

WHO/RHB/97.2
Original: English
Distribution: General

Cost Analysis for Management of Rehabilitation Programmes



Rehabilitation Unit
Division of Health Promotion, Education and Communication
World Health Organization
1997

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Foreword

The need for guidelines on cost analysis of community based rehabilitation (CBR) programmes was identified by several role-players in different countries, as a complement to the existing WHO management guidelines entitled "Disability Prevention and Rehabilitation in Primary Health Care; A Guide for District Health and Rehabilitation Managers".

Although the existing experiences of cost analysis in primary health care settings had been utilized, there was an explicit need to develop guidelines applicable for CBR programmes. Consequently, the WHO Rehabilitation Unit requested Dr L. Lorenzoni, WHO Division of Health Situation and Trend Assessment, to prepare the working document in collaboration with Mr A.L. Creese, WHO Division of Analysis, Research and Assessment.

The expertise of Professor K. Wright, Centre for Health Economics, University of York, UK, guided the process and informed the development of the document throughout.

The initial guidelines were tested in Mauritius by Professor Wright and Dr Lorenzoni with the cooperation of Dr Jhandoo, Chief, Rehabilitation, Ministry of Health, Mauritius. The reviewed guidelines were then retested in Zimbabwe in consultation with Dr Lorenzoni, with the assistance of Dr C. Hongaro, Blair Research Laboratory, Ministry of Health. This final document prepared by Dr Lorenzoni is the adapted guidelines from these two studies and is presented as a proposal set to advise managers of CBR programmes.

The valuable contribution of Dr G. Carrin, Mr C. Politi and Mrs G. Maison Halls, WHO, in reviewing the final draft is acknowledged with appreciation.

We would like to express our thanks to the Swedish International Development Cooperation Agency for provided financial support for this document.

Gratitude is expressed to everyone for their cooperation, time and generous sharing of expertise.

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1. Introduction

Over the last ten years the World Health Organization (WHO) has widely promoted the concept of Community-Based Rehabilitation (CBR). In the Joint ILO/UNESCO/WHO Position Paper on "Community-Based Rehabilitation for and with People with Disabilities" (1994), the CBR programme is described as follows:

"... Community-based rehabilitation is a strategy within community development for the rehabilitation, equalization of opportunities and social integration of all people with disabilities.

CBR is implemented through the combined effort of disabled people themselves, their families and communities, and the appropriate health, education, vocational and social services".

In this framework, the measurement of costs provides a policy relevant approach to the evaluation of services for people with chronic disabilities. This is not so limited an approach as might at first seem likely, but it is not straightforward. Since resources are scarce, deploying them in one way means that the benefits are foregone as the resources are not available to pursue the next best alternative. Therefore cost analysis, in defining a framework for a structure of costs of different programmes, can play an important role as to using objective and timely information to support the decision-making process aimed at maximizing the benefits from the finite, and often, insufficient resources.

Cost information can contribute towards making health care strategic management comprehensive rather than partial, systematic rather than piecemeal, and in making value judgements explicit rather than implicit. In addition, cost information may be used to support planning, evaluation or strategic management decisions at different levels of the health care system.

Although greater awareness of costs can itself create a better environment for increasing the efficiency in the use of resources, it is important to understand the real nature of the costs by asking the right costing question.

Cost analysis may focus on the planning activities by health planners concerned with CBR as well as other programmes. In that situation, the focus is on changes in resource use brought about by introducing and implementing a CBR programme in one area. Thus the focus of the analysis is on changes in resource use that may occur if the existing scale, finance or organization of the provision of rehabilitation services is altered. Answering the costing question is never easy, except when it is related to minor alterations in service provision. However, it is very important in gathering information to support affordability, sustainability, and budgeting analysis for priority setting.

Implicit in the analysis is the measurement of existing service provision which reveals the present value of the resources used for providing rehabilitation services and provides the baseline from which the future changes will be measured.

The cost information on CBR programmes may be also concerned with the evaluation activities. In that case, the comprehensive review of a programme resource utilization or consumption during a specified period of time constitutes a piece of information which may be used to better understand how the available funds have been spent or to ensure that the money has been spent as intended. Keeping track of the expenditures and accountability on the use of available funds are useful for a better adherence to programme budgets and constitute the building blocks for the planning and budgeting analysis.

As a third option, cost information may be used to assist decision-making when choices have to be made among several courses of action within a defined strategy. Cost analysis may then provide an option appraisal to support strategic management issues at the intermediate level in order to improve efficiency in the use of available resources. The programme may relate to training at community level, household screenings for identifying patterns of disability, social mobilization, or income generating projects within a specific national strategy such as the expansion of a CBR programme in one area.

This document relates to the latter option and can be used by programme managers with support from local experts to evaluate the costs associated with different forms of health interventions within their CBR programmes. It should be considered as a "tool-kit" for small scale problem-oriented studies aimed at achieving better understanding and management of resource flow at community level. The methodology for the cost analysis was refined on the basis of two costing exercises of CBR undertaken in 1992 and 1993 in Mauritius and Zimbabwe, respectively.

A potential follow-up step to cost analysis is given by economic evaluation, which covers a range of techniques that may be used to assemble evidence on the expected costs and consequences of different programmes. The four main approaches that may be used are cost minimization, cost effectiveness, cost utility and cost benefit analyses. Each of these approaches involves the systematic identification, measurement and, where appropriate, valuation of all the relevant costs and consequences of the options under review. The analysis of the comparative costs of alternative programmes is common to all forms of economic evaluation and therefore cost analysis is a requisite for carrying out economic evaluation.

