provided basic medical and nutrition services aimed at reducing infant and child mortality. Six of these had reasonable cost data. Grosse and Plessas examined the cost of primary health care systems in seven countries to help determine whether it is feasible to

provide a substantial proportion of the population of developing countries with PHC facilities at costs not higher than current government expenditure levels. Figures from these two reviews are presented in Tables 4.1 and 4.2. It should be noted that the Gwatkin et al annual costs are both capital and recurrent, whereas Grosse and Plessas present only recurrent costs on an annual basis, leaving investment costs as a lump sum outlay. No information on the year to which the costs apply is available in Grosse and Plessas. The 'Narangwal' data referred to in both tables provide information on different components of the same research programme.

Gwatkin et al concluded from their survey that PHC-type programmes can cost less than 2% of annual per capita GNP. The Grosse and Plessas figures for the research/demonstration projects are of a not dissimilar order of magnitude. However, Grosse and Plessas argue that the large-scale service programmes had significantly lower recurrent and capital costs. They were all Ministry of Health-run programmes, whereas the demonstration projects were all (except one) designed by American universities which were involved in the research activities of the projects. Drawing a conclusion on the likely cost of large-scale PHC programmes is, however, still difficult, since it is not clear to what extent the large-scale programmes are providing effective PHC services. For instance, where a programme provides primarily curative services, it is possible for frequent health service contacts to be accompanied by high morbidity and mortality rates in the community since patients are treated by the health service only to fall ill again when they return to their homes. A further possibility is that in the large programmes health service resources may be spread so thinly that they may have little effect on health since staff are overstretched, drugs scarce, and so on. Thus the best estimate we have is still that effective PHC programmes may cost the health sector around 2% of annual per capita GNP. In this

Table 4.1 The Costs of Six Primary Health Care Projects Reviewed by Gwatkin et al

<u>Location</u>	<u>Type of Project</u>	<u>Population covered</u>	<u>Price base (yr)</u>	<u>Annual per capita cost (% of per capita annual income) (a)</u>
Imesi, Nigeria	Service	6,000	1966	\$1.50 (2.0%)
Etimesgut Turkey	Pilot	55,000	1968-74	\$6.50-7.50 (1.5-2.0%)
Narangwal, India	Research Pilot	10,500	1970-73	\$0.80-2.00 (0.8-2.0%)
Rural Guatemala II	Research	3,000	1969-77	\$3.50 (0.75-1.0%)
Jamkhed, India	Service	40,000	1978	\$1.25-1.50 (1.00-1.25%)
Kavar, Iran	Pilot	8,200	1975	\$3.50-5.35 (0.4-0.5%)

(a) Recurring plus capital costs

Adapted from Gwatkin et al (1980)

Table 4.2 The Costs of Seven Primary Health Care Projects Reviewed by Grosse and Plessas

<u>Location</u>	<u>Type of Project</u>	<u>Population covered</u>	<u>Annual recurrent cost per capita</u> <u>(% of per capita GNP)</u>	<u>Investment cost per capita</u>
Afghanistan	Large scale service	1.555m	\$0.60 (0.3%)	\$0.70
Dominican Republic	Large scale service	0.651m	\$2.70 (0.4%)	\$1.90
Tanzania	Large scale service	12.000m	\$1.00 (0.6%)	\$0.22
Montero Bolivia	Research/ Demonstration	0.011m	\$15.40 (3.9%)	\$19.80
Cali Columbia	Research/ Demonstration	0.022m	\$9.80 (1.6%)	N/A
Danfa Ghana	Research/ Demonstration	0.015m	\$8.50 (1.5%)	\$32.8
Narangwal India	Research/ Demonstration	0.011m	\$6.10 (3.4-4.1%)	\$5.40-6.00

Adapted from Grosse and Plessas (1979)

estimate, basic and village-level health services are included, but water and sanitation excluded. A recent study attempting to include all costs (capital, recurrent and training) estimated that annual expenditure of up to 5% of GNP would be required to achieve Health for All based on the essential elements of PHC including MCH and immunization, plus water and sanitation (Patel, 1986).

These costs are by no means inconsiderable. A recent review of health expenditure patterns suggests that low income countries spend between 1% and 2% of GNP on all publicly provided health services (excluding water and sanitation), and lower middle income countries approximately 2% to 3% (de Ferranti, 1984). Thus spending up to 2% of GNP on primary health care implies either a substantial shift in resource allocation patterns, or a substantial increase in resources for the health sector. However, admittedly scanty evidence suggests that adding private to public health expenditure at least doubles the percentage of GNP spent on health care (de Ferranti, 1984). Thus the outlook for PHC is more hopeful if a combination of sources of finance (i.e. both public and private) can be drawn upon, or if it is possible to tap, for publicly-provided PHC, some of the household resources at present used to purchase private sector health services.

**What is the evidence on the cost-effectiveness of the PHC activities of immunization and oral rehydration?**

The second area reviewed here is the cost-effectiveness of two particular PHC activities. Phillips et al (1985) have summarised the cost-effectiveness of EPI programmes, using the measure 'cost per fully immunized child'. Since most of the studies reviewed concentrate on cost analysis, it is not easy to move beyond this measure to a cost per case or death averted. Table 4.3 summarises the results of the international comparison, expressing the figures in 1982 US dollars. Delivering the full EPI schedule of

Table 4.3 Comparative Vaccination Cost per Fully Vaccinated Child

<u>Country</u>	<u>Vaccines delivered</u>	<u>Strategy</u>	<u>Cost per fully vaccinated child (local currency &amp; date)</u>	<u>Cost per fully vaccinated child (\$US 1982 equivalent)</u>
Brazil	Full EPI	(i) routine (static)	4671 cruzeiros (1982)	26.0
	Full EPI	(ii) intensification (outreach)	1579 cruzeiros (1982)	8.8
	Polio	(iii) campaign (mobile)	378 cruzeiros (1982)	2.1
Cameroon	Full EPI	mixed (static/mobile)	2758 francs (1981)	9.5
Gambia	Full EPI	mixed (static/mobile)	38 dalasi <sup>1</sup> (1980/81) 24 dalasi <sup>2</sup> (1980/81)	19.2 12.0
	Full EPI	(i) outreach (ii) mobile	41 cedi (1979) 12 cedi (1979)	154.0 45.5
Indonesia	BCG, 2 DPT	mixed (static/mobile)	1412 rupiah (1979)	2.6
Ivory Coast	Full EPI	(i) mobile unit - Abengourou	2628 francs (1980/81)	8.9
		(ii) static centres - "	5432 francs (1980/81)	18.5
		(iii) static centres - Abidjan	1880 francs (1980/81)	6.4
Kenya	Full EPI	static	150 shillings (1981)	16.6
Philippines	BCG, 2 DPT	outreach	30.12 pesos (1978)	6.2
Thailand	BCG, 2 DPT	mixed (static/mobile)	217.3 baht (1979)	13.2

1. The full EPI schedule includes BCG, DPT, Polio and measles vaccines
2. With expatriates
3. Without expatriates

Source: Phillips et al (1985)

immunizations cost between \$6.4 and \$26.0 per fully immunized child. (The Ghana figures have been excluded from this range because over-valuation of the cedi makes the dollar cost unreliable.)

A similar type of comparison has been made for programmes designed to encourage the use of oral rehydration therapy (Applied Communication Technology, 1985). Here, however, costs were expressed not only as per capita of the target population (children) but also as per death averted. The results are shown in Table 4.4. Costs have been adjusted to a price base of 1985.

The figures suggest that oral rehydration can be a relatively cheap intervention in terms of cost per child and cost per death averted. A notable feature, however, from both Table 4.4 and Table 4.3, is the variation in the costs. For immunization, where the technology is reasonably standardized and known to be effective if properly administered, costs per child for the full EPI schedule vary four-fold between the least costly and the most costly (excluding Ghana). For oral rehydration, however, costs and deaths averted vary over twenty-fold, and cost per death averted eighty-five-fold. Much of the explanation for this variation presumably lies in different technologies used to encourage the use of oral rehydration and varying responsiveness of the target population.

This evidence on the variation in the costs of programmes targeted at similar diseases is supported by an extensive review of the costs and benefits of controlling parasitic diseases (Barlow and Grobar, 1986). For instance, they quote costs (1984 prices) of mollusciciding projects directed against schistosomiasis varying between \$9.28 per case-year prevented (Iran) to \$84.23 (St. Lucia). The range for vector control projects directed against malaria was \$1.88 to \$92.10 per case-year prevented. This

Table 4.4 Comparative Cost-effectiveness of Oral Rehydration Projects based on Diarrhoea-associated Deaths

<u>Project or site</u>	<u>Country</u>	<u>Cost per child per year (1985 \$)</u>	<u>Deaths averted per 1000 children</u>	<u>Cost per death averted</u>
Matlab Hospital	Bangladesh	0.50	4.04	\$124
Sukawati	Indonesia	1.14	6.97	\$163
Darmaraja	Indonesia	1.50	8.46	\$177
Mass Media	The Gambia	1.56	6.94	\$224
Bandung	Indonesia	0.92	3.25	\$283
Campurdarat	Indonesia	1.38	4.73	\$291
Salt/Sugar Home	Egypt	4.76	8.20	\$580
Oralyte Home	Egypt	4.99	7.80	\$639
Mass Media	Honduras	4.14	5.16	\$802
Salt/Sugar Pre.	Egypt	9.99	7.00	\$1427
Oralyte Comm.	Egypt	5.56	2.00	\$2780
Con 2-Awareness	Egypt	4.24	0.40	\$10600

Source: Applied Communications Technology (1985)

variation cautions strongly against placing excessive reliance on individual cost-effectiveness estimates where the programme technology, content and effectiveness can vary considerably, and emphasises the need for each country to evaluate the likely cost-effectiveness of a particular programme in its own circumstances and given its chosen technology.

It is also important to stress that some variation in cost-effectiveness results is likely to stem from differences in study methodology. It is therefore extremely important to review the methodology of studies, and particularly to consider whether costs have been calculated appropriately, whether any significant cost items have been omitted, and whether effectiveness estimates are realistic and based on adequate evidence.

**How does the cost-effectiveness of PHC programmes compare with other health programmes?**

To complete this review of international comparisons of the value of PHC, it is useful to end with some cross-programme comparisons of cost-effectiveness, though they must be interpreted with great caution and in the light of the comments on international variations made above. Cochrane and Zachariah (1983) have reviewed the cost-effectiveness of programmes designed to reduce mortality and their results are shown in Table 4.5. No attempt has been made to convert the costs to a common year. In general, PHC-type programmes such as Narangwal, and PHC activities such as immunization and oral rehydration (see Table 4.4) appear as 'good buys' for the health sector relative to hospital care, malaria control or improvements in water and sanitation. Data are lacking, however, to judge how sensitive such conclusions might be to variations in cost (for instance the cost of malaria control is likely to vary enormously between countries depending on the control measures required and their means of delivery) and to variations in

Table 4.5 Cost Per Death Prevented Through Different Health Interventions

<u>Author</u>	<u>Intervention</u>	<u>Country</u>	<u>Cost Per Death Prevented</u>
Shepard (1982)	Measles immunization (includes all joint costs of a programme of polio, DPT, BCG and tetanus)	Ivory Coast	\$490
Barnum <u>et al</u> (1980)	Total immunization programme	Indonesia	\$130
	BCG programme only		\$445
	DPTT programme only		\$135
	BCG added to existing programme		\$101
	DPTT added to existing programme		\$77
Barlow (1976)	Mass vaccination	Morocco, 1971	
	BCG		\$24
	DPTT		\$38
	Polio		\$1,100
Barnum (1980)	Immunization total	Kenya	\$85
	DPT, TT, BCG only		\$274
	Measles only		\$50
	Polio only		\$6,357
	DPT, TT, BCG		\$69
	Measles added to existing programme		\$26
	Polio added to existing programme		\$568
	New births only		\$70
Barnum & Yaukey (1979)	Health programme separate	Nepal	\$508
	Integrated with family planning		\$271
Faruqee & Johnson (1981)	Nutrition programme prenatal	Narangwal, India	\$7.75
	Health care - infant		\$25.00
	- child		\$31.00
Barlow (1976)	Hospital	Morocco, 1971	
	Large		\$2,640
	Medium		\$2,820
	Small		\$2,360
Horton & Claquin (1982)	Hospital treatment for diarrhoea	Bangladesh	
	Sotaki		\$187
	Matlab		\$1,262-
			\$1,352
Prescott (1980)	Malaria eradication (Spraying and drugs)	Bangladesh	\$809-
			\$25,090
Walsh & Warren (1979)	Mosquito control - malaria (infant and child)	Cross-country analysis	\$600
	Community water supply, sanitation		\$3,600-
			\$4,300
	Selective primary health care		\$200-
			\$250

Adapted from Cochrane and Zachariah (1983)

effectiveness (for instance countries with high mortality levels can potentially achieve a larger absolute reduction in mortality than countries where mortality rates have already fallen). In addition, the figures should be treated as only a very rough guide to cost-effectiveness since the measure 'deaths prevented' quantifies only a part of the health effects of the various interventions, and presumes that mortality reduction is the overriding objective of health policy makers. Measures such as the 'quality adjusted life-year' discussed in Section 1.3 are preferable, but as yet little used in developing country studies.

### **How can PHC be delivered more efficiently?**

Given that PHC appears to offer good value for money, attention should therefore turn to how best to deliver a chosen set of PHC activities. A number of choices face decision makers designing a PHC programme, such as choice of target group; choice of the public or private sector for the delivery of supplies such as essential drugs and contraceptives; choice of intervention both between PHC activities (e.g. family planning, immunization) and within a particular activity (e.g. choice of contraceptive method); choice of delivery strategy (e.g. integrated/non-integrated, and static/mobile), and choice of place of intervention such as health centre or patient's home. Such choices can drastically affect both the costs and effectiveness of PHC programmes, and careful evaluation of the choices can help determine the design of an efficient and effective PHC system. However, very little attention has been paid to these questions in economic evaluations. Tentative conclusions are possible only in the area of choice of delivery strategy. There is now considerable evidence, reviewed earlier, that integration of services can bring benefits both in terms of increased effectiveness and reduced costs, providing that the efficiency of the newly integrated programme can be maintained. However, there is less evidence on whether integration is more appropriate for some services (e.g. child care) than for others (e.g. malaria control).

Also in the area of choice of delivery strategy, evidence is accumulating on the relative costs of fixed versus mobile strategies, for instance for immunization. Unfortunately, no clear-cut policy recommendations have emerged. Mobile strategies appear to offer a cheap way of achieving high levels of coverage in the short term, but may provide a more limited range of benefits than immunization services that are integrated with other PHC services, and may be difficult to sustain in the long term.

#### 4.1.2 Developed Commonwealth

In developed countries PHC is seen as an important gatekeeper, controlling the use of expensive secondary care services. For example, the prevention of illness can be justified by the averted costs of hospitalization or medical services, the effective treatment of minor ailments by family physicians can avert the need for specialist services and the existence of good community services for the elderly, mentally ill and mentally handicapped can obviate the need for institutional care. There is also a general belief that treatment in the community is preferred by patients.

However, PHC has to compete with secondary care for scarce resources. Treatment for life-threatening conditions in the hospital often presents as a more immediate problem requiring quick action and arousing public sympathy. In addition, the rapid technological change in medicine, which shows no sign of abating, means that scarce resources are increasingly drawn into secondary care in spite of stated priorities for prevention, primary health care and care for disadvantaged groups such as the elderly or mentally ill.

Therefore, despite the general belief in the efficacy of primary health care in developed countries, there is still a need for expenditure in this area to be justified if PHC

is to compete satisfactorily with suggestions for more investment in secondary care. More precisely three issues can be addressed:

- does PHC provide a feasible and more cost-effective alternative to secondary care in the prevention or treatment of certain common conditions?
- is PHC being organized as efficiently as possible?
- what would be the relative value for money of greater investment in PHC as compared to other potential uses of the same resources?

These are discussed in turn below.

**Does PHC provide a feasible and more cost-effective alternative to secondary care?**

One general message from the review of evidence presented in Section 2.1.2 and the case study presented in section 3.4 is that one would be unwise to answer this question in global terms, since the costs and benefits of PHC activities depend crucially on how these are applied and on the existence of secondary care alternatives. However, the general picture is that most of the PHC activities that have been evaluated from an economic viewpoint perform well when compared with the alternatives.

In the field of primary prevention, most of the vaccination programmes evaluated have shown direct benefits (in health service resource use averted) in excess of the costs of mounting the programme. The only qualifications to be made to this overall conclusion are as follows:

- (i) Some vaccination programmes raise ethical issues since a minority of individuals may suffer harmful side effects (e.g. pertussis vaccine).

(ii) One should carefully examine proposals for expansion of existing programmes to larger populations since the marginal costs may rise significantly while the marginal benefits may remain constant (e.g. extension of influenza vaccination programmes beyond high risk groups).

(iii) Vaccination programmes, while having the potential to save resources, may be an add-on to health care expenditure unless concerted efforts are made to reduce the supply of certain resources (e.g. hospital beds). Therefore proposals to mount new programmes on economic grounds should have an associated managerial plan for rationalising the use of freed resources.

The other major topic in primary prevention is that of health promotion. Here the evidence for the effectiveness of programmes, and hence their ability to generate benefits in improved health and in resource savings, is less convincing (Russell, 1986). Therefore governments would be advised to make evaluation a more central component of these programmes than has been customary to date.

In the field of secondary prevention, activities in screening for disease were reviewed in Section 3.4. In general the results favour the adoption of screening programmes on economic grounds. However, as in the case of vaccination programmes, several qualifications should be made.

(i) As with vaccination programmes, managerial initiatives are probably required to ensure that freed resources are put to good alternative uses, or the supply of resources reduced.

(ii) The choice of population to be screened, frequency of screening and type of screening test all crucially affect costs and benefits. (e.g. in Canada it was argued that the health examination should be periodic rather than annual, and targeted rather than general.) Also, in

Ontario there has been debate about the appropriate number of well-baby visits that should be funded under the provincial health plan.)

