

## **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.