2. Planning the Study

This section describes in detail several points which should be considered before starting any exercise. The case-study, which is part of this document, provides an insight about how to use the approach in practice.

2.1 Defining the scope for the analysis and the alternatives for appraisal

Cost analysis, the approach described in this document, is a tool which may produce relevant information to assess the cost implication of different options to implement a specified strategic programme. Its added value lies in a better understanding of the resources involved in the implementation of a defined programme. This helps in evaluating the financial viability of one option as compared to another, preparing better budgets, and monitoring actual expenditures.

The starting point of the analysis is given by a clear identification of the objective of the analysis (*What programme would I like to implement?*), the options to reach the scope selected as being those considered to offer the greatest potential (*What are the feasible courses of action?*), and the indicators to be used for comparison (*On which basis do I compare the different courses of action?*).

2.2 Specifying the viewpoint and the focus for the analysis

It is important to specify the standpoint from which the evaluation is to be carried out, since an item may represent a cost from one point of view but not a cost from another. The analysis may be based on one or more of the following viewpoints: the individual patient; the hospital or other provider; the public health sector; the government; society at large. The preferred approach is to carry out the evaluation from a societal perspective, the broadest one, with relevant component parts of the costs, i.e. costs borne by patients or their relatives, and costs borne by the rest of society, being made explicit.

The analysis may focus only on permanent disabilities, that is a disability which will be present for the remainder of a person's life. Examples of permanent disabilities include cerebral palsy, hemiplegia following a stroke, paraplegia, blindness, deafness.

Types of permanent disabilities may be grouped into six major categories in order to identify the existing patterns of disability in the area under study: mobility (locomotor) disorders; visual disorders; hearing/speech disorders; mental illness; mental retardation; multiple handicaps. The above classification was identified using the WHO guidelines on the definition of impairment, disability, and handicaps.

2.3 Defining the time period of the analysis

Theoretically all costs which incur over one full year in the programme under study should be measured. A one-year period avoids any distortions that may be caused by seasonal effects and is likely to be consistent with the actual record keeping activities in most types of institutions. If possible and available, the most recent year for which cost and activity data are available should be chosen as a basis for analysis.

2.4 Identifying the level of analysis and the source of financing

It is important to identify the level of analysis - national, provincial, district, community or household - in order to divide up resources according to their actual (or planned) use. This classification may be used for better understanding who will bear the costs of implementing a specific option within a programme. The source of resources is another very important element for the analysis. The providers of funds may include the Ministry of Health, local government bodies, nongovernmental organizations, or international donors. From a classification of resource by source we can estimate, for example, the degree of dependence of a programme on external assistance.

3. Cost Analysis

The CBR costing exercise for strategic management requires the collection of cost and activity data for the measurement of the planned service provision for the different options under study. The costing of the actual/planned service provision demands the availability of good data on costs to be supplemented by good data on activity at all the relevant levels of health services (e.g. provincial, district and community) involved in the different courses of action. In addition financial and activity data may be required from other public agencies and nongovernmental organizations providing relevant services to the programme. Last but not least, information is required from volunteers and from informal carers about their attitude to the opportunity costs as they give their time and other resources to support a programme.

The data to be used in the analysis should include a reliable estimate of the number of persons with disabilities in the area under study, an assessment of their disabilities, and a record of their present service use.

A precious source of information as to the identification of the existing pattern of disability are household screenings surveys which may have already been carried out in the area under study as a part of the introductory phase of CBR. Alternatively, the Ministry of Social Security may supply a list of people receiving invalidity payments and carers' allowances, or of persons who were provided with hearing aids and wheelchairs.

3.1 Definition of Costs

The cost of goods or services is the measure of the value of the resources used or consumed to produce the goods or services. It is calculated by multiplying the number of units of each input used or consumed in the production process by the value of each unit. At least two different concepts of cost can be distinguished: social or opportunity costs and financial costs. For economists the most important concept is that of opportunity costs; that is, since resources are finite, cost refers to the sacrifice (of benefits) made when a given resource is consumed in a programme and is therefore not available for its best alternative use. The notion of financial costs refers to the costs expressed in terms of financial outlays, i.e. the exchange of cash or credit to obtain resources.

The two notions of costs are equivalent when prices reflect the value of best alternative use of resources and diverge when resources are used for which no price is paid or where the price is distorted because of market imperfections or elements of taxation or subsidy. In these circumstances it may be necessary to adjust the market price of the resources or to use a shadow price based on its value in the best alternative use.

In the context of the analysis, an attempt should be made to estimate opportunity costs only when no price is paid, as in the case for donated goods and services. The pragmatic approach of taking existing market prices may be used to value traded items as a fair

approximation of their economic costs, even if, in particular in developing countries, there may be distortions in the price structure and in the wage rates.

3.2 Cost Categories

To estimate a programme's costs, classification of its components is necessary. Resource inputs can be broken down in several ways - by input, by function/activity, or by level, depending on the study design. The classification of costs by component physical inputs, the most widely applicable and useful, should be used. This type of classification distinguishes two important categories of resources: those which are used up in the course of a year and are usually purchased regularly (i.e. recurrent or operating costs); and those that last longer than one year (i.e. capital costs). The scheme suggested for the cost classification is shown in the table below.