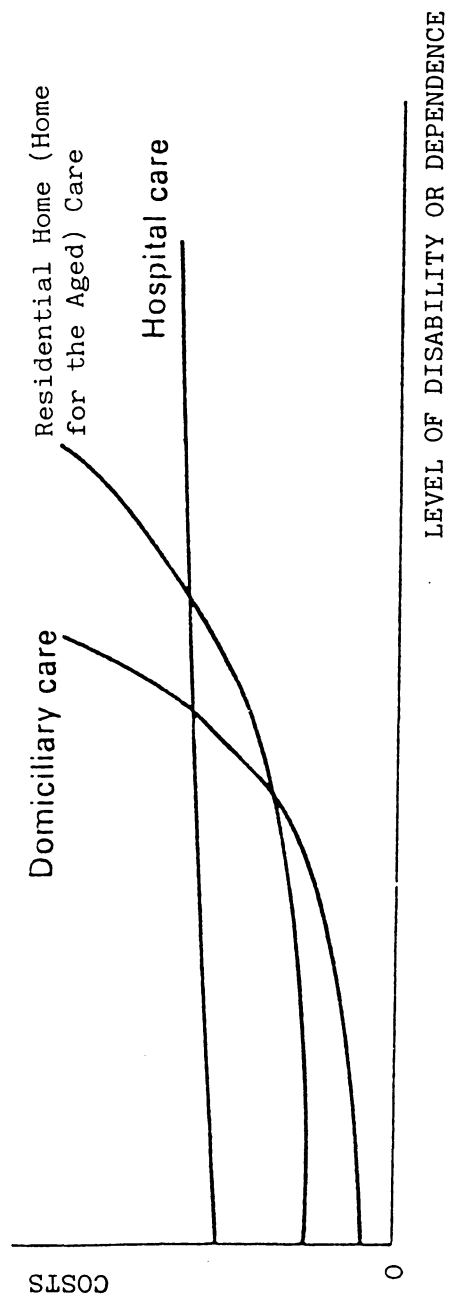
(iii) Screening of the unborn sometimes raises ethical issues. One approach would be to calculate the net impact of such programmes on health service resource use and government expenditure. Then, if the programme's financial benefits exceed its costs, one may be able to offer the programme and leave it to individuals whether or not they participate.

In the long term care field there is growing evidence that it is both feasible and more cost-effective to develop community based services for the elderly, mentally handicapped and mentally ill. The main issues that have so far arisen in the literature are as follows:

(i) The relative costs and benefits of community and institutional care depend crucially on the dependency of the patient. Care in the patient's own home may be of lower cost than the alternatives where the patient's dependency level is low. However, at higher levels of dependency the cost of domiciliary care can rise above that of institutional care. (See Figure 4.1) It is therefore important to undertake more assessments of dependency and cost of care in different settings, in order to estimate the 'break even' point(s) and to explore the extent to which higher funding for community care programmes might be justified on the grounds of higher benefits.

(ii) Many economic evaluations of community care programmes have not paid sufficient attention to costs borne by the family and the burden on the care-giver. Research is now underway (Mohide et al, 1985) which may throw some light on these issues.

Figure 4.1 Alternative Forms of Care for the Elderly: the variation of cost with level of disability  
(Source: Drummond, 1980)



(iii) Community care programmes for the elderly, mentally ill and mentally handicapped require the co-ordination of a number of public and voluntary agencies. There needs to be more research into ways of achieving more effective co-ordination and into the role that budgetary incentives might play in bringing about a more efficient delivery of services (Maynard and Smith, 1983).

#### **Is PHC being organised as efficiently as possible?**

Even if PHC activities compare favourably with other health care alternatives, there is still a need to ensure that the PHC activities themselves are operating as efficiently as possible.

One point has already been made; namely, in the long term care field much could be gained from better co-ordination of the different agencies providing care. The initiatives here can be organisational, by perhaps setting up a system whereby the needs and dependency of patients are adequately assessed and therefore appropriate placement made, or financial, whereby budgetary responsibility for caring for the patients concerned is vested in one organisation, which would then buy in care from a range of appropriate agencies (Wright, 1984). Or, as a third approach, two agencies can be given financial incentives to plan and deliver services jointly. This is the philosophy behind joint financing schemes between health and local authorities in Britain, where funds are specifically allocated for joint initiatives.

Second, an assessment of the operation of family practice ought to be made in order to ascertain whether it could be made more efficient by:

- delivering existing services at lower cost, perhaps by the use of different types of manpower, or controlling prescribing costs;

- increasing the range of services provided, stressing preventive and health promotion activities;
- using expensive diagnostic and secondary care facilities more carefully.

As was mentioned earlier, several initiatives have already been taken in this area in the Commonwealth. In Canada the nurse practitioner project demonstrated the possibilities for using other forms of manpower and there has been some experimentation with pre-paid group practice, as in New Zealand. In Britain a recent consultative document (DHSS, 1986) suggests that general practitioners will be given incentives to provide a wider range of services and also there have recently been attempts to control prescribing costs. However, no Commonwealth country has yet experimented with consumer choice health plans as has been done in the USA (Enthoven, 1985). Under these schemes individuals are given a choice of forms of health care cover, which may vary in price and range of service (subject to certain minimum criteria being met). The objective is to encourage more competition among the suppliers of health care, with a view to increasing efficiency. The advantages and disadvantages of such an approach require further investigation in different country contexts.

**What would be the relative value for money of greater investment in PHC?**

The key to answering this question is in the development of a method for comparing the benefits of disparate health programmes. The best method so far developed is that discussed in the paper by Torrance and Zipursky (1984). Their interest was in whether antepartum administration of anti-D gamma-globulin, which would result in a net cost to the health care sector, represented a good use of resources when compared to other possible health care

programmes. In order to address this issue they calculated the cost per quality-adjusted life-year (QALY) gained by the anti-D programme and compared this with similar indices for some alternatives. These had been calculated in other studies in Canada and the USA (see Table 4.6). It can be seen that the anti-D programme, which it had been argued was too expensive, gives relatively good value for money when compared with some of the alternatives. Other PHC activities shown in Table 4.6 are PKU screening, treatment of hypertension and the school tuberculosis testing programme. There are obviously a number of qualifications that need to be made. The studies whose results are compared were undertaken in different locations at different times and may have employed different methodologies. Also, the QALY measure, whilst rapidly gaining wider acceptance, is still a subject of discussion and debate. In particular there needs to be more exploration of the methods of calculating QALYs and the different values placed on the utility of health states by different sections of the population (e.g. professionals, patients, members of the general public). Finally, it may be that there are other factors that policy makers also wish to take into account when deciding on the priorities for health service investments, such as the number of people having access to the programme, its overall cost and affordability, and the fairness (or equity) in the allocation of resources to different sections of the population.

However, the usefulness of such 'league tables' of the costs and benefits of health care programmes is likely to become greater as more evaluations are undertaken and as evaluation methods are improved. Whilst not forming the total basis for health care decisions, they should give policy makers a broad indication of the relative value for money from investments in PHC and other forms of health care.

Table 4.6 Comparative Cost-Utility Results for Selected Health Care Programmes\*

PROGRAM	REPORTED COST/QALY* GAINED IN U.S. DOLLARS (year)	ADJUSTED‡ COST/QALY† GAINED IN U.S. DOLLARS 1983
PKU screening	< 0 (1970)	< 0
Postpartum anti-D	< 0 (1977)	< 0
Antepartum anti-D	1220 (1983)	1220
Coronary artery bypass surgery for left main coronary artery disease	3500 (1981)	4200
Neonatal intensive care, 1000–1499 gm	2800 (1978)	4500
T4 (thyroid) screening	3600 (1977)	6300
Treatment of severe hypertension (diastolic $\geq$ 105 mm Hg) in males age 40	4850 (1976)	9400
Treatment of mild hypertension (diastolic 95–104 mm Hg) in males age 40	9880 (1976)	19,100
Estrogen therapy for postmenopausal symptoms in women without a prior hysterectomy	18,160 (1979)	27,000
Neonatal intensive care, 500–999 gm	19,600 (1978)	31,800
Coronary artery bypass surgery for single vessel disease with moderately severe angina	30,000 (1981)	36,300
School tuberculin testing program.	13,000 (1968)	43,700
Continuous ambulatory peritoneal dialysis	35,100 (1980)	47,100
Hospital hemodialysis	40,200 (1980)	54,000

\*These studies use similar, but not identical, methods. Generally, costs are net health care costs; however, discount rates and preference weights are not completely consistent. Differences in methods should be considered when comparing the relative cost-utility.

†QALY denotes quality-adjusted life-year.

‡Adjusted to 1983 dollars according to the US Consumer Price Index for Medical Care for all urban consumers. Source: US Bureau of Labor Statistics, *Monthly Labor Review*.

#### 4.2 How should studies be commissioned?

One of the major findings from this review is that governments are not very active in commissioning research into the costs and benefits of PHC activities. In the developing countries it is often international agencies such as WHO or the World Bank that take the lead. In the developed countries of the Commonwealth much is left to the initiative of independent researchers to identify the problem area, to design the study and to seek funding (either from the Ministry of Health, research councils, or agencies providing health care).

Whilst the activities of international agencies and independent researchers should continue to be encouraged, Ministries of Health are much more likely to receive policy relevant results if they either undertake more economic evaluations in-house, or play a more active role in commissioning studies. Apart from ensuring that the most relevant problem areas are investigated, this approach would increase the commitment on the part of policy makers to use the results, although other considerations may prevent the wholesale adoption of study recommendations on every occasion.

Whether Ministries undertake evaluations in-house or commission them from universities or other institutions, they will require some measure of economics expertise if they are to make the most of economic analysis. In commissioning studies it is important that Ministries are able to judge the methodological quality of research protocols and to interpret results intelligently. It is to be hoped that this report contributes in a small way towards this goal, although there is a broader need for educating policy makers in the potential and limitations of economic evaluation.

Given the overall limitations on the resources available to undertake economic evaluations, especially the skilled manpower required, it is important for Ministries to develop a policy for when to undertake economic analysis. For example, Williams (1974) suggested that economic evaluation is most likely to pay off in situations where (i) sizeable amounts of resources are at stake; (ii) responsibility is fragmented; (iii) the objectives of the respective parties are at variance or unclear; (iv) there exist alternatives of a radically different kind; (v) the technology underlying each alternative is well understood; and (vi) the results of the analysis are not wanted in an impossibly short time.

Clearly it does not make sense to devote considerable amounts of scarce resources to undertaking evaluations when there is little chance of better decisions being made. Managerial arrangements should therefore be in place to make it possible to act on study results. However, in many situations it may be more the way of thinking embodied in economic evaluation that is important. That is, economic evaluation provides a useful framework for thinking about choices in health care. A simple checklist of questions based on economic evaluation has been proposed for judging requests for health service developments (see Table 4.7). Only in a minority of cases may it be necessary to go further and to estimate costs and benefits of the alternative programmes although, as will be argued later, it is important to build an evaluation component into a broader range of health care activities.

#### 4.3 How should studies be conducted?

In situations where studies are carried out it is important that the key methodological principles are adhered to. These were set out briefly in Sections 1.3 and 2.2, and are given more fully in the Technical Appendix. Particularly important points to note are that

Table 4.7 Checklist of Questions Policy Makers should ask of any Proposal for Service Development (Source: Drummond, 1984)

### *Consideration of alternatives*

What is the main justification for the proposed service; what would be the consequence of doing nothing at all?

Does the proposal contain an explicit comparison of alternative treatments or programmes, or is the implicit alternative the existing service provision?

If a completely new alternative treatment or programme is proposed:

- is it adequately described?
- why was this particular option chosen?
- were other options rejected, if so why?

Would costs and benefits be substantially different if the proposed service provision were of a different scale? That is:

- if the service provision could be larger, what would be added and what would be the additional costs and benefits?
- if the service provision had to be smaller, what aspects of it would be cut and what would be the reductions in costs and benefits?

Is it claimed that the proposal will be partly self-funding, in that savings will be generated? If so, what specific actions need to be taken to realise such savings (e.g. closing hospital wards or whole institutions) and what are the likely resource costs associated with taking these actions?

### *Assessment of cost and benefits*

In evaluating the proposed service against alternatives, what range of costs is considered? Does this include:

- capital as well as revenue costs?
- costs other than those resulting in money expenditure (e.g. the opportunity cost of space denied other uses)?
- costs outside the immediate department where the service will be provided?
- costs on parties other than the Health Authority (e.g. patients, other public agencies)

What is known about the effectiveness of the health treatments or programmes discussed in the proposal?

- have these been evaluated by a randomized controlled trial or similar method?
- are there plans to monitor the effectiveness of any new procedures; if so, how?

### *Other important issues*

Does the proposal acknowledge any differences in the timing of costs and benefits between the alternatives assessed? If so, how is this dealt with in the proposal?

What are the main sources of uncertainty surrounding the proposal (e.g. in the effectiveness of new medical procedures, or in expected revenue costs or savings)?

- what happens to costs and benefits if the analysis is re-worked using more pessimistic assumptions?
- what could be done, perhaps at a slight increase in cost, to reduce uncertainty (e.g. by additional information gathering)?

The above checklist does not comprise a comprehensive range of questions. It is the intention that the questions themselves, and the responses they solicit, will suggest further questions pertinent to the evaluation of choices in the use of health service resources.

costs other than those falling on the Ministry of Health should be considered if the evaluation is being carried out from a societal perspective; the economic evaluation should be based on good medical evidence; and the sensitivity of study results to changes in the key parameters should be tested. Furthermore, the study results should be presented in a form that enables study methodology to be assessed. In this review it was often impossible to assess, from published material, how costs and benefits were estimated.

It has recently been suggested (Russell, 1986) that economic evaluation methodology should be standardised in order to facilitate comparisons across studies. This is probably some years away in the PHC field, given the controversy over some methodological issues. However, greater adherence to well accepted methodological principles should be encouraged.

Improvements in the quality of economic evaluation would be brought about if more Ministries had a policy for developing and supporting centres of excellence within universities or other local institutions. Given the comments above about basing economic evaluations on good medical evidence, multidisciplinary groups should particularly be encouraged. Even where international agencies bring in additional expertise, it is vital to have a local input to the evaluation to ensure relevance to the country concerned and the development of local expertise. In some countries this may require a concerted effort in the recruitment and training of economists with a special interest in the health field. Other countries may already have the necessary expertise.

In commissioning universities to undertake economic evaluations in the health care field, it is important that Ministries keep in close contact with the progress of the research in order to ensure relevance of the study results. It appears that this had been done with varying degrees of success in the studies reviewed.

#### 4.4 How should study findings be interpreted and implemented?

The discussion in Section 4.1 pointed out some of the difficulties in interpreting the results of studies conducted in different settings. Three points were emphasised: the need to be clear on the precise nature of the strategies evaluated in the study concerned; the need to appreciate the key methodological features of the study; and the need to interpret study results in the light of one's own circumstances. The issues still merit attention when interpreting the results of an evaluation conducted in one's own country. Many projects are carried out under ideal conditions which may not exist in other locations. Alternatively, research criteria may require that service activities are carried out in a more time-consuming way than might be the case in a normal service setting. This further emphasises the need for governments to have some measure of economics expertise available, if merely to interpret existing published studies rather than to undertake or commission further evaluations.

One major deficiency in the economic evaluations carried out to date is that analysts pay very little attention to the problem of extrapolating study results from one setting to another or from the research study to normal service delivery. It may therefore be important for national governments and international agencies to put more effort into developing methods for synthesizing study results, along the lines of the studies by Grosse and Plessas (1979), Barlow and Grobar (1980) and Torrance and Zipursky (1984) cited in Section 4.1 above.

This survey has thrown very little light on the issues of implementation of economic evaluation results. Clearly some of the recommendations made above, on the close involvement of policy makers in the commissioning and conduct of studies, may assist in the implementation of results. Previous surveys have shown that many

independent researchers undertake studies merely out of interest and are not concerned beyond publication of the results in a reputable journal (Drummond and Hutton, 1986). Ludbrook and Mooney (1984) point to further problems in implementation in Britain. These include the lack of awareness about economic evaluation, misconceptions about economic evaluation, the political framework in which decision making takes place, the potential threat to professional expertise and the practical and methodological problems in carrying out the evaluations themselves.

Certainly it has to be recognised that economic evaluations merely identify the potential for gains in economic efficiency. It may be that the costs of making the necessary managerial and organisational changes exceed the potential gains, or that other governmental objectives are more important. Therefore it is not irrational to reject study results providing the implications (in inefficient use of resources) are fully understood. Unfortunately policy makers usually have to take decisions without adequate information on the costs and benefits of health programmes. It is this information which economic evaluation seeks to provide.

## 5. RECOMMENDATIONS

### 5.1 Recommendations to member governments

Given the diverse nature of the countries in the Commonwealth it would be wrong to propose hard-and-fast rules for all. However, several general points have emerged from this review which could be considered to constitute guidance for health ministries. Obviously, such guidance may be ignored, either because it is inappropriate given local circumstances, or because it is already implicit in current policy.

The main points are as follows:

(i) In general, primary health care programmes can reach large numbers of people at a cost which is low relative to that of hospital-based care. Moreover, primary health care can act as the vehicle for interventions that are potentially effective in reducing morbidity and mortality. Thus, given that many PHC activities have been found to give good value for money when compared to other uses of health service resources, Ministries should continue to develop them.

(ii) Certain interventions, such as immunization and oral rehydration in developing countries, and screening for disease and community care programmes for the elderly or mentally ill in developed countries, have been shown to represent good value for money in many countries. However, in developing PHC activities several general principles should be observed if PHC is to be provided in the most cost-effective way. These are that the target population needs to be carefully selected, the timing and frequency of the intervention should be carefully considered and the least cost method of organising delivery of the service should be chosen. The overall principle should be that the marginal costs in further expansion of the PHC activity should not exceed the marginal benefits.

(iii) Economic evaluation in developing countries has concentrated on a few PHC activities (immunization, oral rehydration, family planning) neglecting vital areas such as health education and health promotion, appropriate treatment patterns and essential drugs. More economic evaluations should be encouraged in these areas.