Table 1: Classification of Costs by Input

Capital Costs:	
<i>Vehicles:</i>	motorcycles; 4-wheel drive vehicles; trucks; ambulances.
<i>Equipment:</i>	whirlpools; diathermy machines; other equipment with unit cost of US\$100 or more.
<i>Buildings-space:</i>	health centres; hospital departments; accommodation for rehabilitation workers.
<i>Training-non recurrent:</i>	training activities for personnel that accrue only once or rarely.
<i>Social mobilization non-recurrent:</i>	social mobilization activities that occur only once or rarely.
<i>Housing adaptation</i>	
Recurrent Costs:	
<i>Personnel:</i>	supervisors; health workers; administrators; consultants; rehabilitation technicians.
<i>Supplies:</i>	drugs; small equipment (unit cost of under US\$ 100)
<i>Vehicles-operation and maintenance:</i>	petrol; lubricants; tyres; insurance.
<i>Buildings-operation and maintenance:</i>	electricity; heating; fuel; telephone; cleaning.
<i>Training recurrent:</i>	short, in-service courses.
<i>Social mobilization:</i>	operation costs.

Source: Creese (1994), modified

Once the relevant resources used or consumed in the programme under study have been identified, they must be measured in appropriate physical and natural units, and valued at all different levels and in all institutions which provide rehabilitation services included in the study.

3.2.1 Capital Costs

Total costs are usually expressed in terms of costs per year. However capital costs, for items such as buildings and vehicles, which by definition last longer than one year, represent an investment at a single point in time on an asset which is used over time. Therefore the value of a capital item has to be spread out over its useful life to determine an annual cost. Because the capital goods are bought in one year but used for several more, expenditure records give a distorted picture of the value of capital goods used in any one year. To measure the contribution of these outlays, first the capital items being actually used in the programme during the period for which costs are measured should be identified and, second, the annual value of these capital items should be calculated.

The method proposed to calculate the equivalent annual value of capital items (described in detail in Annex 1) incorporates both the depreciation and the opportunity cost aspect of the capital cost. Pragmatically, the accountant's concept of costs will be used to determine how much of the original price of the capital item can be charged at current costs in order to save the amount of money needed to substitute the capital item at the end of its useful life.

Vehicles

The kind of vehicles that should be valued include ambulances, motorcycles, four-wheel drive vehicles, cars and trucks. The current cost for a similar vehicle (including freight) should be taken, not the original purchase price. The sources of cost data are recent government contracts, supply records of donors (who frequently supply vehicles), or local dealer estimates. The working life of a vehicle may vary considerably, depending on type, terrain, use, and maintenance; consequently the expected working life of each type of vehicle should be determined by local consensus. Information from people who use, drive, or service cars may be used for an estimate of how long those types of vehicles have lasted in the past (i.e. how long before they reached the stage where it was not worth repairing them). In the unlikely event that some of the necessary data are not available, local rates of renting vehicles can be used as an implicit cost estimate, that is, what someone else would be willing to pay for the use of a similar vehicle.

Equipment

The kinds of equipment that should be valued include wheelchairs, parallel bars, whirlpools, filing cabinets, computers, refrigerators, cold boxes and swimming pools. There is a need to establish a cut-off value that marks the boundary between supplies and equipment. For example, if the unit price is less than US\$ 100.- (or some other value set), even if it lasts longer than one year, it will be simpler to use the recurrent input category of supply and so fully count any such items purchased during the year that are used for the programme. If it is US\$ 100.- or higher, then the capital category equipment

will be more appropriate. Useful sources of cost data are recent government contracts and supply records of donors. The working life of a piece of equipment can be ascertained by asking individuals who operate it how long this type of equipment generally lasts before it is beyond repair.

Buildings: space

The kinds of buildings that may be valued include health centres, hospital departments, staff accommodation, rehabilitation centres, and training/education centres.

The cost of constructing the building now should be calculated, that is, the current cost of site development, architect's fee, construction costs and the cost of the land should be used. The cost of basic furnishing and built-in equipment should also be included. If it is impossible to itemize these separately, it could be considered to add 10% to the total cost.

Recent government contracts for similar buildings are a useful source of cost information. The planning or tendering section of the health department or architects in the Ministry of Works or local construction firms should have this information.

Twenty years should be used as the expected working life of most buildings, unless they are very temporary structures with much shorter expected duration or unless general past experience in the area clearly indicates a longer period. The annual cost of building space can be approximated by an implicit approach through which an estimate of the annual price charged for renting similar space would be obtained (opportunity cost). As an example, the cost of accommodation at district level for CBR workers (e.g. rehabilitation technicians) has been singled out as a major constraint in expanding CBR, in particular in Zimbabwe, where there is a shortage of living accommodation, thereby resulting in very high rents.

Housing adaptation

The improvement or adaptation of housing for disabled persons represents a one-off capital investment which should be considered as a financial outlay for the disabled persons and caregivers. Information on extra expenditure on this item may be collected from the disabled persons or carers either through self-administered or interview-led questionnaires.

Training costs: non recurrent

One of the major clearly identifiable change in resource use for CBR is the training of CBR workers. Therefore those costs are likely to be relevant and should be clearly reported in the study.

Other capital inputs

For some programmes, at least at certain levels of the health system, there will be relevant social mobilization activities. Some of these may include one-time, start-up activities, which constitute non-recurrent inputs. Cost estimation is greatly simplified by summing-up all of the cost elements of a training or a social mobilization programme (e.g. personnel, buildings, vehicles, food and accommodation etc.) and treating the cost as a lump sum. As an example, in Zimbabwe a social mobilization programme of three weeks takes place in every area at the introductory stage of a CBR programme according to the following format:

- week 1: community awareness and mobilization; training of volunteers;
- week 2: volunteers conduct a house-to-house survey;
- week 3: screening of people with disabilities.

The resources consumed for those start-up programmes are likely to be relevant for a CBR programme, depending on the size of the catchment population, the extent of the coverage and the duration.

3.2.2 Recurrent Costs

For inputs which are purchased regularly, there are two approaches to estimating costs. One is to document the quantities of the inputs used, determine the price of each unit and estimate costs from these two sets of data. The other approach is to make use of the documents which have already combined the quantities and unit prices of the resources to give cost estimates which is what budget and expenditure records do.

If expenditure records are detailed enough, they will be the best and easiest source of cost data. Budget and expenditure records are normally broken down by input and sometimes by function. They have the advantage of eliminating the need to itemize resources and identify prices, and they are often available centrally. Budget records are less satisfactory than those related to expenditure as they are only statements of planned rather than actual expenditure. Expenditure data should be used in preference to budget data.

Personnel

Salaries and wages, along with other expenses for personnel, are likely to be the single largest cost item in CBR programmes. Both the staff directly involved in the activity under study (e.g. therapists, rehabilitation technicians, tutors, etc.) and other supporting staff (e.g. management staff, drivers, etc.) will be of concern. An attempt will be made to cover the costs only of persons whose time in whole or in part is properly assigned to the programme under study.

The full cost of employing personnel is represented by the individual's gross earnings, that is the individual's take-home pay, together with any supplementary (fringe) benefits that may have been deducted (e.g. contribution to health insurance, social security, and pension plans). These gross earnings should include any special incentives, overtime, or hardship bonuses, holiday and sick pay, uniform, housing, and travel allowance. If the worker receives any additional commodities, housing, or other non-monetary benefits, the value of these should also be estimated, using the prevailing market prices of similar items. Fees and honoraria for short-term services of experts, advisers, and others involved in the activity who are not employees should also be included.

Expenditure records and payrolls either in the Ministry of Health or in the Ministry of Finance will have cost data on salaries and allowances according to the actual salary scales. It may therefore be necessary to look elsewhere for some other figures. For example, pensions may be paid by the Civil Service Board or another agency, and per diem is often paid by external agencies.

Supplies

This cost category includes materials used in the course of the year as direct inputs into the principal activities performed by the programme, and other small items purchased during that period. As noted above, a reasonable value for the cut-off between equipment and supplies which last one year or more should be used, say a unit price of US\$ 100. The full cost of supplies should include the cost of transportation to the point of use, including any freight charges as a result of importing materials and any international distribution costs. The cost should be that of all the materials consumed, including those which are lost or wasted as well as those used or consumed for their intended purposes.

Supplies to be costed do not include those that are distributed but are kept in store (as inventory stocks). Only those that are consumed should be counted. Unless expenditure records are very detailed, they are unlikely to be useful for estimating the cost of most of the materials specific to the programme. Instead information on quantities and prices is needed.

As to quantities, for many supplies there will be stores at different levels (national, regional, district) and these stores will usually have inventory records. As to prices, supply invoices, order forms, price lists, and catalogues are good sources of information on the purchase, or, even better, the replacement price. Costs of international and internal transport should be included.

Vehicles: operation and maintenance

CBR programmes rely heavily on vehicles to carry out supervision, teaching and education activities, and implement the provision of care. The costs of operating,

maintaining, and repairing vehicles should be measured and valued. These costs should include materials, such as fuel (diesel or petrol), lubricant (oil), insurance and registration fees, tyres, batteries, and spare parts. The cost of drivers should be recorded under personnel. Where repairs and maintenance are contracted out or where they are performed by a different office or agency, their cost should be included under vehicle operating costs.

Expenditure records may give some indications of the costs of operating and maintaining vehicles, but it is likely that drivers and mechanics will need to be interviewed and log books consulted to get a sufficiently detailed picture. Fuel consumption is one input for which records are probably reasonably good. The ministry's central motor pool personnel should be able to give a rough estimate of the total annual cost of operating, maintaining, and repairing each type of vehicle.

Buildings: operation and maintenance

This is a category of inputs that is rather easily handled. Operation and maintenance costs for buildings should include charges for lighting, water, telephones, heating, building insurance, materials for cleaning, painting, and repairs of plumbing, roofing, heating and office furniture. Recurrent costs for buildings will normally be listed under such headings as "utilities", "maintenance" or "cleaning" and "security". The salaries of guards, cleaners, etc. should be counted under personnel. This is one category where recorded expenditure data are usually quite adequate.

Training and social mobilization: recurrent

Under the heading of "other capital inputs" the manner of counting the costs (quickly summed-up for totals) was recommended to be used for training and social mobilization. Each of these categories of inputs has its recurrent counterpart, when activities are repeated periodically. On an annual basis, they represent the recurrent cost of a programme. There are probably no special problems encountered, or instructions needed for calculating the costs of these two categories of inputs. When either a training or a social mobilization programme serves more than one programme, the total cost must be distributed (allocated) among those served.

Other operating inputs

This is the "catch-all" or residual category that covers all recurrent input costs not covered by any other category. It will consist of a few, if any, relatively small cost elements not requiring great effort in cost calculations.