(iv) A number of studies in both developing and developed countries have documented the potential for shifting interventions or care conventionally delivered in hospital to a primary care setting or to individual's homes. Such a shift has generally proved to be both feasible and cost-effective (e.g. tuberculosis treatment in developing countries, care of the mentally ill in developed countries). Countries should review their policies on the delivery of health care and identify services and interventions that could be shifted away from the hospital.

(v) In particular in developing countries further evaluation is required of the merits of the integrated and vertical organisation of particular interventions, and of fixed and mobile delivery strategies.

(vi) As a background to undertaking more economic analysis, Ministries should introduce a monitoring system for health service resource use, especially on PHC activities. This would improve the availability of information on the costs of PHC. Alternatively there should be more ad hoc cost analyses. Ideally cost analyses should be an integrated part of any programme evaluation.

(vii) Ministries' capacity to undertake, or to commission, economic analysis would be greatly enhanced if they developed their own capability for economic evaluations, for example, by having at least one person with economics training in the Ministry of Health.

(viii) Economic evaluation should be viewed predominantly as a way of thinking about choices in the provision of health and health services. Therefore, quite apart from undertaking studies of some major programmes, Ministries should try to incorporate economics concepts into health planning. One method was outlined in Section 4.2, where it was argued that a simple checklist of questions could be used to assess possible health developments.

(ix) In addition, Ministries should encourage the development of health economics expertise at selected universities or other suitable institutions. The development of multidisciplinary working, between clinicians, economists, epidemiologists and other health service researchers should be encouraged.

(x) Attention should be given to training in health economics, both for the planners and economics specialists themselves and for the policy makers who seek to use the results of economic analyses. Ideally policy makers should attend short workshops where they would learn how to interpret the results of economic evaluations. Planning and economics specialists will require longer courses, where the methodology of economic evaluation is fully explained and where there is the opportunity to undertake some practical project work.

(xi) Ministries should further ensure that teaching of economic evaluation is incorporated in the general management training of health personnel, including clinical practitioners.

(xii) Ministries should give more consideration to the managerial and organisational aspects of the adoption of PHC activities. For example, do the incentives and

disincentives in the primary health care field encourage the adoption of cost-effective practices and the efficient use of manpower? Are planning mechanisms in place to bring about compensating adjustments in secondary care facilities (e.g. closure of hospital beds that are no longer required) if the emphasis is on a shift towards primary care?

## 5.2 Recommendations to the Commonwealth Secretariat

The Commonwealth Secretariat could have an important role in furthering many of the objectives set out in section 5.1 above. In particular the following initiatives should be considered.

(i) Workshops could be mounted at the National and Regional level to educate those who may undertake economic evaluations and those who will use the results. Such workshops could focus on the evaluation of strategies to combat the major disease problems of each region and would be useful for those countries which could not justify the resources to mount their own workshops.

For example, the Commonwealth Secretariat could mount short one-week workshops for the users of evaluation results. These could concentrate on what to look for in a published study and the potential and problems of interpreting study results across different country settings.

Those who may undertake economic evaluations would benefit from a longer period of training of up to 3 months in duration. This should include extensive project work, some of which could take place back in their own countries. There may further be the possibility to link both training initiatives at the regional level. For example, policy makers and other evaluation users could review the project work undertaken by those attending the longer courses.

(ii) In order to develop further the technical expertise in economic evaluation in countries where it is currently lacking, attendance of individuals on larger and more advanced courses in health economics including economic evaluation, could be sponsored.

(iii) The Commonwealth Secretariat could give technical assistance to those countries wishing to develop local expertise in this field and to undertake economic evaluations of primary health care projects. For example, the Secretariat could facilitate the transfer of health personnel with economics skills between Commonwealth Countries.

(iv) The Commonwealth could assist in the dissemination of information relating to the economic aspects of health care, its planning and management.

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APPENDIX 1

**SUMMARY OF QUESTIONNAIRE RESPONSES**

1. Overview
2. Tabular Summary
3. Country Summaries
4. Questionnaire

## 1. Overview

Replies were received from 19 countries, plus three of the States of Australia. In this section an overview of the replies is given. In the following section a tabular summary is given of those responses that could easily be expressed in tabular form. Finally, a short summary is presented for each of the 19 countries, highlighting particularly interesting points.

### **Organisation and delivery of PHC**

In general the responsibility for the delivery of PHC is not solely that of the Ministry of Health (Table A-1). This reflects both the broad definition of PHC accepted in most countries (e.g. including water supply and sanitation) and the fact that in a number of countries other public sector agencies, the private sector and voluntary agencies are active in this field. The main implication is that in order to fulfil the aims of PHC in most countries, the MOH needs to coordinate its efforts with other agencies. This emphasises the need for clear policies and good management structures for PHC.

In many countries PHC services and hospital services are not managed by the same organization. This suggests that shifts in the balance of resources from secondary care to PHC may be difficult to achieve and that there may be organisational barriers to coordinating the efforts of the two sectors, e.g. to encouraging ambulatory care, or shorter hospital inpatient stays.

The priorities for PHC vary from country to country. However, it was noticeable that many countries listed most of the components of PHC as priority areas. It was also interesting that lack of funds was not the only obstacle to these priorities being met. Some countries also pointed to management difficulties.

## Monitoring and evaluation of PHC

Routine financial data on PHC are available in about one half of the countries (Table A-2). In most cases this is restricted to data on the total government expenditure on PHC and its relationship to total government expenditure on health care. The large variation from country to country in the proportion of health care expenditure devoted to PHC relates partly to different definitions of PHC in different countries. Hardly any countries could give estimates of non-governmental expenditure on PHC. In general, the availability of routine financial data was much less than that of activity data on PHC.

Almost all countries collect activity data (e.g. number of immunizations given, number of antenatal care visits). However, few countries have sought to link data on, or changes in, activity levels to data on, or changes in, the government expenditure on PHC. Indeed, programme budgeting approaches have not, in general, been utilised for PHC (Table A-3). This presumably arises at least in part from the difficulties in collecting data on the expenditure on individual components of PHC. Where programme budgeting methods have been applied, this is mainly to plan future expenditure. Few countries have monitored trends in expenditure through time, related expenditure on PHC to priorities, or related changes in expenditure on PHC to changes in the quantity of services delivered.

About one half of the countries reported that more detailed evaluations of the costs and/or benefits of particular PHC programme have been carried out (Table A-4). The most frequently evaluated programmes are malaria control and immunization programmes. This is not surprising because in both cases external agencies (e.g. the WHO through the Expanded Programme on Immunization) have encouraged evaluation, and the procedures for evaluating these programmes are relatively well established. Few evaluations consider costs, however.

Given the lack of routine financial information on PHC programmes in many countries, it is not easy to see how this situation will improve in the short run except through the conduct of special one-off surveys. Indeed, most evaluations that have been carried out, particularly in the developing countries, have been of an ad hoc nature, often with external support. There is clearly a need for the encouragement of institutional capacity that can make economic evaluation more of a routine activity.

#### **Relationship of economic evaluation to health care decision making**

About one third of the countries have a unit within the Ministry of Health which has economic evaluation as one of its potential functions. However, it was hard to assess whether such units possess all the necessary skills (Table A-5). The majority of countries also rely on a central capacity for planning and evaluation, usually located in the Ministry of Finance or Ministry of Planning and Development. In the case of the smaller countries, this is often the only expertise available to the Ministry of Health.

Given the intersectoral nature of health problems and the link between health and economic development, it obviously makes sense to have central coordination of planning and evaluation for health and health care. However, it could be argued that the existence of a unit within the Ministry of Health is also vital, to enable some of the special evaluation problems in the health care field to be addressed and claims for more resources to be better supported by hard data. Nevertheless, these potential benefits need to be balanced against the need for the concentration of scarce specialist skills, particularly in the smaller countries. In general, few countries would currently claim to have the capability to carry out good economic evaluation of programmes in the health care field.

Furthermore, few countries use other expertise, such as that in Universities or other institutions (Table A-6). In many cases this is because such expertise does not exist in the countries concerned.

Not surprisingly, apart from in the developed countries there was little evidence that economic evaluation had had an impact on health care decision making, although it is possible to point to modest contributions, such as the changes in tuberculosis treatment policy following an evaluation in Botswana. As indicated in the main body of this report, thought needs to be given not only to how the capability for economic evaluation can be developed, but also to how the results of such evaluations can be used by decision makers. Only in this way will any investment in skills to perform economic evaluation bear fruit.

## 2. Tabular Summary

A number of replies to questions are contained in the following 6 tables. Where no entry is given for a given country, this means that either:

- no reply was given to the question concerned; or
- the information was not available; or
- the answer given was not clear; or
- the question was not applicable in the country concerned.

If representatives for the various countries wish to clarify any points we would be most grateful.

Table A-1 Organisation of PHC

Country	Is the MOH solely responsible for organising and delivering PHC?	Are hospital and PHC services managed by the same organisation?
Australia	No	No
Bangladesh	Yes	Yes
Barbados	Yes	Yes
Botswana	No	No
Brunei Darussalam	Yes	No
Canada	No	No
Cyprus	No	Yes
Fiji	No	Yes
Malaysia	No	Yes, except for 4 urban areas
Maldives	No	Yes
Malta	Yes	Yes
New Zealand	No	No
Papua New Guinea	No	Yes (for government services)
Singapore	No	No
Solomon Islands	No	No
Swaziland	-	-
Trinidad and Tobago	No	No
Tuvalu	No	Yes
Western Samoa	Yes	Yes

Table A-2 Availability of routine data on PHC

Country	Are routine financial data collected?	Are routine data on quantity of services collected?
Australia	Yes	Yes
Bangladesh	Yes	Yes
Barbados	Yes	Yes
Botswana	-	Yes
Brunei Darussalam	No	-
Canada	No	Yes
Cyprus	No	No
Fiji	No	-
Malaysia	No	Yes
Maldives	No	No
Malta	Yes	Yes
New Zealand	-	-
Papua New Guinea	Yes	Yes
Singapore	Yes	Yes
Solomon Islands	No	Yes
Swaziland	-	-
Trinidad and Tobago	No	Yes
Tuvalu	No	Yes
Western Samoa	No	Yes

Table A-3 Use of financial data on PHC

Country	Have financial data been used for:			
	analysing trends	relating expenditure to policies	planning future expenditure	relating expenditure changes to changes in the quantity of PHC
Australia	No	No	Yes	No
Bangladesh	No	No	Yes	No
Barbados	No	No	No	No
Botswana	No	No	Yes	No
Brunei Darussalam	No	No	No	No
Canada	-	-	-	-
Cyprus	No	No	No	No
Fiji	-	-	-	-
Malaysia	Yes	Yes	Yes	Yes
Maldives	No	No	No	No
Malta	No	No	No	No
New Zealand	-	-	-	-
Papua New Guinea	No	No	No	No
Singapore	Yes	Yes	Yes	Yes
Solomon Islands	No	No	No	No
Swaziland	No	No	No	No
Trinidad and Tobago	No	No	No	No
Tuvalu	No	No	No	No
Western Samoa	No	No	No	No

Table A-4 Evaluating the costs and benefits of PHC

Country	Have there been any formal evaluations of the costs and/or benefits of PHC services in the last 10 years?  (Component of PHC listed)
Australia	Many areas, including MCH, water fluoridation, nutrition
Bangladesh	Immunization programmes, malaria control, diarrhoeal disease
Barbados	None
Botswana	MCH, tuberculosis, health education
Brunei Darussalam	Some analysis from statistics, but no full evaluations
Canada	Many areas including MCH, health education, appropriate treatment for common diseases
Cyprus	Immunization programmes
Fiji	-
Malaysia	None
Maldives	None
Malta	None
New Zealand	-
Papua New Guinea	PHC development
Singapore	MCH, immunization programmes, health education, control of locally endemic diseases
Solomon Islands	Water supply, malaria control
Swaziland	Immunization programmes, diarrhoeal disease, malaria control
Trinidad and Tobago	None
Tuvalu	None
Western Samoa	Immunization programmes, filariasis control

Table A-5 Relationship between economic evaluation and health care decision making

Country	Does MOH have a section concerned with economic evaluation?	Does the section contain economists?	Is another Ministry or department involved in economic evaluation of health projects?
Australia	Yes	Yes	Yes, in the future
Bangladesh	Yes	No	Yes
Barbados	Yes	-	Yes
Botswana	Yes	Yes	Yes
Brunei Darussalam	No	-	Yes
Canada	Yes	No, but available elsewhere in government	Yes
Cyprus	No	-	Yes
Fiji	-	-	-
Malaysia	No	-	Yes
Maldives	No	-	Yes
Malta	No	-	Yes
New Zealand	-	-	-
Papua New Guinea	Yes	Yes (but position unfilled)	Yes
Singapore	No	-	No
Solomon Islands	No	-	Yes
Swaziland	No	-	Yes
Trinidad and Tobago	Yes	-	Yes
Tuvalu	No	-	Yes
Western Samoa	No	-	No

Table A-6 Commissioning economic evaluations and using the results

Country	Does the MOH use other institutions for economic evaluation of PHC?	Is there evidence that economic evaluations have had an impact on decision making?
Australia	Yes	Yes
Bangladesh	-	-
Barbados	No	-
Botswana	Yes	Yes
Brunei Darussalam	No	-
Canada	Yes	Yes
Cyprus	No	No
Fiji	-	-
Malaysia	No	-
Maldives	No	-
Malta	Yes	No
New Zealand	-	-
Papua New Guinea	No	-
Singapore	No	No
Solomon Islands	No	-
Swaziland	-	-
Trinidad and Tobago	No	-
Tuvalu	No	No
Western Samoa	No	No

### 3. Country Summaries

#### **Australia**

Questionnaire responses for Australia were received from the Federal Government and 3 of the States (Tasmania, South Australia and Western Australia). The major role in the provision of PHC belongs to the State Governments, although the Federal Government has a role in the provision of funding and local government has a role in basic public health matters (e.g. safe water and sanitation). The main elements of PHC are maternal and child care, family planning, immunization, prevention and control of locally endemic diseases, health education and treatment (by private medical practitioners, public hospitals, non-institutional public health services, and by private hospitals). The main Federal priorities are increased emphasis in prevention and improved coordination of the existing services. Routine financial data on PHC are available and in 1981-82 PHC expenditure was 38% of total government health expenditure. Programme budgeting will be introduced by the Federal Government in the near future. The extent to which it has been adopted at the State level varies.

There have been evaluations of a number of PHC programmes; in particular economic evaluations have been undertaken of water fluoridation and cervical cytology. In the case of some of the water fluoridation studies, in South Australia and Tasmania, there was an identifiable impact on decision making.

The obstacles to securing more value for money from PHC include the reliance on private entrepreneurial general practitioners (which sometimes inhibits a multidisciplinary approach) and the lack of appropriate outcome measures.

Specialist resources are available for programme evaluation, including economic evaluation, at the Federal level. Similar capability exists in some States and has been proposed for others. Expertise is also available in Universities and this has been used from time to time.

**Bangladesh**

Routine information is collected on curative and preventive PHC activities. Financial information is used to plan future expenditure. Evaluations have been, or are being carried out, on programmes of malaria control, diarrhoeal disease control and immunization, the first being commissioned locally and the second externally. The malaria control evaluation was undertaken by a local institute. None of the evaluations calculated costs. The major obstacles to PHC are socio-economic conditions such as poverty, illiteracy, lack of employment opportunities, poor transport and communications.

A planning group exists within the MOH which plans the use of health resources.

**Barbados**

The main PHC services are MCH including family planning, immunization, general medical care, communicable disease control and water and sanitation. Recent PHC initiatives include the construction of polyclinics offering comprehensive health care and a free drug service for priority groups. Routine financial and activity data for PHC are available and PHC absorbed 33% of government health expenditure in 1984. The main obstacle to obtaining more value for money from PHC is resource management, and the main PHC priority is improved management.

A planning unit exists in the MOH with responsibilities for planning, evaluating and implementing health programmes. It is staffed by twelve officers.

**Botswana**

Main PHC services are curative treatment, family health (MCH, family planning, nutrition, health education) community health (epidemiology and disease control, environmental health, occupational health), rehabilitation and oral health services. The proportion of government health sector expenditure on PHC has been estimated (40%) and service statistics are collected. Financial information is used to plan future expenditure. Evaluations have been carried out for EPI and MCH, TB control and health education. The TB evaluation calculated costs and effects of alternative treatment patterns and influenced MOH policy in favour of short course chemotherapy. Main PHC priorities are comprehensive coverage, manpower development, community involvement and intersectoral planning, and main problems in obtaining value for money are lack of continuous evaluation of costs and impact, and lack of management skills.

The planning unit of the MOH has responsibilities for planning, implementation and evaluation and 3 of the 4 staff are economists. An external agency provides further health economics expertise in the field of health financing studies.

**Brunei Darussalam**

Main PHC services are MCH, outpatient, travelling dispensary and flying medical services. PHC services are evaluated from routine statistical reports. Main PHC priorities are community participation, intersectoral co-ordination and health education.

The economic planning unit determines funding for health development according to PHC.

## Canada

The overall responsibility for the provision of health care rests with each Provincial Government and there are therefore slight differences in the organisation and delivery of health care across the country. In general all PHC services are available, although the range varies somewhat, depending upon geographical location, available financing and local priorities. The main Federal priorities in PHC are health promotion and education, safe water and sanitation in remote and rural areas and community-based health and social services delivery systems, including the encouragement of native communities to control the delivery of their own health care services. Although routine financial data may be collected on individual services which together comprise PHC, these data are collected, analysed and published in relation to general accounting requirements within each Province. Provincial procedures also vary in relation to the use of programme budgeting methods. At the Federal level, programme budgeting methods are used to monitor the implementation of health care services to client populations.

Formal evaluations of PHC services have been carried out in a range of areas. Particular evaluations of note concern programmes to promote moderation in the use of alcohol, the periodic versus annual health examination and a programme to develop community health representatives to improve the delivery of health services in native and northern communities. The results of all these evaluations have been accepted by government and are likely to have an impact on policies in the future.

The main obstacles to obtaining more value for money from PHC are a lack of consensus as to what PHC is and who can deliver it, and the need to integrate PHC within the

health care system as a whole, so that treatment and preventive health care is available at the appropriate health care level.

Many specialist resources exist to undertake programme evaluations within the Federal and Provincial Governments and within Universities. There is evidence that some evaluations have had a direct impact on decision making.

**Cyprus**

Main PHC services are primary medical care, MCH, immunization, health education, environmental health, thalassaemia prevention, hydatid disease control, occupational health and school health. Recent PHC initiatives include an intersectoral development project which developed PHC infrastructure, the thalassaemia prevention and control programme and the hydatid disease programme. An EPI coverage evaluation has been done, commissioned by WHO, and carried out by a WHO/UNICEF/national team. Costs were not calculated. PHC priorities include staff orientation, prevention and control of cardiovascular diseases, neoplasms and accidents, health education, occupational health and care of the elderly. Main obstacles to obtaining value for money from PHC include lack of staff and public awareness of PHC, and shortage of PHC workers.

The planning bureau is responsible for health plans and employs an economist.

**Fiji**

Main PHC services are population control and family planning, food and nutrition, environmental sanitation, safe water, family health, health education, prevention of non-communicable diseases, and appropriate health services and basic drugs at the community level. Recent initiatives include training of village health workers and establishment of village PHC centres. PHC priorities are population control through family planning, health education, food and nutrition, proper drinking water and environmental sanitation, immunization and prevention of communicable and non-communicable diseases and accidents, training village health workers and provision of basic drugs at the community level.

**Malaysia**

The main PHC services are MCH, water and sanitation, immunization, disease prevention and injury, health education, food and nutrition, and provision of essential drugs. Main PHC priorities are the provision of basic health services to underserved/unserved areas and community education and participation. A recent PHC initiative is a community health development programme in Sarawak which trains community health volunteers.

Programme budgeting methods are in use. No formal evaluations of specific programmes have been done but annual trends in communicable diseases and health status are noted and programmes evaluated informally.

**Maldives**

The main PHC services are curative and preventive services run by health centres, mobile teams and hospitals, MCH clinics, and safe water and sanitation. Recent PHC initiatives include formulation of a country health plan, and national meetings on Health for All strategies and PHC promotion. PHC priorities are MCH, immunization, health education, health manpower development, control of communicable diseases, provision of safe water, sanitation and essential drugs, curative care and nutrition. Routine financial data on PHC are not available, but the PHC share of total health expenditure can be estimated (65% in 1984). A County Resource Utilization exercise has resulted in increased allocations to health and particularly to PHC.

The Ministry of Planning and Development is involved in health planning and evaluates the physical and financial progress of health projects.

**Malta**

Main PHC services are 24 hour GP service, personal and specialist health services in the community, health education, nutrition counselling, vaccination, school medical services, and dental, occupational and environmental health services.

A recent major intervention/evaluation initiative is a national diabetes programme, designed to establish the dimension of the problem and then design appropriate educational and treatment services. PHC expenditure can be estimated and amounts to 21% of government and 52% of total (public plus private) health expenditure. Main PHC priorities include health education and nutrition counselling, health services concerned with immunization, MHC, the elderly, non-communicable diseases, diabetes, mental health, oral health, workers' health and environmental health. Major obstacles to obtaining more value for money from PHC are lack of staff trained in economic evaluation and lack of data.

The Economic Planning Division and Treasury are involved in formulating development and annual budgets for health, and in cost evaluation. The MOH can draw on the expertise of the University Department of Management Studies.

There is a comprehensive range of health services provided by a combination of central and local government agencies, private medical practitioners and voluntary organisations. Eighteen health districts provide public health services. These services provide for family health, disease prevention and control, dental health, environmental health, health education, control of air pollution, food and nutrition, control of drugs and poisons, occupational health and toxicology. The main priorities are to improve the capacity of public health services in relation to areas of particular need and to facilitate access to primary medical services (with specific reference to general practitioners' services). A particular initiative involves increases in the number of staff working in 'at risk' areas involving teams of medical staff, public health nurses, health assistants and occupational health nurses - with particular focus on schools, residential areas and small factories with poor occupational health records. In addition, the government has sought to assist the work of non-governmental voluntary community groups, through its Community Health Initiatives Funding Scheme, and is promoting programmes targetted at the health of Maoris (an ethnic group with particular health needs). A significant proportion of health expenditure (around 70%) is directed toward hospital care and the need for a shift in resources toward primary health care has been identified.

At the central government level there is an annual review of health service programmes in the context of the government's expenditure review. The continued relevance of existing programmes is reviewed on a selective basis, and assessed against claims for additional resources for new policies. The Department of Health has recently prepared its first Corporate Plan. This sets out the

Department's mission, statement of philosophy, areas of emphasis and priorities, together with divisional objectives for the coming year. The plan will be prepared forthwith on an annual basis and used as a management tool to monitor progress on a regular basis against stated objectives and recorded priorities.

**Papua New Guinea**

Main PHC services are MCH and family planning, malaria, disease control, TB and leprosy, immunization, nutrition and dental services. A 3½ year research and development project in PHC has demonstrated that the PHC approach is effective in fostering village self-reliance in health care. Expenditure on PHC can be calculated when required (56% of national health budget and 65% of provincial health budgets). PHC priorities are health promotion, emphasising community health responsibilities and allocation of resources to the 'disadvantaged' to ensure equality of access. Obstacles to value for money are lack of effective management of existing resources.

The policy, planning and evaluation section of the MOH is responsible for economic evaluation. A health economist post is unfilled.

**Singapore**

Main PHC services are curative services, MCH including family planning, school health services and training and health education. A recent PHC initiative is the establishment of a home nursing foundation, supported by the MOH and communities, to provide free nursing care for the aged sick in their homes. PHC expenditure makes up 10% of government health expenditure, and financial information is extensively used in planning and monitoring. Formal evaluations have been done in the areas of MCH, communicable disease surveillance and health education. PHC priorities are to improve service quality at reasonable cost by phasing out small, uneconomic clinics and replacing them by fewer, larger polyclinics. Major obstacles to value for money are increasing costs and increased public demand for higher quality PHC.

**Solomon Islands**

Main PHC services are disease control, basic health services, promotion and improvement of village hygiene and portable water and sanitation. Studies on PHC expenditure are planned, and routine data on the services provided are collected. Formal evaluations have been done for MCH, immunization and malaria control. Main PHC priorities are the development of appropriately trained manpower and PHC infrastructure. The major obstacle to value for money is the lack of trained staff.

**Swaziland**

A health sector financing and expenditure survey attempted to assess policy implementation by surveying expenditure patterns. A cost analysis has been done of three components of the CCCD programme (immunization, diarrhoeal disease control and malaria control), commissioned and carried out by external agencies.

A planning unit exists but lacks the staff (especially economists) to undertake regular economic evaluations.

**Trinidad and Tobago**

Main PHC services are acute and post-natal care, family planning, general medical clinics, chronic disease and accident and emergency care. Routine data are collected of the quantity of PHC services provided, but not financial data on PHC. Main PHC priorities are MCH including immunization, chronic diseases (especially hypertension and diabetes) and environmental sanitation, including food control and insect vector control. Major obstacles to value for money are poor attendances of doctors, inappropriate mix of nursing/medical personnel, poor use of trained nursing assistants and inadequate ancillary staff.

The MOH has a department responsible for national health planning, project formulation and implementation and research, with 8 members of staff.

**Tuvalu**

Main PHC services are MCH including family planning, water and sanitation, nutrition, immunization, health education and prevention and control of endemic diseases. Routine data are collected on quantity of services provided, but not on expenditure. Main PHC priorities are family health including family planning, nutrition, and water and sanitation facilities improvement. Major obstacles to value for money are insufficient and irregular supply of materials for water and sanitation facilities, breakdown of ship and waterpumps, and lack of community co-operation and participation.

A government planning officer has responsibility for health planning and would rely on external input for economic evaluation of health projects.

**Western Samoa**

Main PHC services are EPI, well baby and child health, family planning, school health, MCH, sanitation, health education, and communicable disease and malnutrition follow-up. Formal evaluations have been done for EPI/diarrhoeal diseases and filariasis control, the latter comparing the effectiveness (but not the costs) of drug distribution by a filariasis team, or district nurses and/or primary health workers. The filariasis evaluation was commissioned and carried out by the Department of Health, and the EPI evaluation by the Department with assistance from WHO and UNICEF. PHC priorities are health manpower development, water supply and sanitation, MCH and family planning, filariasis, TB and leprosy services, strengthening of health education, nutrition and oral health and chronic disease control. The main obstacle to value for money is a brain drain, resulting in a chronic shortage of staff and wasted training.

**EVALUATING INVESTMENTS IN PRIMARY HEALTH CARE  
COUNTRY QUESTIONNAIRE**

SECTION A: BACKGROUND INFORMATION

- A1. Country:
- A2. Name of person completing the questionnaire:
- A3. Job title:
- A4. Address and telephone number:

Date

Signature

SECTION B: PRIMARY HEALTH CARE IN YOUR COUNTRY

B1. Is the provision of health services for the general public a central (federal) government or local (state or provincial) government responsibility in your country?

B2. At the relevant tier of government, is the responsibility for organising and delivering primary health care (PHC) solely that of the ministry of health?

Yes	No

B2.1 If NO, please give details of other ministries, government agencies and non-government agencies that are involved.

B3. Are both hospital and PHC services in a given geographical area managed by the same organisation?

Yes	No

B3.1 If NO, please outline the administrative arrangements

B4. At the present time what are the main PHC services in your country?

B5. What are considered to be the main priorities for the development of PHC services in your country?

B6. Are there, or have there been in the last 10 years, any specific projects or initiatives in PHC that you would like to bring to our attention?

Yes	No

B6.1 If YES, please give details, e.g. objectives of the project, PHC services provided, time span of project. If any reports on the projects are freely available we would be grateful if they could be returned to us with the questionnaire.

(please continue on a separate sheet if necessary)

SECTION C: EVALUATION OF PRIMARY HEALTH CARE IN YOUR COUNTRY

C1. Is routine financial data on PHC collected in your country?

Yes	No

C1.1 If YES, please provide any of the following statistics if readily available. Space is provided for your answer below. Please add extra sheets if necessary.

- total and per capita expenditure on PHC in 1984/85 or most recently available year (in local currency);
- PHC expenditure as a proportion of total health expenditure and/or government health expenditure;
- trends in PHC expenditure over the last 5 years (or shorter period up to 5 years), e.g. as a proportion of total health expenditure and/or government health expenditure

N.B. Please make it clear

- (a) what services are included in PHC expenditure
- (b) whether any health expenditure figures given relate to the country as a whole, the government, or just the ministry of health.

C2. Is routine data collected on the quantity of PHC services delivered in your country?

Yes	No

C2.1 Please list each main service (e.g. immunization, ante-natal care) and the type of information collected on the volume of services provided (e.g. number of immunizations, number of ante-natal visits). Please add extra sheets if necessary.

- C3. Has there been any attempt to use financial information to monitor the implementation of government health policies, in particular those relating to PHC? (e.g. through the use of programme budgeting methods)

Yes	No

C3.1 More specifically, has programme budgeting been used to:

- analyse trends in expenditure levels through time?

Yes	No

- examine whether expenditure patterns have changed in response to changes in government health policies?

Yes	No

- plan expenditure for future years?

Yes	No

- relate changes in expenditure (inputs) to changes in volume of quantity of services (outputs)?

Yes	No

Please add any further comments on the use of programme budgeting in your country below and attach copies of any available reports relating to programme budgeting exercises.

C4. Have there been, in the last 10 years, any formal evaluations considering the costs and/or benefits (outputs) of services in the following areas?

(These are the components of PHC as identified by the Alma Ata declaration.)

	Evaluation done		Title(s) of study or studies
	Yes	No	
(a) promotion of proper nutrition			
(b) adequate supply of safe water			
(c) basic sanitation			
(d) maternal and child health care including family planning			
(e) immunization against major infectious diseases			
(f) prevention and control of locally endemic diseases			
(g) education concerning prevailing health problems and the methods of preventing and controlling them			
(h) appropriate treatment for common diseases and injuries			

C4.1 For up to 3 major evaluations from the ones listed above could you please provide extra information as indicated by the questions below.

**In the Appendix to this questionnaire (Section E) we list documents already in our possession relating to evaluations undertaken in your country. There is no need to duplicate the information in these documents. However, please ensure that the published documents contain the answers to the questions below, especially C4.1.9, C4.1.10 and C4.1.11.**

Use this page for comments on the first evaluation and add further pages if you are able to comment on two further evaluations.

C4.1.1 what was the subject of the evaluation?

C4.1.2 when was the evaluation carried out?

C4.1.3 which agency commissioned the evaluation?

C4.1.4 which agency carried out the evaluation?

C4.1.5 did the evaluation incorporate any assessment of alternative strategies (e.g. alternative ways of delivering a PHC service)? If YES, please list the alternatives evaluated.

C4.1.6 were calculations made of the costs of the services being evaluated? If YES, please describe below what cost information was calculated (e.g. total costs to the government, total social costs, unit costs).

C4.1.7 what measures of output were used in the evaluation?  
(e.g. measures of quantity of services delivered such  
as number of immunizations; measures of effect on  
health such as change in infant mortality rate)

C4.1.8 what were the major conclusions of the evaluation?

C4.1.9 were these accepted by the government? If NO, why not?

C4.1.10 did the government take any specific decisions based on the evaluation? If YES, please give details.

C4.1.11 do you have any further comment on the effect of the evaluation on government policies or strategies?

C4.1.12 Is there someone who could provide us with further information if we need it?

Name

Address

If any reports on the evaluation are freely available we would be grateful if they could be returned to us with the questionnaire.

C5. What do you consider to be the major obstacles to obtaining more value for money from PHC activities in your country?

SECTION D ECONOMIC EVALUATION AND HEALTH CARE DECISION MAKING IN YOUR COUNTRY

In this section we ask some questions about the general role of economic evaluation in health care decision making. Although our main interest is in the PHC field, the questions relate to health care more generally.

- D1. Is there a section or department in your health ministry (at the central or local level) concerned with economic evaluation and the costs and effectiveness of present and proposed health services (e.g. economic advisers' office, planning unit)?

Yes	No

If YES, please answer the following questions

- D1.1 what are the major functions of the department?

D1.2 please give the number of staff, indicating the number of trained economists?

D1.3 please summarise the types of economic study carried out

D2. Is there another ministry besides the Ministry of Health that is involved in the economic evaluation of health projects (e.g. the planning ministry, finance ministry or treasury)?

Yes	No

If YES, please answer the following questions:

D2.1 what are its main functions in the health field?

D2.2 please list the number of staff who are involved in the evaluation of health projects indicating the number of trained economists.

D2.3 please summarise the type of economic work on health carried out by these people.

D3. Does the Ministry of Health draw on expertise of any university department or institute that carries out economic studies related to health?

Yes	No

If YES, please answer the following questions:

D3.1 what are the main types of economic work on health carried out in the department(s) or institute(s) concerned?

D3.2 has the Ministry of Health commissioned any studies from the department/institute(s) in the last 5 years? If YES, please list the studies.

D3.3 has the Ministry of Health made use of any other of their economic studies on health? If YES, please list the studies used and state who commissioned/funded them.

D4. Is there evidence that any of the economic evaluations of health services undertaken in your country have had an impact on decision making?

Yes	No

If YES, please answer the following questions:

D4.1 what was the title(s) of the evaluation(s)?

D4.2 what services were being evaluated?

D4.3 who commissioned the evaluation(s)?

D4.4 what persons or groups undertook the evaluation(s)?

D4.5 in what way were the evaluation results useful in, or had an impact on, health care decision making?

SECTION E: APPENDIXOur Current State of Knowledge of Economic Evaluation of Primary Health Care Projects in Your Country

We already have in our possession the following papers relating to projects or evaluations undertaken in your country. If you wish to make any additional comments about these particular evaluations, in order to correct errors in the papers concerned or to give us more recent information, please do not hesitate to do so.

Country:

Papers already in our possession:

**We have not been able to find any published papers relating to economic evaluations of PHC services in your country.**

## APPENDIX 2

## TECHNICAL APPENDIX

The attached papers are extracted from World Health Statistics Quarterly; 38(4), 1985.

Due acknowledgement is given.

The first paper, by Drummond and Stoddart, outlines the principles of economic evaluation. These are relevant to all countries. The second paper, by Mills, outlines additional methodological issues which arise in evaluations in developing countries.

Finally, for those unfamiliar with economic evaluation, a Glossary of Terms is provided.

## PRINCIPLES OF ECONOMIC EVALUATION OF HEALTH PROGRAMMES

M. F. Drummond<sup>a</sup> & G. L. Stoddart<sup>b</sup>

### Introduction

All countries, no matter what their stage of industrial development, need to make tough choices on how to use their scarce resources. The competition for resources is not only between different sectors of the economy, but within each sector as well. Should more resources be devoted to education or to health care? Within the health care sector: should more resources be devoted to primary care or to high-technology medicine? Within the treatment options for a given clinical condition (e.g. inguinal hernia), should extra resources be allocated to expand day-care surgery?

No one is going to pretend that such choices are easy to make. In all countries, resource allocation decisions in the health care field have to take account of the complex interplay of social, cultural, economic and political factors. However, for those decision-makers wanting some guidelines in the wilderness, this article discusses a method of evaluating health service options that is consistent with the notion that resources should be deployed so as to maximize the total benefits to the community. Economic evaluation, or the "cost-benefit approach", has been used quite extensively to evaluate the efficiency or cost-effectiveness of alternative health programmes or clinical procedures (1,2). It starts from the premise that resources are scarce and therefore their use in one programme or treatment implies a cost; that is, benefits which could be realized from an alternate use of resources are sacrificed. Economists view the costs of health care programmes not merely as money expenditures but as potential benefits that are being forgone. For example, in some industrialized countries the cost of expansions in high-technology medicine may be that community care programmes for the elderly may not expand as much as they otherwise might. In developing countries, a commitment to large hospital developments may imply a cost in forgone rural health services.