3.3 Inflation

Costs of different inputs must be expressed in prices of the same year. It may be found that the only prices available for some inputs are prices from the previous years. In this case those prices need to be converted using an appropriate price index which measures inflation. The Ministry of Finance or the Ministry of Planning should be able to provide information on inflation rates. The appropriate formula to apply is the following, under the hypothesis of a constant rate of inflation over the last n years:

$$P_t = P_{t-n}(1+i)^n$$

where P_t is the price (unknown) at year t , P_{t-n} is the price (known) n years earlier, and i is the inflation rate.

As an example, if for a minibus the only price which is known is that of 1990 (US\$ 20,000) and, today in 1997, we would like to estimate the current price given an average inflation rate of 10% over the last eight years, we have:

$$\begin{aligned} \text{Price 1997} &= (\text{Price 1990})(1 + 0,1)^8 \\ \text{Price 1997} &= (20,000)(2,14) = 42,800 \end{aligned}$$

When available, a rate of inflation health sector specific should be used because all prices may not move together.

3.4 Donated Goods and Services

The major inputs which are provided "free" to the programme should be identified and an attempt should be made to estimate how much the resource input would be worth if employed in its best alternative use. It should be noted that donated goods are free to CBR but subsequent payments, including running costs and depreciation or replacement allowances if the equipment has to be bought out of CBR funds in later years, may need to be included in the analysis.

In the case of CBR, the main "free" resource used is the time of volunteers, informal carers, and persons with disabilities. The issue of informal care is particularly important in this framework because the CBR approach envisages a relative to act as a trainer for the person with a disability. This may be someone who is not employed (people under 15 years of age, women with young families and people aged over 60 years).

The costing approach of the time of disabled persons and carers might be based on defining time as foregone waged production; foregone non-waged production (household tasks); and foregone leisure time. For forgone non-waged time the opportunity cost may be approximated as the market value of commodities that could have been produced for that

household; assuming that most of this would be housework, the hourly rate of local domestic help may be utilized. For forgone waged time the cost may be fairly approximated by an average gross wage rate for unskilled workers in the area under study. It is important to stress that the assumption of using a wage rate for unskilled labour as an estimate of the economic cost for the time donated to the CBR programme is highly dependent on the working opportunities and attitudes in the area under study.

Discussions at the Ministry of Economic Planning and Development of Mauritius indicated a low rate of unemployment generally (around 2.5% of the workforce) and a high rate (40%) of female participation in the labour market. This suggested that both voluntary labour and the time of informal carers and disabled persons are likely to be in short supply and their social cost is likely to be relevant. Leisure time estimation is more difficult and might be taken as a proportion (e.g. 25%) of average hourly unskilled earning.

It should be noted that, given that most developing countries are facing a serious economic crisis, the need to take care of a disabled person may affect the productivity of the entire household. The survival needs of the family may then take priority over providing care for the disabled person at home. It was noticeable both in Mauritius and Zimbabwe, that persons with disabilities were frequently left alone at home to take care of themselves. This means that the economic cost of informal carers' time is likely to be relevant.

The concept of opportunity cost should be extended to those incurred by persons using health care. To take advantage of the treatment and education available in a health centre, individuals need to travel to the centre and wait their turn and, eventually, take time off from paid work and forfeit wages. Or they may sacrifice useful time at home. Costs may also be incurred by people who go to the health facility but receive no treatment; they might find that either the health centre is closed, or there are no drugs in stock, or they cannot afford to spend the time waiting.

3.5 Cost Allocation

If a particular input is used only for the programme under study, then the entire value of it can be assigned to that programme. Very often, however, people, buildings, vehicles, and supplies have multiple uses, only some of which may be for the programme.

Within a CBR programme, there will be a variety of services that depend on shared inputs, such as staff members who provide various types of care or overhead services in a facility (e.g. electric power, cleaning, administration). There might be practical difficulties in separating how much of the resource was used for each particular programme, given that there is no right way to apportion such shared costs.

A reasonably accurate way needs to be found. This process is called cost allocation. It is helpful to start thinking about the dimension of inputs which determine costs. The

following table identifies the main dimension of each type of resource which most directly determines the cost.

Table 2: Dimension of Resource Input which Most Directly Determines the Cost

Input	Dimension
Vehicles	Distance travelled / Time used
Equipment	Time used
Building - Space	Time used / Space used
Personnel	Time worked
Supplies	Weight /Volume
Vehicles - Operation and Maintenance	Distance travelled / Time used
Building - Operation and Maintenance	Time used / Space used
Other inputs	Miscellaneous

Source: Creese (1994), modified

Ideally these dimensions should be directly used as the basis for allocating costs. For personnel, the time that they devote to the programme should be used; for a shared vehicle, the distance travelled or the time used for duties related to the programme should be measured. It is especially important to get good measures of the proportion of time that a staff member spends on the activities in which we are interested.

There are some highly accurate ways of measuring time. For example, because it is risky to rely on staff members' memories of how they distributed their time, an attempt should be made to arrange for staff to fill out time sheets routinely or over a certain period of time. Another way would be to directly observe staff on a random sample of days and record what they do every hour. It may also be thought to use variables which are expected to be closely related to the direct determinant of costs. A useful variable for allocating personnel costs is the proportion of visits or contacts that are made for a particular function.