The notion of costs as forgone opportunities (or sacrifices) provides the logic for comparing health service options in terms of their benefits and costs. Economic evaluation seeks to do just this and takes various forms depending on the problem at hand and the extent to which the benefits of programmes can be quantified and valued.

### Forms of economic evaluation

Those who have studied the literature on economic evaluation in health care will have encountered a confusing range of labels such as "cost-benefit analysis" and "cost-effectiveness analysis". In our experience, the titles of

studies are notoriously bad guides to their contents and the most important issue is whether the methodology used in a given study suits the problem under review. This theme is developed in the next section. The following are a few examples of different types of study to aid those wrestling with economic jargon.

The first point to note is that all the forms of economic evaluation concern choices between *alternative courses of action*. In the evaluation of prevention, diagnosis, treatment or rehabilitation, the options are usually explicitly stated and described. A minority of studies published in the literature do not compare alternatives; for example, Cohen (3) calculated only the costs of schistosomiasis in Zanzibar. Such studies provide important information to those assessing priorities for resources to be allocated to the control or eradication of particular diseases. However, they do not constitute economic evaluations unless they examine competing strategies. We prefer to use the terms "cost description" or "outcome description" for studies that examine costs or consequences in the health care field without embodying a comparison of options.

In some cases, the alternative to the programme under evaluation is implied to be the existing situation of "no programme" or "doing nothing". For example, the tacit alternative to a vaccination campaign may be the existing situation of treating individuals as and when they contract the disease. Some caution is advisable in considering such studies, as "doing nothing" rarely means that no costs are incurred or no services provided. Another important feature of choices in the health care field is that many of them are questions of "how much?" Rarely is it argued that no resources should be devoted to tackling a given health problem or disease, usually the question is one of how far one should go in attempting to alleviate the condition. A most spectacular illustration of this kind of choice is the screening for asymptomatic cancer of the colon, reported by Neuhauser & Lewicki (4). They showed that, while the average cost per case detected by the advised protocol of six sequential tests on the same population was only around US\$ 2 500, the incremental cost per case detected by performing a sixth test (having already done five) was US\$ 47 million! (This was because the returns, in case finding, from repeated screening were small.) Therefore, it is always important to examine such incremental costs and their consequences when evaluating choices in the health care field.

The second point to note is that while all forms of economic evaluation consider costs, they differ in the way in which they consider consequences. Some examples will serve to make these distinctions clearer. The simplest form of analysis, "cost analysis", considers only costs and is justified only when there is good reason to believe that the alternatives being compared result in the same consequences. Such situations are rare in the health care field. One example of a cost analysis is that which was carried out by Lawson et al. (5) comparing different ways of providing long-term domiciliary oxygen therapy for chronic bronchitis. The authors argued that the three methods compared, cylinder oxygen, liquid oxygen and the oxygen concentrator, produced equivalent clinical effects since in all cases oxygen was administered via a face mask. However, strictly speaking, such an assumption should be tested and cost analysis therefore represents a partial form of economic trial of two medicines whose costs are similar, the emphasis being on the establishment of relative clinical effectiveness as costs are assumed to be the same.

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All other forms of economic evaluation explicitly consider both costs and consequences. The next three forms often go under the general label "cost-effectiveness analyses" and have the common feature that while costs are expressed in monetary units, consequences are not. At the risk of introducing more terminology, we prefer to use three labels which we believe highlight important differences in approach. First, in "cost-minimization analysis", equivalence in consequence is tested through controlled study, rather than assumed as in cost analysis. Typically, the economic evaluation is conducted at the same time as a controlled clinical trial. If the trial demonstrates equivalent effects for the two medical interventions, the economic evaluation can concentrate on estimating the relative costs. An example of this type of study is that by Russell et al. (6). In a controlled trial of day-care surgery versus traditional in-patient surgery for inguinal hernia they found no significant difference in clinical complications or length of convalescence. Therefore, they were able to compare the economic efficiency of the alternatives by examining their relative costs, in hospital care, community care and out-of-pocket expenditure by patients.

However, it is rare to find pairs of health care interventions where the consequences are alike in all respects. Nevertheless, if there is one important dimension upon which a comparison can be made, it is still possible to compare alternatives without "valuing" the consequences. For example, it might be argued that extension of life is of overriding importance and that the options can be compared in terms of cost per year of life gained. This approach, which we call "cost-effectiveness analysis", has frequently been used in comparisons of kidney transplant, hospital dialysis, home dialysis and continuous ambulatory peritoneal dialysis for chronic renal failure (7-9). Even though the alternative treatments may differ in the number of years of extra life gained, a comparison of them in cost per year of life gained can suggest how the budget for chronic renal failure treatments should be spent so as to maximize the total years of life gained. Some cost-effectiveness analyses consider effects like "cases correctly diagnosed". This is admissible providing the achievement of such intermediate clinical objectives can be clearly linked to improvements in patient outcome.

It is not usually possible to argue that there is but one relevant dimension along which achievements can be measured. For example, the quality of life afforded by kidney transplantation is likely to be higher than that under the dialysis options. In addition, some treatments, such as cancer chemotherapy, may extend life, but have associated morbidity. Therefore one would ideally like to develop a measure that considered the "utility" or quality of life gained, as well as the quantity of life gained. In a form of economic evaluation known as "cost-utility analysis", options are compared in terms of their cost per quality-adjusted life-year (QALY) gained. This approach was used by Stason & Weinstein (10) in a comparison of options in the screening and treatment of hypertension. They considered that a year of life on anti-hypertensive treatment, with its attendant side effects, was equivalent to about 0.99 of a year of life without such problems. In this particular study, the quality assessments were made by a panel of medical experts. In addition, the sensitivity of the study results to changes in these assessments was examined. In other studies (11), researchers have obtained quality of life assessments from patients and members of the general public.

The last three forms of economic evaluation discussed have the common feature that while the consequences of interventions are assessed and measured to some degree, they are not expressed (or valued) in money terms. Obviously, valuation of all the costs and consequences in money terms would permit the broadest type of comparison. In principle, it would be possible to ascertain whether particular health care treatments or programmes were worthwhile in themselves. In "cost-benefit analysis" attempts are made to express a broad range of costs and consequences in money terms. For example, in a comparison of a community-oriented mental illness programme with the hospital-based alternative, Weisbrod et al. (12) measured the costs to the health sector, other public agencies, the patient and family, and monetary benefits in terms of the increased earning potential or productivity of those patients able to return to work. However, as is nearly always the case, there are categories of health consequence that are difficult to express in money terms. In practice, cost-benefit analysis concentrates on those consequences that are relatively easy to value, such as productivity gains (through return to work or extension of working life) and savings in health care resources arising from the patient's improved health. Therefore, it is our view that "cost-utility analysis", where health consequences are valued relative to one another rather than in money terms, offers the greatest scope for consideration of a broad range of costs and consequences. That is not to say that economists have failed to develop methodologies for the valuation of health consequences in money terms (13, 14), rather that their practical application has been limited.

In summary, we have considered five forms of economic evaluation which differ in the extent to which they measure and value the consequences of interventions. The simplest forms, such as "cost analysis" and "cost-minimization analysis", respectively assume or test for equivalence in consequences so that the economic evaluation is of relative costs alone. "Cost-effectiveness analysis" reviews different ways of achieving the same objective, with the consequences often expressed in physical units. The more complex forms attempt some valuation of the consequences, either in money terms as in "cost-benefit analysis", or in terms of health utilities as in "cost-utility analysis". In general, we believe that the label to be attached to a given study is less important than whether the study's methodology is appropriate to the issue being examined. In the next section we outline the features of good study methodology, concluding with a checklist of ten questions to ask of any published study.

### Elements of a sound economic evaluation

#### *Posing a well-defined question in answerable form*

As in all fields of scientific inquiry, it is important to be clear on the study question. For example, is it assumed that a given treatment objective, such as screening and treatment for essential hypertension, is going to be met? In which case the evaluation can concern itself with ascertaining the most efficient way of meeting the chosen objective. Alternatively, is the evaluation concerned with the more fundamental question of whether the given objective should be met, or the extent to which it should be met, compared to alternative uses of the same resources? Attempts to answer such a question are likely to require more sophisticated forms of evaluation.

A well-defined study question will also clearly identify the alternatives being compared and the viewpoint(s) from which the comparison is to be made. Questions such

as "Is a community care programme for the elderly worthwhile?" beg the questions "to whom?" and "compared with what?". A well-specified question might be the following: "From the viewpoints of (a) the ministry of health, (b) other public sector agencies providing care and (c) patients and their families, is a community care programme preferable to the existing programme of institutionalization in long-term care facilities for patients of a given level of dependency?". Note that there are a number of possible viewpoints of evaluation: particular health care agencies, the patient and family and the third-party payer (i.e. government or insurance company). However, in addition, the economic evaluation should also consider the costs and consequences of alternatives to society as a whole, as this is the broadest and most comprehensive viewpoint.

Finally, in stating the chosen alternatives for comparison it is often useful if studies mention any other relevant options and why they have been excluded from further consideration.

#### *Giving a comprehensive description of the competing alternatives*

Although there are often limitations of space in health service journals, it is important to give a full description of the alternatives being evaluated. For example, one needs to know who does what, to whom, where and how often. The reasons for such a description are self-evident; readers need to judge whether the options concerned are applicable to their own setting and to assess whether any important costs or consequences have been omitted from the analysis. Therefore, an evaluation of a community care programme for the elderly would need to give details of what is involved in visits by health care workers, accommodation at home, day care, institutional relief or respite care and inputs from the family or friends.

#### *Establishing the effectiveness of programmes or interventions*

Since economic evaluation requires consideration of both the costs and consequences of options, it relies on technical evidence of the effectiveness of interventions. That is, to what extent do they meet the objectives in prevention, diagnosis, treatment or rehabilitation? In the health care field the most widely accepted method of establishing the effectiveness of interventions is the randomized-controlled trial and one would certainly expect economic evaluations to be based on such clinical research where it is both ethically and practically possible to conduct it. Where evidence from controlled trials does not exist, some assessment should be made of the impact of uncertainties in the medical evidence on the results of the economic evaluation. (We will return to this point under sensitivity analysis below.) Often the lack of good medical evidence can limit the scope for economic evaluation. In their study comparing the cost-effectiveness of cimetidine with proximal vagotomy for peptic ulcer, Culyer & Maynard (15) noted that, despite the large number of trials of the new drug, few were well designed. Either they did not compare relevant service alternatives (e.g. many involved a placebo, which was unlikely to be given routinely), or were too small, or were inadequately controlled. For more discussion of the quality of medical evidence see reference (16).

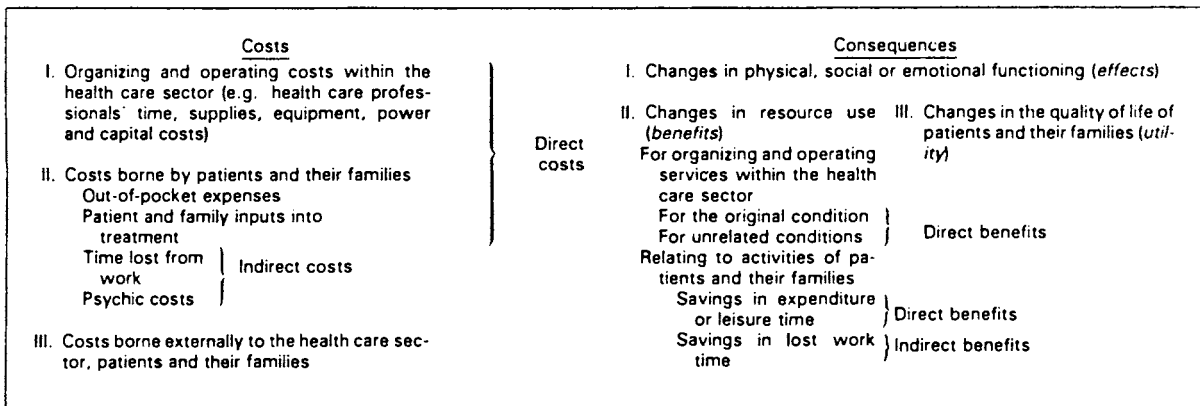
For some large public health interventions, such as vaccination campaigns, it is much harder to conduct experiments to establish effectiveness, although in some cases the efficacy of the vaccine (when administered under ideal conditions) may be known. In such cases economic evaluations may have to rely on evidence from "before-and-after" studies conducted in other locations, undertaking sensitivity analysis if review of the existing literature generates a range of estimates. In addition, some public health interventions, particularly those in the developing world, have multiple objectives (some of which may not be connected with improvements in health). This introduces further complexities in study design.

*Identifying all the important and relevant costs and consequences*

Even though it may not be possible or necessary to measure and value all the relevant costs and consequences of the alternatives being compared, it is important that they be identified. This is to minimize the chances that the analysis becomes biased in favour of the easily measurable items, at the expense of others.

An overview of the types of costs and consequences that may be relevant to economic evaluation of health

**FIG. 1**  
**TYPES OF COSTS AND CONSEQUENCES RELEVANT TO ECONOMIC EVALUATION OF HEALTH CARE SERVICES AND PROGRAMMES**



programmes is shown in *Fig. 1*. The costs comprise those resulting from resource inputs by the health sector and other agencies providing care, and inputs by patients and families (direct costs). In addition there may be further costs resulting from time lost from work as a result of the intervention (called "indirect costs" by economists) and psychic costs (e.g. anxiety or pain and suffering caused by treatment). Finally, there may be costs borne externally to the health care sector: for example a chemical safety measure may alter the cost or availability of products if it results in more costly production processes.

Turning to consequences, it can be seen that there are changes in the physical, social or emotional functioning of individuals which give rise to two other important categories of consequence. For example, there may be changes in resource use arising from treatment. Many of these changes are likely to be in the form of resource savings, if the patient's improved health results in lower consumption of medical services. (This is one of the main arguments for preventive measures.) However, there may also be increased resource consumption in the future, if patients being cured of one condition contract others. Weinstein & Stason (17) argued that a hypertension screening programme, if it prevented strokes and heart attacks, would lead to increased costs in the future, owing to the diseases of old age (e.g. cancer, arthritis). These costs must be balanced against the undoubted benefits of individuals living longer.

In addition, there are likely to be other resource savings, to patients and their families, and savings in lost work time. (These mirror some of the items on the cost side of the equation.) Finally, there will be changes in the quality of life of patients and their families which are, of course, the main objective of health care interventions.

The general schema of costs and consequences outlined above reflects that found in the published literature. However, the inclusion of some items is not without controversy. In particular, the inclusion of indirect costs and benefits in the analysis biases evaluations in favour of individuals or groups that participate in the work-force. This is clearly a dilemma; while countries are crucially dependent on the wealth created by those members of the population that are at work, it may not be considered ethically defensible to give such groups priority in access to health care. Similarly, inclusion of savings in health care resources as one of the consequences, although not the subject of methodological controversy, can bias the analysis against disadvantaged groups. For example, in comparing the costs and consequences of vaccination programmes in urban and rural settings in Zambia, Pongnighaus (18) found programmes to be more costworthy in the large centres of population. One of the reasons for this finding was that health services were already better developed in the urban areas; therefore there were potentially more health service resources to be saved by the preventive programmes in urban locations. However, this is not necessarily a good justification for concentrating the vaccination effort in such areas.

In short, while the general schema of costs and consequences for evaluation should be as outlined in *Fig. 1*, the inclusion or exclusion of items needs to be judged in the broader context of objectives for health services in a given country; one such objective is equality in the provision of services (19).

#### *Measurement of costs and consequences in appropriate physical units*

Although one tends to view the estimation procedures in economic analysis as being directed towards measurement of costs and consequences in money terms, there is

an important intermediate stage. That is, one needs to measure the resource inputs to the programme in the appropriate physical units prior to valuation, e.g. hours of medical time, number of nurse visits, consumable items used, hours of family or volunteer time used. Often these estimates are not reported in published work, although they must surely have been made in order to calculate costs in financial terms. We believe it would be helpful if the "ingredients" of health programmes were listed more often, as it helps the reader identify the likely costs of implementing the programme in his own setting. This is particularly true in an international context, where results given in another country's currency may be difficult to interpret.

Estimation of many of the resource inputs may be relatively straightforward. However, "overhead" or shared costs present a particular problem. For example, if the programme or treatment is delivered as part of a larger activity, what proportion of the shared resources, such as central administration, should be attributed to a given programme? This problem will be evident in the hospital setting, where many resources are shared, but it arises also in primary care, e.g. in vaccination campaigns delivering more than one vaccine. On occasion it might be possible to identify the extra resources that are required to add the new programme to the existing activity, which it might be assumed will continue in any case. For example, one might argue that adding measles vaccination to an existing immunization programme results in little extra administration costs but involves significant extra costs in maintaining a more efficient cold chain. In principle, economists subscribe to this approach — that of identifying incremental costs and consequences — but problems arise when every programme director denies responsibility for the shared resources! Here, one needs a method of assessing the consumption of shared resources by each programme if one wants to estimate the full costs of a service that is delivered in conjunction with others, e.g. the neonatal care unit in a regional hospital. The subsequent valuation of those costs (discussed below) would be based on the opportunity cost principle. That is, what benefits could be derived from those resources if they were freed for use in other activities.

Problems in the estimation of the consequences of programmes in the physical, social or emotional functioning of individuals have already been mentioned. There are problems of interdependence here too. For example, a child who might be prevented from contracting measles by an immunization programme in a developing country may also be suffering from other diseases or malnutrition, which in turn influence the potential for life extension arising from the vaccination campaign. Similarly, a programme that saves health service resources (e.g. hospitalization) may only save the incremental costs of treating the averted illness. For example, if an influenza vaccination programme for the elderly reduces hospitalization, the full benefits of this would not be realized unless the hospital beds were put to good use, or capacity closed. If the beds remain empty the overhead costs also remain and the savings may be minimal.

#### *Credible valuation of costs and consequences*

Depending upon the form of economic evaluation being employed and the question for study, it will be necessary to express many of the measured costs and consequences in money terms. All the forms of economic evaluation require money estimates of costs. These are easier to obtain than money estimates for some of the consequences of health treatments or programmes. However, valuation of costs should not be viewed as a simple,

value-free process.

For the direct costs to the health care sector of operating health care programmes, it is normal to take existing market prices as the source of valuation. That is, estimates are taken from current operating budgets or from billings made to the health insurance plan, depending on the category of resource and the method of funding health care which exist in the country concerned. Apart from sheer convenience, the use of market prices is based on the notion that, where markets are operating perfectly, prices reflect the opportunity cost of the given resource. Of course, this approach is open to question since it is well known that markets do not operate perfectly owing to the existence of monopolies. In addition, taxes and subsidies may cause observed prices to deviate from true opportunity costs.

In principle, the price observed for each resource should be considered separately and adjusted upwards or downwards if thought necessary: that is, a shadow (or accounting) price should be calculated. In evaluations performed in industrialized countries this is rarely done and few examples exist in the literature. (For example, in a study on care of the elderly, Wager (20) deducted fuel tax from the cost of home nursing, as he felt the tax made that programme artificially expensive relative to institutional care.) In developing countries, particularly those operating exchange control policies, such adjustment may be more important to make.<sup>c</sup>

However, in all countries it may be necessary to develop shadow prices for resources that do not have a market price. For example, inputs of family time or volunteer time may have an opportunity cost, although they may not result in a financial cost to the programme. In principle, these costs should be estimated, although in practice they rarely are. Finally, as mentioned earlier, the measurement and valuation of indirect costs and benefits raises particular problems. Do the wages received by workers really reflect the opportunity cost of their labour? Is it inequitable to value these costs and consequences using wage rates, as it will bias the analysis against the poor, the elderly, the housewife and the unemployed?

The extent to which consequences in improved health are valued will depend on the form of analysis being employed. Some of the methods were mentioned earlier and will be discussed further in the context of the review of published work in later articles in this issue.

#### *Adjusting costs and consequences for differential timing*

It is usually argued that as individuals or as a community we are not indifferent to the timing of costs and consequences. Most of us would prefer to postpone resource outlays or other costs, yet receive benefits or other favourable consequences as soon as possible. This notion (known as "time preference") is particularly important when comparing alternatives whose time profiles of costs and consequences differ. For example, a preventive programme aimed at changing risk factors in cardiovascular disease requires resource outlays now, but most of the improvements in mortality and morbidity will not occur until many years in the future. This is not usually the case for curative programmes, such as coronary-artery-bypass surgery. The most widely accepted method of comparing costs and consequences occurring at different points in

time is to discount costs and consequences to present values. This approach, the arithmetical procedure for which resembles a compound-interest sum performed in reverse, has the effect of giving costs and consequences in the present a greater weight in the analysis than those occurring in the future. (For details of the calculation see (1,2).)

The key assumption in the approach is the choice of discount rate. There exists a good deal of economics literature on this point, which is outside the scope of this article. The main points to note are as follows. First, most economists agree that the discount rate should be greater than zero, but disagree on the precise rate. Most of the economic evaluations in the literature apply rates of between 2% and 10% in real terms.

Second, there is no reason to suppose that every country would want to discount the future at the same rate. After all, the choice of rate is a value judgement, reflecting the community's preference for goods and services now compared to later. In addition, to the extent that the composition of the community changes through time, there are also inter-generational equity issues to be addressed when making choices between those programmes which deliver benefits now rather than in the future. In some countries the government recommends a rate, as in the United Kingdom (21). Where there is some uncertainty about the rate to be applied in the evaluation, the most sensible approach is to rework the analysis using a range of rates in order to assess whether it has an important impact on the study result. Often it does not.

Finally, it is worth pointing out that whereas the most common use of a discount rate is to convert costs and consequences occurring in the future to present values, another use is to convert a capital expenditure occurring at the beginning of a programme into an equivalent annual cost. This approach is useful where all the other costs and consequences are already expressed as annual recurring amounts.

#### *Performing an incremental analysis of costs and consequences*

The example of the screening test for cancer of the colon cited earlier (4) illustrated the importance of performing an incremental analysis of costs and consequences. That is, the relevant question to pose was not "what is the average cost per case detected by each screening strategy?", but rather "what are the extra consequences and extra costs of one strategy when compared to another?". Therefore, this is the best way to compare the alternatives being evaluated. Also, when the implicit alternative to the programme being examined is "doing nothing", it should be remembered that "doing nothing" rarely results in zero costs or zero consequences.

#### *Performing a sensitivity analysis*

This approach has already been mentioned in the discussion of uncertainties in medical evidence and uncertainties in the choice of discount rate. Sensitivity analysis is simply a reworking of the analysis using different assumptions on the values to be assigned to variables about which there is uncertainty or methodological controversy. The objective is to ascertain whether the different assumptions have any impact on study results. If the results are sensitive to the estimates assumed, further work may be justified to improve the accuracy of estimates. For example, the health consequences of a vaccination programme may be crucially dependent on vaccine

<sup>c</sup> See Mills A *Economic evaluation of health programmes: application of the principles in developing countries*, p. 368 of this issue.

effectiveness and this would therefore need to be known accurately in order to perform a good economic evaluation. In other cases, accurate estimates may not be important. For example, Henderson (22) has shown that while there is considerable uncertainty in estimating the psychic benefits of screening for neural tube defects, these uncertainties would be unlikely to cancel out the net benefits of such screening programmes.

*Including a presentation and discussion of all issues of concern to users*

It will be clear from the above discussion that economic evaluations require the analyst to make a number of technical and value judgements. A good analysis will make these judgements as explicit as possible so that the reader can question them and make different judgements where appropriate. It has to be remembered that economic evaluation is an aid to decision-making and not a substitute for thought. Therefore, it is important that the evaluation includes a discussion of the main judgements made, the ways in which the costs and consequences of the alternatives may differ from one setting to another and any other important factors in the choice between options that may have been inadequately incorporated into the analysis.

It is particularly important to note the distributional impact of programmes. That is, which groups in society bear the costs and which groups benefit. Sometimes analysts may examine the incidence of costs and conse-

quences to rich and to poor, or to particular geographical regions, as this is often a major factor in decision making. On a few occasions, distributional weights have been applied, thereby assigning a higher value to a dollar of benefit received by a poor person compared with that received by a rich person. However, if such approaches are used, care must be taken not to obscure such value judgements from the decision-maker in a mass of figures. In our view it is probably more helpful to raise the distributional issues through an intelligent discussion of study results, unless an explicit set of distributional weights has been agreed in a given country.

#### *A checklist of questions to ask of any published study*

The methodological points discussed above are summarized, in *Table 1*, in the form of a checklist. We do not suppose for one moment that any study will satisfy the reader on every criterion. Certainly our own studies do not! Rather our aim is to give the reader a methodological "gold standard" against which studies can be judged.

**TABLE 1. TEN QUESTIONS TO ASK OF ANY PUBLISHED STUDY**

<p>1. Was a well-defined question posed in answerable form?</p> <p>(a) Did the study examine both costs and effects of the service(s) or programme(s)?</p> <p>(b) Did the study involve a comparison of alternatives?</p> <p>(c) Was a viewpoint for the analysis stated or was the study placed in a particular decision-making context?</p> <p>2. Was a comprehensive description of the competing alternatives given (i.e. can you tell who did what to whom, where, and how often)?</p> <p>(a) Were any important alternatives omitted?</p> <p>(b) Was (should) a "do-nothing" alternative (have been) considered?</p> <p>3. Was there evidence that the programmes' effectiveness had been established?</p> <p>Was this done through a randomized, controlled clinical trial? If not, how strong was the evidence of effectiveness?</p> <p>4. Were all important and relevant costs and consequences for each alternative identified?</p> <p>(a) Was the range wide enough for the research question at hand?</p> <p>(b) Did it cover all relevant viewpoints (e.g. those of the community or society, patients and third-party payers)?</p> <p>(c) Were capital costs as well as operating costs included?</p> <p>5. Were costs and consequences measured accurately in appropriate physical units (e.g. hours of nursing time, number of physician visits, days lost from work or years of life gained) prior to valuation?</p> <p>(a) Were any identified items omitted from measurement? If so, does this mean that they carried no weight in the subsequent analysis?</p> <p>(b) Were there any special circumstances (e.g. joint use of resources) that made measurement difficult? Were these circumstances handled appropriately?</p> <p>6. Were costs and consequences valued credibly?</p> <p>(a) Were the sources of all values (e.g. market values, patient or client preferences and views, policy makers' views and health care professionals' judgements) clearly identified?</p> <p>(b) Were market values used for changes involving resources gained or used?</p>	<p>(c) When market values were absent (e.g. when volunteers were used) or did not reflect actual values (e.g. clinic space was donated at a reduced rate) were adjustments made to approximate market values?</p> <p>(d) Was the valuation of consequences appropriate for the question posed (i.e. was the appropriate type, or types, of analysis — cost-effectiveness, cost-benefit or cost-utility — selected)?</p> <p>7. Were costs and consequences adjusted for differential timing?</p> <p>(a) Were costs and consequences that occurred in the future "discounted" to their present values?</p> <p>(b) Was any justification given for the discount rate used?</p> <p>8. Was an incremental analysis of costs and consequences of alternatives performed?</p> <p>Were the additional (incremental) costs generated by the use of one alternative over another compared with the additional effects, benefits or utilities generated?</p> <p>9. Was a sensitivity analysis performed?</p> <p>(a) Was justification provided for the ranges of values (for key parameters) used in the sensitivity analysis?</p> <p>(b) Were the study results sensitive to changes in the values (within the assumed range)?</p> <p>10. Did the presentation and discussion of the results of the study include all issues of concern to users?</p> <p>(a) Were the conclusions of the analysis based on some overall index or ratio of costs to consequences (e.g. cost-effectiveness ratio)? If so, was the index interpreted intelligently or in a mechanistic fashion?</p> <p>(b) Were the results compared with those of other studies that had investigated the same questions?</p> <p>(c) Did the study discuss the generalizability of the results to other settings and patient/client groups?</p> <p>(d) Did the study allude to, or take account of, other important factors in the choice or decision under consideration (e.g. distribution of costs and consequences or relevant ethical issues)?</p> <p>(e) Did the study discuss issues of implementation, such as the feasibility of adopting the "preferred" programme, given existing financial or other constraints, and whether any freed resources could be used for other worthwhile programmes?</p>
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Source: Reference (19)

Only in this way can the reader begin to assess the significance of published work for the policy decisions he may have to take in health service planning or in his own practice.

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## **ECONOMIC EVALUATION OF HEALTH PROGRAMMES: APPLICATION OF THE PRINCIPLES IN DEVELOPING COUNTRIES**

Anne Mills<sup>a</sup>

### **Introduction**

The essential principles of economic evaluation outlined in the article by Drummond & Stoddart in this issue<sup>b</sup> are the same throughout the world. However, the methodology of the economic evaluation of health programmes in developing countries draws not only on the techniques described in the literature from developed countries, but also on a well-established tradition of economic theory and analysis (namely, development economics and cost-benefit analysis) within developing countries themselves. This results in certain emphases which are not found, or only rarely found, in the literature from developed countries.

Most developing countries formulated ambitious economic development plans (covering usually a five-year period) as they achieved political independence. The plans usually set out a national framework (macro-planning) subdivided into sectors (industry, agriculture, health, etc.) with the proposals for each sector consisting of a number of individual project investments (micro-planning). Investment funds were sought overseas, particularly from development banks and aid agencies. The allocation of funds between sectors and projects was believed to be critical to the achievement of economic growth and other national objectives such as equity in the distribution of goods and services. Project appraisal techniques using cost-benefit analysis concepts were developed in order to assist decisions on how to allocate resources to maximize the achievement of national development objectives.

Much emphasis was laid initially on the macro-planning component of development plans but as disillusionment grew with both the methodologies and the practical feasibility of macro-planning, increasing stress was put on the activities of micro-planning and on project appraisal, within an overall framework of broad policy guidelines. The cost-benefit analysis techniques used in project appraisal were developed particularly by agencies such as the Organization for Economic Co-operation and Development (OECD), United Nations Industrial Development Organization (UNIDO) and the World Bank to assist in the selection and implementation of projects. The methodological advances have shifted cost-benefit analysis techniques rather far away from their original roots in developed countries (1).

Owing to the general acceptance of the desirability of development planning in all sectors of developing countries, the place of cost-benefit analysis within development planning, and the insistence of aid donors on the economic appraisal of proposed projects, economic evaluation techniques seem to be applied more in developing than in developed countries (2). The health sector has not been completely insulated from these influences, although it is generally agreed that conventional cost-

benefit techniques need to be adapted for use in this sector (3).

Indeed, the main themes of development planning and development economics have had considerable influence in shaping the approach to the economic evaluation of health sector projects. Early models of economic growth emphasized shortage of capital as a significant constraint on growth (4). The need to increase material production was stressed, and second place given to expenditure for social purposes such as health. In response, economic analysis of the health sector concentrated on investigating and demonstrating (often on rather weak evidence) the link between improved health and improved productivity, arguing that the former was a pre-condition for the latter and a vital part of any policy aimed at increased economic growth.

More recently, development strategies have become less preoccupied with growth alone and more concerned with the distribution of income, as exemplified by the "basic needs" strategy (5). Health, as one of the basic needs, can therefore be viewed as contributing directly to peoples' welfare rather than indirectly, via increased production. Economic analysis has now become less concerned with the value of health expenditure *per se*, and more interested in investigating which are the most efficient means to health improvement. Nonetheless, the productivity consequences of disease continue to be of interest to decision-makers.

Since developing countries in general lack the physical infrastructure of developed countries, the potential means for health improvement encompass a broader range of interventions than those relevant to developed countries. The improvement of water supplies and sanitation facilities in particular are important alternatives (or complements) to expansion of health service provision in developing countries. Other subjects of concern are often common ones for developed and developing countries (for instance primary health care, nutrition) although the health problems to be tackled differ significantly.

In summary, there are four main characteristics which distinguish the economic evaluation of health programmes in developing countries from that in developed countries. Firstly, evaluation techniques draw on the cost-benefit analysis methodologies developed specifically to suit the economies and development policies of developing countries. Secondly, despite the recent shifts in development philosophy, the productivity consequences of improved health remain an important theme. Thirdly, there is a close association between the application of economic evaluation techniques and the involvement of aid agencies, influencing the topics selected for evaluation, the methods of evaluation and the use made of evaluation conclusions. Finally, a wide range of potential interventions to improve health have been evaluated, ranging from those aimed primarily at environmental change to those concerned primarily with personal health.

### **Elements of the methodology of economic evaluation in developing countries**

All the elements of a sound economic evaluation discussed in the first article in this issue<sup>b</sup> apply to economic evaluation in developing countries. However, some of the elements are either approached in a particular way, are given particular emphasis, or present distinctive features or problems. Where this is so, the element is discussed below.

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<sup>b</sup> See *Principles of economic evaluation of health programmes*, p. 355 of this issue.

### *Establishing effectiveness*

In general, controlled trials are the accepted means of establishing the effectiveness of an intervention. These can be either clinical trials, which appraise the worth of a form of care given to individuals, or programme trials, which appraise the value of a type of health care directed at the welfare of a group or population (6). A programme trial which tests a programme in a total, defined community can be termed a community trial.

There are few developing country studies that combine an economic evaluation with a clinical or programme trial. Such studies are more common in the case of interventions directed at specific diseases or conditions such as parasitic diseases and anaemia. For example, an investigation of the effect of iron-deficiency anaemia on the productivity of adult males in Indonesia evaluated the change in the productivity of three groups: one receiving elemental iron and an incentive payment, a second a placebo and an incentive payment, and a third no treatment or payment (7). The Narangwal study (8), discussed in a later article in this issue,<sup>c</sup> is a rare example of an economic evaluation combined with a programme trial directed at evaluating the effectiveness of a variety of interventions to improve infant and child health in a defined community.

Such programme trials, however, can be difficult and expensive to set up and their results may be inconclusive because many factors can confound the relationship between health activities and their consequences. It is often the case, therefore, that the information on effectiveness required for economic evaluation is obtained in other ways. These may include:

- changes in clinical case reporting or differences in prevalence or incidence rates in a defined population over a given period before and after an intervention;
- census enumerations of villages or regions in two or more time periods (9);
- obtaining professional consensus, for instance through use of the Delphi technique, on the effectiveness of the interventions evaluated (10);
- reviewing the evidence on effectiveness available from published sources.

Since few countries have good surveillance systems (discussed further below) and economic evaluation is not often done as part of an epidemiological trial, economic evaluation studies often rely on evidence of effectiveness taken from a diverse range of countries and programmes. Sensitivity analysis becomes indispensable as a way of exploring the implications of uncertain medical evidence on study conclusions.

### *Identifying costs and consequences*

The types of cost and consequence identified in *Fig. 1* of the article by Drummond & Stoddart<sup>b</sup> apply in general to developing countries, though with differences of emphasis particularly on the various types of consequence. The figure is reproduced again here (see *Fig. 1*). The first type of consequence, "changes in physical, social or emotional functioning", is usually measured initially in terms of changes in days of illness or deaths. Perhaps because infectious diseases predominate over chronic conditions and also because of scanty evidence, little attention has been paid to the social or emotional dimensions of illness (or to the third type of consequence, changes in the quality of life of patients and their families). In contrast, physical functioning, discussed further below, has been given considerable emphasis.