4. How to Proceed in the Analysis

In the following section, a case-study is presented in order to structure a process of analysis with a well-defined set of steps and tables to complete. The model for analysis may then be used for the evaluation of different programmes at the local level and which are of interest to CBR managers.

Step 1:

a. Defining the problem and the objective of the appraisal

The Province of Somewhere (10 Districts with a population of 1,000,000 people) would like to provide a programme of training and education to mothers/carers of young children with cerebral palsy and mental retardation in order to let the mothers/carers provide support and training to their children at home. A screening survey conducted in the area identified 100 children with cerebral palsy and mental retardation in 50 different villages. The CBR programme manager would like to better understand how to best use the resources. The purpose of the analysis is therefore to compare the annual cost of the alternative options for implementing the above-mentioned programme.

Step 2:

a. Identifying the options

The analysis should start from the identification of the different courses of action to implement the programme. In this specific situation, the options may be summarized as follows:

1. build three new huts in a convenient place and let the mothers/carers and disabled children come for training two days every four months;
2. use existing facilities and have mothers/carers and disabled children come for training and education two days every four months;
3. for each village/group of villages with disabled children arrange several visits by CBR professionals for specific training/education of mothers/carers.

Step 3:

a. Cost analysis

For each option defined on the shortlist in Step 2, all relevant cost items according to the classification described in Table 1 should be identified. These items should then be measured according to the methodology described in section 3.

Option 1:**Table 3: Cost Items Checklist**

Category	Item
Capital	Building three new huts
Capital	Purchase of basic furniture
Recurrent	Therapists and rehabilitation workers time
Recurrent	Travel time for disabled children and mothers/carers
Recurrent	Travelling expenses for disabled children and mothers/carers
Recurrent	Food

Once the relevant cost items have been identified, they should be valued.

b. Valuing capital items

To estimate the annual cost of building three new huts, we should use the methodology described in details in Annex 1. The Ministry of Work may provide a figure relating to the cost of building a new hut in the province. Assuming that the cost of building three huts is Somewhere Dollars (SW\$ 300,000) and that the average expected inflation rate is 10% (the Ministry of Finance is the best source for that figure), the value of the capital item varies according to the expected length of its working life:

<i>Working Life (in years)</i>	<i>Value (in SW\$)</i>
20	2,018,250
22	2,442,082
24	2,954,920

First year annual cost are then estimated for varying rates of interest and expected length of working life:

Table 4: First Year Annual Costs of Building Three New Huts (in SWS)

N	r = 12%	r = 14%	r = 16%
20	11,717	8,371	6,015
22	10,274	7,085	4,917
24	9,085	6,047	4,053

r = rate of interest; N = useful life (in years)

The figure of SW\$ 9,085 may be chosen as an estimation of the first year annual cost of building three new huts (under the hypothesis of 24 years of working life, an annual interest rate of 12%, and an annual inflation rate of 10%). Assuming that the space available will be used by two other programmes, we may then allocate the cost to training/education of the children with cerebral palsy and mental retardation and their mothers/carers according to the actual use of space in terms of time. In this example, we assume that 75% is to the CBR programme and 25% to other programmes. In addition, we can fairly approximate the cost of furniture as being 10% of the annual cost of the buildings, i.e. SW\$ 9,085. The cost figure in entirety is allocated to the programme under study because is specific to disabled children.

c. Valuing recurrent cost items

As to valuing recurrent cost items identified, we may obtain from the Ministry of Health the total salary of the professionals involved in the programme. Then with an estimation of the number of working days per year, we may estimate the per diem cost of personnel as follows:

Table 5: Per Diem Cost of Personnel

Personnel	Total Salary (SW\$)	No. of Working Days per Year	Cost per Working Day (SW\$)
Occupational Therapist	30,000	288	104.17
Physiotherapist	30,000	288	104.17
CBR Worker	20,000	288	69.44

Under the scenario of 30 training/education sessions with the involvement of two rehabilitation workers for two working days each and one occupational therapist and one physiotherapist for one day each, the total cost of personnel equals SW\$ 14,583. The figure is obtained by multiplying the cost per working day by the number of sessions and the number of training days in each session for the different professional persons involved. The general idea is to have the huts built close to the provincial hospital in order to minimize the travel time by the trainers.

Calculating that the average distance to the education/training place is 100 km., the public transport company may tell you that a return fare for the mother/carer costs SW\$ 50 and that public transport for disabled persons is free. On average, it will take 12 hours to travel from the village to the huts and back. Multiplying by three (number of training/education sessions per year), 36 hours is the equivalent travelling time per mother/carer.

The local government can provide you with an estimate of the average unskilled wage in the area. We can assume that SW\$ 10,000 is the average unskilled wage and that the opportunity cost of carers time (forgone leisure time) may be approximated by 25% of that wage as to 50% of the mother/carer time; thus the annual cost is SW\$ 31.29 per mother/carer per year.

The following table summarises the cost implication of Option 1.

Table 6: Cost Implications

Cost Item	Annual Cost (SWS)	Cost to Health Sector (SWS)		Cost to Disabled Families (SWS)
		Government Funds	External Funds	
Building Huts	6,814	6,814	---	---
Purchase of Furniture	908	908	---	---
Therapists and Rehabilitation Workers Time	14,583	14,583	---	---
Travelling Time	3,129	---	---	3,129
Travelling Expenses	15,000	---	---	15,000
Total	40,434 (100%)	22,305 (55%)	---	18,129 (45%)

The cost to mother/carer of the two day training/education session is not included in the analysis because it represents an item common to all three options; in other words, we take into account only differential costs. Under the same hypothesis, also the cost of food is not valued. If we are interested in estimating the total cost of the three options, the two above-mentioned items should be included in the analysis.

Option 2:

Table 7: Cost Items Checklist

Category	Item
Recurrent	Renting of space
Recurrent	Therapists and rehabilitation workers time
Recurrent	Travel time for children with disabilities and mothers/carers
Recurrent	Travelling expenses for children with disabilities and mothers/carers
Recurrent	Food

a. Valuing recurrent cost items

The cost of renting three huts-like space may be approximated by local prices. In our analysis, we assume that the Local Renting Company provides you with an estimate of the cost of renting the space needed at SW\$ 50 per day, including basic furniture. By multiplying that figure by 60 - the number of sessions times by the number of days for each session - we come up with a figure of SW\$ 3,000.

The per diem cost of personnel may be estimated as for option 1 described above.

Under the scenario of 30 training/education sessions with the involvement of two rehabilitation workers for two working days each and one occupational therapist and one physiotherapist for one day each, the cost of personnel is SW\$ 14,583. The general idea is to have the space rented close to the provincial hospital in order to minimize travelling expenses for trainers.

Assuming that the average distance to the education/training place is 100 km, a return fare for the mother/carer may cost SW\$ 50 (persons with disabilities are entitled to free public transport). On average, it will take 12 hours to travel from the village to the huts and back. Multiplying by three (the number of training/education sessions per year), 36 hours is the equivalent travelling time. Assuming that SW\$ 10,000 is the average unskilled wage in the area under study and that the opportunity cost of carers time (foregone leisure time) may be approximated by 25% of that wage as to 50% of the mother/carer time, the annual cost is SW\$ 31.29 per mother/carer per year.

The following table summarizes the cost implications of option 2.

Table 8: Cost Implications

Cost Item	Annual Cost (SW\$)	Cost to Health Sector (SW\$)		Cost to Disabled Families (SW\$)
		Government Funds	External Funds	
Renting of Space	3,000	3,000	---	---
Therapists and Rehabilitation Workers Time	14,583	14,583	---	---
Travelling Time	3,129	---	---	3,129
Travelling Expenses	15,000	---	---	15,000
Total	35,712 (100%)	17,583 (47%)	---	18,129 (53%)

Option 3:

Table 9: Cost Items Checklist

Category	Item
Capital	Purchase of a new minibus
Recurrent	Renting of space in each village
Recurrent	Therapists and rehabilitation workers time
Recurrent	Travel time for children with disabilities and mothers/carers
Recurrent	Travelling expenses for children with disabilities and mothers/carers
Recurrent	Food

The Ministry of Transport says that the average cost of a new minibus is SW\$ 100,000; assuming that the average expected inflation rate is 10%, the value of the capital item varies according to the expected length of working life:

<i>Working Life (in years)</i>	<i>Value (in SW\$)</i>
8	214,358.90
10	259,374.20
12	313,842.80

First year annual costs are predicted for varying rates of interest and expected length of working life:

Table 10: First Year Annual Costs of Purchasing a Minibus (SWS)

N	r = 12%	r = 14%	r = 16%
8	12,121	10,708	9,481
10	9,353	7,976	6,820
12	7,519	6,188	5,111

r = rate of interest; N = useful life (in years)

We may use the figure of SW\$ 7,519 as an estimate of the first year cost of the minibus. We can assume that the minibus will be purchased using international donor funds. Assuming that the vehicle is used by three other programmes, we can allocate the cost to the training/education of the children with cerebral palsy and mental retardation and their mothers/carers according to the actual use of the vehicle in terms of travelling distance. In

our example, we may want to assume that 35% is to the programme under study and 65% to other programmes. As to recurrent cost items, the per diem cost of personnel may be estimated according to the following table:

Table 11: Per Diem Cost of Personnel

Personnel	Total Salary (SWS)	No. of Working Days per Year	Travel Allowance per Day (SWS)	Cost per Working Day (SWS)
Occupational Therapist	30,000	288	30	134.17
Physiotherapist	30,000	288	30	134.17
CBR Worker	20,000	288	20	89.44

Under the scenario of 60 training/education sessions at village level, five children with disabilities are seen per session. This involves two rehabilitation workers for two working days each and one occupational therapist and one physiotherapist for one day each. The cost of personnel equals SW\$ 37,566.

We should also estimate the cost of running the minibus. The cost per day may be summarised as follows on the basis of the figures provided by the Ministry of Transport:

Table 12: Per Diem Cost of Running a Minibus

Item	Cost per Day (SWS)
Salary of driver	50
Fuel	20
Maintenance of the vehicle	15
Total	85

Assuming 120 days of use per year, the total cost of running the vehicle is SW\$ 10,200.

The opportunity cost of space available for education/training may be approximated by SW\$ 20 per session (it is likely to be a common village space or homes of persons with disabilities).

Assuming that the average distance to the village where the education/training session takes place is 20 km, a return ticket for the mother/carer may cost SW\$ 10 (disabled persons are entitled to free public transport). On average it will take three hours for a return trip between the hospital and the village where the training session takes place. Multiplying by

three (number of training/education session per year), nine hours is the equivalent travelling time. Assuming that SW\$ 10,000 is the average unskilled wage in the area under study and that the opportunity cost of the time of mother/carer (foregone leisure time) may be approximated by 25% of the wage to 50% of the time of mother/carer, the annual cost equals SW\$ 6.1 per mother/carer per year.