The second type of consequence listed in *Fig. 1* is "changes in resource use". The resource savings to the health care agency in the form of reduction in treatment costs resulting from a preventive programme (such as

**FIG. 1**  
**TYPES OF COSTS AND CONSEQUENCES RELEVANT TO ECONOMIC EVALUATION**  
**OF HEALTH CARE SERVICES AND PROGRAMMES**

<u>Costs</u>		<u>Consequences</u>
I. Organizing and operating costs within the health care sector (e.g. health care professionals' time, supplies, equipment, power and capital costs)	} Direct costs	I. Changes in physical, social or emotional functioning ( <i>effects</i> )
II. Costs borne by patients and their families		II. Changes in resource use ( <i>benefits</i> )
Out-of-pocket expenses		For organizing and operating services within the health care sector
Patient and family inputs into treatment		For the original condition } Direct benefits
Time lost from work		For unrelated conditions }
Psychic costs	} Indirect costs	Relating to activities of patients and their families
III. Costs borne externally to the health care sector, patients and their families		Savings in expenditure or leisure time } Direct benefits
		Savings in lost work time } Indirect benefits
		III. Changes in the quality of life of patients and their families ( <i>utility</i> )

immunization) are commonly included in developing country studies. However, as pointed out, the existence of savings is dependent on the provision of health services: where these are absent, resource savings to the health care agency will be zero, but this does not necessarily imply that the preventive programme should not be provided.

Resource savings accruing to patients and their families are categorized in the figure as both direct and indirect. The direct benefits — savings in household expenditure or leisure time — may well assume significance in a developing country context where self-care or private expenditure, or traditional forms of medicine take the place of, or complement, formal health services.

In the literature on the economic consequences of disease<sup>c</sup> indirect benefits (savings in lost work time) are in general given greatest prominence. The studies employ

<sup>c</sup> See *Survey and examples of economic evaluation of health programmes in developing countries*, p. 402 of this issue.

the "human capital" approach, where health programmes are viewed as investment in people which enables them to be more productive and to increase their material well-being (11). The consequences of illness are likely to go beyond lost work time — the main measure used in a developed country context — to include decreased productivity whilst at work and possibly, as Stevens (12) suggests, a pervasive effect on the willingness of individuals to innovate and take risks in their daily lives.

In more detail, the main effects of ill-health on production are hypothesized to stem from:

- (a) reduction in the availability of labour because of premature mortality and inability to work through illness. For instance, morbidity among the labour force may disrupt a production process and morbidity among subsistence farmers at times of sowing and harvesting may have a critical effect on crop yields;
- (b) reduction in productivity while at work because of loss of strength, stamina and ability to concentrate;
- (c) reduction in the return to education investments because absence from school due to illness may reduce educational attainment and malnutrition and disease may impair learning ability (13).

The empirical evidence on these various consequences presents a confusing picture and is summarized by Barlow (11) and Mills & Thomas (14).

Two further economic consequences of health programmes should be mentioned since they are frequently cited though rarely quantified. Firstly, the prevalence of certain diseases (especially malaria) may restrict settlement in areas with fertile land and other resources (15). The movement of labour and capital into these areas following disease control provides a benefit in the form of net additional production.

Secondly, in some countries, any consequences of health improvement affecting the size of the population may be treated as a "cost" of the health programme, to be set against the benefits. Population growth increases the dependency ratio (the proportion of the population who, because of their age, are dependent on others for their living), possibly increasing the proportion of national income that is consumed and decreasing that which is saved, and requiring additional public funds for the less immediately productive forms of public investment such as housing and schools. Knudsen, for example, allows for population growth being viewed as an undesirable consequence in his analysis of supplementary feeding programmes (16). Clearly countries will differ widely in the effect of health improvement on population growth and in how they view the desirability of population growth and its social and economic consequences.

Health professionals and health economists are in general uneasy about this emphasis in the literature on the productive capacity of society (9). Such an emphasis may bias project selection in favour of projects that benefit the (often predominantly male) labour force. Moreover, in a subsistence farming economy, the effect of disease on production may be mediated through redistribution of tasks within the household. For instance children may be called on to assist with farm activities (17), resulting in a loss not of production but of child schooling, leisure or time devoted to the care of younger siblings.

In order to take account of these various effects, a new conceptual framework (18) has been suggested for assessing the social and economic consequences of the major tropical diseases. The framework attempts to look

at both the risk and the actual occurrence of infection from a social perspective. (see Fig. 2).

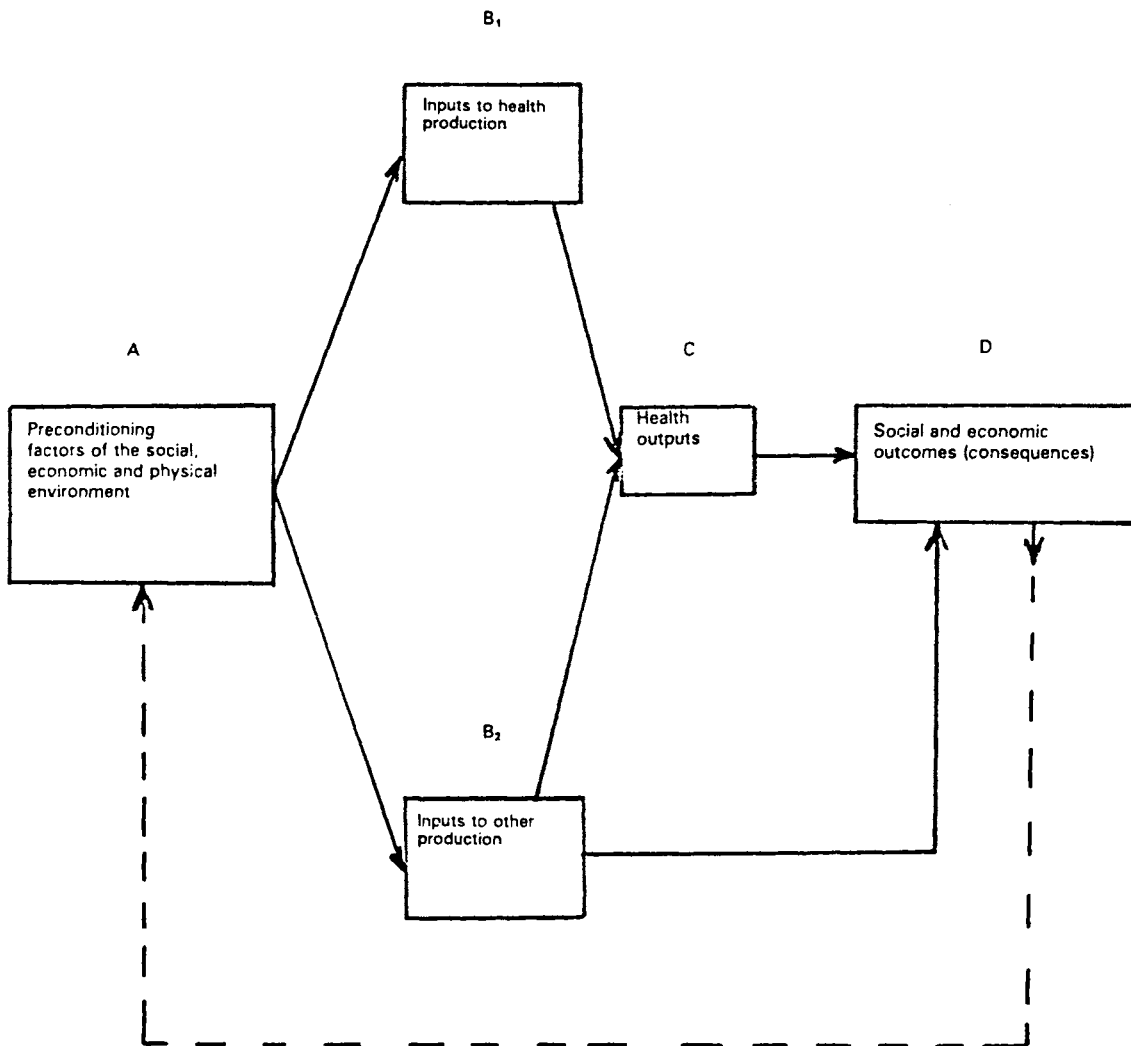
First of all, the framework takes the household rather than the individual as its unit of analysis. Household decisions heavily influence individual behaviour since resources allocated to each individual and the individuals' obligations are a result of the decisions taken by the head of the household or collectively within the household. Moreover, the consequences of disease can be mitigated by the family which both reassigns responsibilities and nurtures its members.

However, aspects of the social, economic and physical environment provide a context within which decisions at the household level are taken. These preconditioning aspects (A) include:

- (i) aspects of the physical environment (climate, soil) likely to affect the household's exposure and response to disease and to determine economic production;
- (ii) availability of public- and private-sector social welfare services;

*Wld Hth statist. quart.* 38 (1985)

FIG. 2  
CONCEPTUAL FRAMEWORK FOR ASSESSING THE SOCIAL AND ECONOMIC CONSEQUENCES OF TROPICAL DISEASES FOR HOUSEHOLDS



Source: Reference (18) - Réference (18)

(iii) the household's social and economic endowments (e.g. skills, land, capital).

These factors affect household decisions about health-related ( $B^1$ ) and other types of production ( $B^2$ ). For instance, decisions to allocate the time of family members to certain activities — producing market and non-market goods (e.g. nutritious food), caring for each other — can be viewed as inputs to the production of health. The same can be said of the utilization of modern and traditional health facilities and behaviour that is deleterious to health, such as smoking and alcohol consumption. Material inputs (seeds, fertilizer) contribute to other production (primarily economic) as do such decisions as how to use available land and whether to raise credit.

These decisions about health- and non health-productive activities ( $B^1B^2$ ) made in response to the preconditioning factors (A) will result in individual health status (C). Health status can be expressed through measures of mortality, morbidity, impairment and fertility. The figure then indicates that individual and community health status, along with other inputs and production, will in turn have social and economic consequences (D). The illness of one family member, for example, may cause a redistribution of duties, perhaps reducing the time allocated to food preparation. Less nutritious food may lead to diminished labour productivity or to illness-related work absences.

Within this conceptual framework, therefore, it is possible to trace the effects of tropical diseases on:

- (i) the availability and productivity of time spent in activities in the home and market;
- (ii) the demand for various subsistence commodities (nutrition and health);
- (iii) the demand for marketed goods such as health services, improved housing, and improved water supplies that can be inputs into the production of better health.

Eventually, (C) and (D) outcomes, along with decisions taken outside the sphere of the household, will influence preconditioning factors (A) generating new inputs and diseases which again affect (C) and (D), reflecting the dynamic nature of such an approach.

A particular focus of the approach is on the allocation of time within the household and on the time-costs of disease, since time-costs are likely to capture more of the consequences of tropical diseases than the physical production and income losses of the traditional approach.

### *Measuring costs and consequences*

The discussion on measuring costs and consequences in the first paper in this issue<sup>b</sup> applies fully to developing countries, especially, for instance, the problem of identifying the resources used by a programme when they are shared with other activities. For example, the Expanded Programme on Immunization (EPI) of the World Health Organization (WHO) has suggested a method of apportionment based on staff time in order to estimate the resources used by immunization activities at health centres (19). However, two specific issues that arise in a developing country context need some discussion here: the availability of routine information on costs and consequences, and the choice of suitable measures of health effect.

Analysts in developed countries are fortunate in being able to draw on information from sophisticated routine data collection systems. Although financial information may not be totally accurate, complete, or available in the most desirable form, expenditures can be disaggregated

by geographical area, institution, and department within institutions. Routine surveillance is also maintained of demographic events (births, deaths) and of certain diseases and conditions (for instance, notifiable infectious diseases). In addition, regular surveys of morbidity are carried out and additional detailed records are available from the information systems of health institutions.

In developing countries information systems vary considerably in their sophistication. Expenditure may not be disaggregated by geographical area, let alone by health institution. Different budgets may fund the same institutions, making it difficult to calculate total expenditure. Communications and accounting difficulties may mean that expenditure records of local institutions are not kept up to date and actual expenditure may not be known until many months after the end of the financial year. Hospital accounts are usually not disaggregated by individual department and it is usually necessary, for instance, to apply estimation procedures to separate in-patient from out-patient expenditure (29).

Good information on the mortality, morbidity and fertility of a community is often unavailable and the records of health institutions must be used to deduce community mortality and morbidity patterns. Even where birth and death registration systems have been set up, there may be incomplete coverage of vital events. Monitoring the effect of a programme on a community usually requires a special (and expensive) data collection effort, although innovative approaches are being initiated; e.g. using village members such as community health workers to collect health and demographic information (21).

Choosing a suitable measure of health effect is often a major difficulty in economic evaluation studies in developing countries. If the intervention being evaluated has a fairly narrow and specific objective (for instance, reduction in the incidence of a particular disease), deaths prevented or cases averted may be an appropriate measure. It is more useful, however, to have a measure that can be used to compare the effects of interventions targeted at different diseases which have differing effects on mortality, morbidity and disability and on various age groups. Using reduction in child mortality as a measure to compare the effect of water supply, oral rehydration and measles immunization interventions (22) neglects the various other effects of the interventions. Water supply in particular often appears to be very expensive in relation to its effects in such evaluations, yet reduction in child mortality is only one of the objectives of a water supply programme (23).

Recently the measure "healthy days of life" has been proposed as an index of effectiveness (24). The measure, a rough version of a "quality-adjusted life-year",<sup>b</sup> is derived from information on incidence rate, case fatality rate and the extent and duration of disability produced by a disease. Modifications to the measure have been suggested by Prescott et al. (25) to reflect time preference (discounted years of healthy life) and age-preference (discounted productive years of healthy life). Choice of the effectiveness measure can have a significant effect on choice of intervention. Prescott et al. compared the onchocerciasis control programme in West Africa with two measles immunization programmes (see Table 1). Using the measure "healthy years of life added", the onchocerciasis control programme was twice as expensive per year of healthy life added, and three times as expensive per discounted year of healthy life added as the immunization programmes. Both these measures favour interventions such as measles immunization which reduce infant and child mortality, since they produce the greatest total

**TABLE 1. ESTIMATED COST-EFFECTIVENESS OF ONCHOCERCIASIS CONTROL AND MEASLES IMMUNIZATION**

Effectiveness measure and cost in US\$	Onchocerciasis control	Measles immunization	
		Ivory Coast	Zambia
Per year of healthy life added	20	10	12
Per productive year of healthy life added	20	15	17
Per discounted year of healthy life added	150	49	56
Per discounted productive year of healthy life added	150	190	221

Source: Table 1 in reference (26) – Tableau 1 référence (26).

increase in years of healthy life per case averted. However, using the measure "discounted productive years of healthy life added" switches the cost-effectiveness ranking in favour of onchocerciasis control because blindness prevention results in an immediate gain of productive years (since blindness occurs in adulthood), whereas the gain of productive years from measles immunization is deferred for some years and is thus heavily discounted.

Such measures are rightly controversial for they embody value judgements on the relative weight to be attached to preventing mortality as against morbidity as against disability, to improving the health of different age groups (especially small children and adults) and to improving health sooner in time rather than later. Little is known of the relative value that individuals and communities place on these effects.

On a practical note, data is often lacking to calculate the measure of "healthy days of life lost". For instance, different economic evaluation studies of malaria have used widely differing estimates of the length and severity of a case of malaria (26).

In the absence of good information on health effects, many studies use what are often called measures of "intermediate output". These may be measures merely of contact or utilization, such as "number of patients seen" or "immunization contacts". It is preferable to use measures that more closely approximate effect on health, such as "number of fully immunized children" (27). Given the difficulty and expense of assessing the health effects of many programmes, particularly those aimed at reducing ill-health through a package of interventions, such measures can be a useful short-cut for economic evaluation studies. However, it is always important to consider the validity of assuming that utilization measures are correlated with measures of health effect.

#### *Valuation of costs and consequences*

Economic evaluation techniques recommended for use in developing countries diverge most markedly from developed country practices in their approach to the valuation of costs and consequences. The article by Drummond & Stoddart<sup>b</sup> suggested that in certain circumstances market prices may deviate from true opportunity costs and shadow/accounting prices should be calculated.

In a highly developed market economy, the relative prices of goods and services normally provide a fair approximation of their relative production costs. In less developed countries, the local prices of goods and services often provide a much less reliable guide to their costs. Firstly, the domestic price structure may be dis-

torted by measures such as tariffs, subsidies, import licensing and excise taxes which shelter the domestic economy from international competition, and by an acute scarcity of foreign exchange. These distortions may mean that goods produced domestically could be purchased from abroad at lower real cost by using domestic resources to produce exports and exchanging them for the foreign products. The domestic price thus exaggerates the opportunity cost of the goods.

Secondly, the existence of a large pool of unemployed or underemployed labour, together with rigidities in the labour market which influence wage levels, can mean that wage rates do not reflect the opportunity cost of employment. The health services might be able to employ additional unskilled labourers without a corresponding decrease in output from their previous occupations because they were unemployed. If they were previously subsistence farmers, their opportunity cost would be greater than zero but might still be less than the market wage. (This issue is further discussed later in the text, in relation to the valuation of indirect benefits.)

The recommendation of cost-benefit methodologies (see, for instance, 3, 28, 29) is therefore to use a system of shadow or accounting prices when valuing costs and consequences. For goods that are traded internationally, the use of "world prices" (the price at which a good can be bought on the world market) is suggested; labour is valued at its domestic opportunity cost; and the domestic value of non-traded goods and services (including labour) are translated by various procedures into world prices.

Non-traded goods can make up a large proportion of total costs and the translation into world prices may have to use a short-cut (the "standard conversion factor" (28)). Alternatively, non-traded goods can be valued at their domestic price and the world price of traded goods translated to rough equivalent domestic prices through the use of a shadow exchange rate (30). These two methods (using a standard conversion factor and using a shadow exchange rate) are essentially equivalent.

These pricing adjustments produce shadow prices which are called "economic" or "efficiency" prices. Economic prices are intended to ensure that the prices used in an analysis reflect true opportunity costs. In addition, a further set of adjustments may be made, to convert economic prices into "social prices". Social prices are calculated to reflect a country's preference for savings versus consumption, and/or for benefiting some income groups more than others. In the case of savings, it is suggested that some developing countries may face a serious shortage of savings for private or public investment, and may wish to bias project selection by using a "savings premium" that weights costs and consequences that produce savings more heavily than those that increase consumption. In the case of income distribution, it is suggested that countries may be unable to use general economic policies to favour the lowest socioeconomic groups, and that the value of project costs and consequences accruing to different income groups could be adjusted by the use of a consumption weight which reflects the value decision-makers place on reducing inequality.

The practice of shadow pricing described above has its origin in the economic appraisal of industrial projects whose output carries a price and is internationally traded. The difficulties of valuing the consequences of health programmes, whose output is not traded and often not priced, mean that cost-effectiveness procedures are gen-

erally recommended and health consequences measured but not valued (3). The principles of shadow pricing apply, although usually only to the costs and resource-saving consequences of programmes.

The importance of shadow pricing can be illustrated by reference to several hypothetical examples. For instance, construction of a hospital may involve a choice between a high-technology design using imported materials and labour-saving equipment and a low-technology design using local materials and more staff. Domestic prices (reflecting an overvalued exchange rate and market wages) might favour the first choice whereas economic prices (adjusting domestic prices to reflect their true opportunity cost) would favour the second.

In an immunization programme, one might be faced with a choice between introducing immunization in static health centres or delivering immunization through a mobile strategy. In densely-populated areas such as towns, static centres might achieve high coverage rates whereas in rural areas, achieving sufficient coverage might require a mobile strategy. A straight comparison of total costs and total consequences (number of fully-immunized children) might favour the static strategy. However, an immunization administered to a poor rural child could be weighted more heavily than one administered to a better-off urban child (31). The total consequences of each strategy could thus be adjusted to reflect the different mix of rural and urban immunizations.

In general, actual economic evaluation studies of health programmes in developing countries have either neglected shadow pricing or adjusted the value of foreign exchange inputs by using a shadow exchange rate, rather than attempting a conversion of domestic prices to world prices. The study by Horton & Claquin (32) reviewed later in this issue<sup>c</sup> discusses shadow exchange rates and shadow wages. For those interested in exploring further the approach of economic and social pricing, Porter & Walsh (33) illustrate their application to evaluating the cost-effectiveness of the provision of rural water supplies, and Knudsen (16) uses economic and social prices to undertake a cost-benefit analysis of supplementary feeding in India.

A final issue that requires further discussion is the approach to the valuation of the indirect benefits of health programmes. For example, what is the value of an increase in time available for productive work? In principle it is the value of the additional production (the "marginal product"). It is this value that may then be converted to world prices, with weights attached to that proportion which is saved if a savings premium is used, and/or weights given to indirect benefits that accrue to low-income groups.

In practice, it is often difficult to establish the domestic value of the marginal product. In a perfectly competitive economy, wages should reflect the marginal product. It is clear that in developing countries there may be many reasons why this does not hold true (see also the discussion above on shadow wages). If demand for labour is slack, an increase in productivity may displace other workers. Alternatively, if there are only a few large employers, wages may be kept below their competitive level. Moreover, if a health programme results in a large additional supply of work-time, it may be used in increasingly unfavourable production situations resulting in a decreasing marginal product at least until complementary inputs such as capital goods and additional land are brought into use.

While consideration of these possibilities is complex, appreciation of their significance is important. In the past,

many studies have used an extremely crude approach towards valuing the production of additional labour time. Dunlop has reviewed the methods of valuation used in some studies of the economic impact of parasitic diseases (9). In general, average or minimum wages are used, or some estimate made of the marginal product which is then valued at the market price of the good produced. These methods generally ignore the problems, outlined above, of the relationship between wages and marginal product, and the likely change in the marginal product as labour time increases.

#### *Discussion of issues of concern to users*

There are two further issues of particular relevance to economic evaluations of health programmes in developing countries: affordability and recurrent cost consequences for the government.

Because of the great scarcity of resources in the health sector in many developing countries, the ability of a country to afford a proposed programme has to be considered in addition to the question of cost-effectiveness. Governments of least developed countries spent only an average of US\$ 3 per head on health services in 1981 (34). An economic evaluation of a proposed new programme should consider the additional per capita expenditure required for implementation throughout the country, and whether this sum is likely to be feasible. In this assessment actual expenditure rather than shadow prices is used, since the former represents the funds that have to be found for the programme.

Associated with the question of affordability is that of recurrent cost consequences. Health programmes tend to give rise to significant recurrent costs (35) and since health services are often provided without charge or at a highly subsidized price, the running costs have to be borne by the government. Yet, government funds to support recurrent expenditure are usually much more scarce than development funds and may represent the most severe constraint on health sector expansion. Thus a discussion of the recurrent expenditure needs of a programme and how they might be financed should be included in a study which evaluates a new programme.

#### **The theoretical framework of economic evaluation**

The techniques of economic evaluation discussed in this issue are techniques of micro-economic analysis. Their analytical framework is a partial equilibrium framework, used to analyse interventions whose consequences have a marginal impact on the economic, demographic and social structure of a country.

Health interventions in developed countries are likely to be of this type. However, in developing countries some interventions may have a massive effect on the demographic structure, and supply and price of factors of production such as land and labour. These effects cannot easily be taken into account in a micro-economic framework. For this reason an assessment of the economic effects of the eradication of malaria in Sri Lanka took account of its impact on mortality, morbidity and fertility and used a macro-economic model to simulate their consequences for growth in income (36). The economic evaluation techniques discussed here are most useful when programmes are relatively self-contained and unlikely to have consequences that spread throughout the economy.

#### **International comparisons**

The economic evaluation literature on developing countries is diverse in many respects: programmes/diseases evaluated, countries, dates of the evaluations, and methodologies used. Recently there has been interest in synthesizing studies from a number of countries in order to draw conclusions on the cost-effectiveness of different interventions. The usual approach is to establish an objective (for instance, reduction in infant mortality) and to analyse the available published literature in order to establish the range of costs and effects that have been found. This has been done, for instance, by Gwatkin et al. (37) who reviewed the costs of reducing infant and child mortality rates in ten primary care field projects; by Cochrane & Zachariah (38) who present the cost of preventing a death through a variety of interventions; and by Shepard & Cash (39), who also look at the cost per death averted by different interventions.

These reviews can give very useful indications of which interventions provide the greatest return in terms of the chosen objective. However, the dangers of such comparisons are considerable. For instance:

- many programmes have multiple objectives which may be overlooked in a comparison considering one objective only;
- the effectiveness of a programme depends on a number of factors, such as delivering an effective drug or vaccine, patient compliance and coverage. These can vary considerably between different social, cultural and economic settings resulting in different levels of effectiveness for the same intervention;
- programme costs will similarly vary between different settings, for instance depending on the organizational structure and scale of the programme, administrative procedures, degree of public cooperation, environmental circumstances, population density, and the relative prices of different inputs such as drugs and various grades of manpower;
- programme costs will also vary depending on whether a new programme requires a new organizational structure or will be added on to existing activities. For instance, the unit cost of adding vaccine to an existing immunization programme is likely to differ considerably from the unit cost of setting up a new programme;
- the introduction of a new programme in a particular setting may produce resource savings for governments and households. For instance, introduction of an oral rehydration programme may reduce expenditure on hospital treatment of diarrhoeal disease (39). These savings should be set against the cost of the programme and will affect its relative attractiveness in particular settings. In addition, there are methodological problems in converting expenditure in local prices to a common base:
  - the price index (e.g. a gross domestic product (GDP) deflator or consumer price index) used to convert expenditures of different dates into a common year may not be an accurate reflection of changing price levels for health service inputs;
  - exchange rates are used to convert expenditure in local currencies into a common currency such as US dollars. However, exchange rate conversions can be misleading because exchange rates do not necessarily reflect the purchasing power of currencies. They may be particularly misleading when used to convert the values of goods and services which are not internationally traded (40). For instance, in low-income countries manpower tends to be cheap relative to other health service inputs such as drugs. International comparisons will be affected if relative prices vary between the countries being compared, or if the interventions compared use

different mixes of inputs.

### **Conclusion**

The tradition of cost-benefit analysis in development planning means that there is perhaps greater pressure on the health sector in developing than in developed countries to justify its proposals in economic terms. Thus there is considerable interest in the application of techniques of economic evaluation to the health sector. Unfortunately, the lack of economists with an interest in health, and the problems of obtaining adequate data on costs and consequences are considerable obstacles to good economic evaluation.

Moreover, the application of the techniques is still at an early stage and many studies aim to stretch the boundaries of the discipline rather than to provide practical guidance. The studies done under the aegis of the WHO Expanded Programme on Immunization provide a good example of the way in which early theoretical work can be developed into a methodology capable of application by health service managers. These studies emphasize two further points: the importance of choosing issues that are amenable to economic evaluation, where calculations or plausible assumptions can be made of the relationship between health interventions and health consequences; and the need for collaborative work between economists, epidemiologists and other health researchers.

The results of economic evaluation are of assistance to decision-makers, but they do not dictate their course of action. While it is important to know the cost-effectiveness of different ways of organizing primary health care activities, other consequences less easy to quantify, such as stimulating community participation and promoting the capacity to improve individual health, must not be neglected. Decision-makers will wish to take these also into account when they review the results of economic evaluation studies.

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## ECONOMIC EVALUATION OF HEALTH PROGRAMMES: GLOSSARY OF TERMS

Anne Mills & M. F. Drummond

### Average costs

The cost per unit of output (total costs divided by total number of units of output). Also known as unit cost.

### Benefit-cost ratio

Total discounted benefits divided by total discounted costs. The outcome should be greater than 1 for an investment to be potentially worthwhile.

### Capital

The stock of goods which are man-made and used in production (as opposed to consumption). Fixed capital (durable goods such as buildings and machinery) is usually distinguished from circulating capital (stocks of raw materials and semi-finished goods which are rapidly used up). In accounting conventions, capital goods are usually taken as those with a life of more than one year, such as land, buildings and equipment.

### Capital costs

The cost of employing capital goods. In an economic sense, it is the rate of return forgone by not using the funds spent on particular capital goods in other ways. In accounting terms, it is the money expenditure required to purchase capital goods.

### Consumption

Acquiring goods or services in order to obtain immediate satisfaction; in contrast to investment which permits greater consumption in the future by increasing a country's productive capacity.

### Costs

What has to be given up to achieve something. Either:

- (a) the value of the benefits which are forgone in order to achieve something (the economic definition); or
- (b) the total money expenditure required to achieve something (the accounting definition).

See **Opportunity cost**.

### Cost-benefit analysis

A form of economic evaluation where all the costs and consequences are expressed in money terms. In principle, this form of analysis enables one to assess whether a particular objective is worth achieving. However, estimation difficulties often reduce cost-benefit analysis to a consideration of those costs and consequences that are easy to express in money terms.

### Cost-effectiveness analysis

A form of economic evaluation where the costs are expressed in money terms but where some of the consequences are expressed in physical units (e.g. life-years gained, cases detected). It is usually used to compare different ways of achieving the same objective (e.g. life saving) and assumes the objective is worth achieving. If two programmes have consequences that are identical in all respects, the analysis is sometimes called a *cost minimization analysis*. If consequences are measured in quality-

adjusted life-years or "utilities", the analysis is sometimes called *cost-utility analysis*.

### Cost-utility analysis

A form of economic evaluation where the costs are expressed in money terms but where some of the consequences are expressed in utility units (e.g. "quality-adjusted life-years" or "healthy days of life").

### Depreciation

Decrease in the value of a capital good because of passage of time, wear and tear, etc. An allowance for depreciation may be included as an operating cost in accounts.

### Demand

The quantity of goods or services that consumers wish and are able to buy at a given price in a given period.

### Development funds

The funds for activities which promote a country's development. Many governments have a development budget to finance (often from external sources) activities which will increase the country's productive capacity.

### Discounting

The treatment of time in the valuation of costs and benefits, requiring a choice of discount rate and time frame. This process estimates what something is worth today, given that it cannot be obtained or used until some time in the future. (i.e. its "present value").

### Discount rate

The annual rate at which the value of a future cost or consequence is reduced to find its present value. The discount rate expresses society's time preference rate. For example, at a discount rate of  $r$ , an event occurring in  $n$  years' time has a present value of  $(1 + r)^{-n}$ .

### Economic evaluation

A process whereby the costs of programmes, alternatives or options are compared with their consequences, in terms of improved health or savings in resources. Also known as the *cost-benefit approach* or *economic appraisal*. It embodies a family of techniques including cost-effectiveness analysis, cost-benefit analysis and cost-utility analysis.

### Economic prices

A type of shadow price where market prices are adjusted to reflect their true opportunity cost.

### Efficiency

Relates to output per unit cost of the resources employed. Resources are being used efficiently if a given output is produced at minimum cost, or maximum output is produced at a given cost ("operational" efficiency). Economists also use the term in the wider sense of cost-benefit analysis ("allocative" efficiency).

### **Equivalent annual cost**

The recurring annual sum or annuity, which over the life of the project has a present value equal to a lump sum payment made now.

### **Fee-for-service**

Payment of a charge per item of health care received, (e.g. consultation, diagnostic test).

### **Fixed costs**

Costs which do not vary with the level of output in the time period considered (usually one year).

### **Foreign exchange**

The currency of other countries. It is required by individuals and institutions to buy goods and services from, or make gifts or loans to, people in other countries.

### **Health sector**

The part of the economy which is involved in activities intended to improve health. The term may be used to mean health services, but it is often used synonymously with the term health system, to mean health services and health-related activities.

### **Human capital**

The skills and capabilities generated by investments in education and health.

### **Incremental cost**

The additional cost of one programme, alternative or option over and above another.

### **Indirect costs**

The productivity losses associated with illness, or the worktime taken up in medical treatment. Typically, these are valued by using earnings as a proxy.

### **Inputs**

Goods and services used in production, such as capital goods (buildings, equipment, labour, raw materials, etc.).

### **Investment**

Expenditure on capital goods which are then used in production. In a more general sense, it means undertaking any activity which involves a sacrifice (e.g. payment of money) followed by a benefit (e.g. enjoyment of a good).

### **Marginal cost**

The change in total cost at a given scale of output when a little more or a little less output is produced. This concept of 'marginality' can also apply to benefit, value, income, production, etc.

### **Marginal product**

The change in total production at a given scale of output resulting from an additional unit of input (e.g. labour).

### **National income**

The money value of all goods and services earned in a country over a specified time period. It may be calculated as the sum either of incomes or of expenditures of all residents, companies and government bodies. Gross domestic product (GDP) and gross national product (GNP) are related measures.

### **Non-traded goods**

Goods which are not imported or exported.

### **Operating costs**

Also called recurrent costs: the cost of operating an enterprise or service; i.e. those costs of providing a service that vary with the level of output (e.g. drugs) in contrast to those which are fixed over a given time period, usually a year (e.g. capital costs). Usually calculated on an annual basis.

### **Opportunity costs**

The benefits to be derived from using resources in their best alternative use. It is therefore a measure of the sacrifice made by using resources in a given programme. When economists use the term "cost", they mean opportunity cost. This may not be the same as health care expenditures.

### **Outputs**

The end-result of production, that is, what is produced.

### **Overheads**

The costs pertaining to general services (e.g. administration) which do not necessarily arise from the operation of a given programme.

### **Per diem**

The daily rate for reimbursement of hospital expenditures. It is usually based on the hospital average daily cost and is unlikely to reflect the costs of treating any given case. It should therefore be treated with caution when used in economic evaluations.

### **Present values**

The value now of future costs or benefits discounted at a given rate.

### **Price index**

A price index shows how the prices of goods and services have changed over time. It is based on a given physical quantity of items which are priced at prevailing prices. The resulting total value of the items is then expressed as a percentage of their value at some base year.

### **Productivity**

Output per unit of input in a stated time period, e.g. labour productivity can be measured as output per person per hour.

### **Project appraisal**

Analysis undertaken prior to project implementation to estimate net benefit in relation to costs.

### **Public sector**

That part of the economy of a country that comes within the scope of central government, local government authorities and public corporations.

### **Quality-adjusted life-year**

A measure which reflects both the quality and quantity of life gained from health programmes. It is usually derived by making assessments of the relative value or "utility" of defined states of health. These assessments can be made by professionals, patients or the general public and are obtained by interviews with individuals or through consensus-forming exercises.

### **Real terms**

A variable (such as national income, or health expenditure) is expressed in "real terms" if its value has been

adjusted to remove the effect of change in price. The resulting value is said to be at a constant price.

### **Recurrent costs**

Costs that "recur", i.e. the costs of running an enterprise, such as salary and raw material costs. Also known as operating costs.

### **Resources**

The inputs that are used to produce and distribute goods and services. These are conventionally classified into land (including natural resources), labour (people) and capital (goods made to produce other goods). In health programmes they include inputs which are not under the control of the health sector, such as patients' time.

### **Scarcity**

The lack of a commodity in relation to the demand for it. Resources are scarce, and thus choices must be made on how to allocate them.

### **Sector**

The economy of a country can be divided into "sectors". The broadest classifications are between the private and public sectors, and the economic and social sectors. The latter can be divided into sectors with common activities such as manufacturing and agriculture in the economic sector and education and health in the social sector.

### **Sensitivity analysis**

A technique designed to allow for uncertainty by testing whether plausible changes in the values of the main variables would affect the conclusions of an analysis.

### **Shadow prices**

Adjustment of prices of goods and services in order to take into account market price distortions and government objectives. Also known as accounting prices. The most

common shadow prices are for foreign exchange (shadow exchange rate) and labour (shadow wage rate).

### **Social cost**

The cost of an activity to society and not merely to the agency carrying out the activity.

### **Social prices**

A type of shadow price where net benefits are weighted to reflect a country's preference for savings versus consumption, and/or for favouring some income groups more than others.

### **Standard conversion factor**

The shorthand means by which non-traded goods can be valued in terms of world prices.

### **Supply**

The quantity of goods or services coming on the market at a given price in a given time period.

### **Time cost**

The cost individuals incur in being inactive through illness or in travelling to and waiting for health services. Time can be valued in terms of its opportunity cost (i.e. value of lost production or lost leisure).

### **Trade goods**

Goods which are imported or exported.

### **Unit cost**

The total cost of an activity divided by the number of units of output produced. Also known as average cost.

### **World price**

The value of a good when purchased internationally.

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