The following table summarizes the cost implications of option 3.

Table 13: Cost Implications

Cost Item	Annual Cost (SWS)	Cost to Health Sector (SWS)		Cost to Disabled Families (SWS)
		Government Funds	External Funds	
Purchase of a minibus	2,632	---	2,632	---
Therapists and rehabilitation workers time and travel allowance	37,566	37,566	---	---
Running of the minibus	10,200	10,200	---	---
Travelling expenses	3,000	---	---	3,000
Travelling time	610	---	---	610
Renting of space	1,200	1,200	---	---
Total	55,208 (100%)	49,966 (80%)	2,632 (4%)	3,610 (6%)

Step 4:

a. Comparing the different options

In order to judge the cost implications of the three different courses of action, we should compare the results of the analyses carried out in the previous steps. The following table summarizes the cost of the three different options as described above and focuses on whom the costs are borne.

Table 14: Cost Comparison of the Three Different Options in terms of Annual Cost

Option	Annual Cost (SWS)	Cost to Health Sector (SWS)		Cost to Disabled Families (SWS)
		Government Funds	External Funds	
1	40,434	22,305	---	18,129
2	35,667	17,538	---	18,129
3	55,208	49,966	2,632	3,610

Under the assumption of equal effectiveness, comparable catchment areas and number of users of the training/education across the three options, we may also want to estimate the annual cost per disabled child. This ratio represents a feature of cost-minimization analysis, the less complex approach to economic evaluation.

Table 15: Cost Comparison of the Three Different Options in terms of Annual Cost per Disabled Child

Option	Annual Cost per Disabled Child (SWS)	Cost to Health Sector (SWS)		Cost to Disabled Families (SWS)
		Government Funds	External Funds	
1	404.3	223.1	---	181.3
2	356.7	175.4	---	181.3
3	552.1	499.7	26.3	36.1

According to the ratio estimated above, Option 2 results show the less expensive (unit differential cost of SW\$ 365.67), even if it is the most expensive as to the cost to disabled families (unit cost of SW\$ 181.29).

Option 2 results appear preferable to Option 1 (same cost to families with member with disabilities; less cost to the health sector). The choice between Option 2 and 3 may depend on the different policy options as to who should bear the costs of the specific CBR programme. Here the viewpoints for the analysis come to the front: if it is society at large or the health sector, than Option 2 should be preferred; if it is disabled families, than Option 3 should be chosen. In Option 3, the degree of dependency on external funds is very low.

Information from the analysis, with political and social preferences, can assist the decision-makers in the process of searching for the best, i.e. the most efficient course of action for a specific programme.

Equations

To calculate the annual value of a capital item we should take into account:

- the years of working or useful life (N);
- the rate of inflation in the country (i);
- the rate of interest in the country (r);
- for imported goods, the rate of depreciation of the local currency to the currency of the country where the capital item is purchased (d) and the rate of inflation in the country from where the good is imported (i*);

Suppose equipment locally produced costs C_0 and has a useful life of N years. If the inflation rate in the country remains constant over the N years, the equipment value at the end of the N-th year will be:

$$C_N = C_0 \times (1+i)^N$$

Thus at the end of the N-th year, an amount of C_N should have been saved to replace the capital item.

Every year a sum P_i has to be saved to replace the item in N years:

$$P_1 + P_2 + P_3 + \dots + P_N = C_N$$

If the funds available at the end of the first year are put into a bank account at an interest rate of r, the funds will be worth:

$$\begin{aligned} &P_1 \times (1+r) \text{ at the end of the second year;} \\ &P_1 \times (1+r)^2 \text{ at the end of the third year;} \\ &P_1 \times (1+r)^3 \text{ at the end of the fourth year;} \\ &P_1 \times (1+r)^{N-1} \text{ at the end of the N-th year.} \end{aligned}$$

If the future cost C_N is shared equally over the N years, the money saved at the end of each year gives C_N / N at the end of the N-th year. The annual provision at the end of the i-th year has to be:

$$P_i = C_N / N(1+r)^{N-1}$$

For an imported item, the rate of depreciation d and the rate of inflation i^* in the country from which the item is imported have to be taken into account. The value in local currency of the equipment at the end of the N-th year will be:

$$C_N^* = C_0^* \times (1+d+i^*)^N$$

and the annual provision in local currencies at the end of the i-th year has to be:

$$P_i^* = C_N^* / N(1+r)^{N-i}$$

As an example, let us consider a piece of equipment whose costs is SW\$ 1,000 with a useful life of 10 years in a country where the average rate of expected inflation is 10% and the average expected rate of interest is 10%. The equipment value at the end of the 10th year will be:

$$1000 * (1 + 0.1)^{10} = \text{SW\$ } 2,594$$

If the future cost of SW\$ 2,594 is shared equally over 10 years, the first year annual cost equals:

$$2594/[10 * (1 + 0.1)^9] = \text{SW\$ } 109.90$$

Glossary of Terms

Average Costs

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

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.

Costs

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

- (a) the value of the benefits which are foregone in order to achieve something (the economic definition); or
- (b) the total money expenditure required to achieve something. 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 something 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 terms (e.g. "quality-adjusted life years" or "healthy days of life").

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

Related 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).

Inputs

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

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.

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.

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.

Unit Cost

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

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