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Is Rehabilitation Cost Effective?

by

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DISCUSSION PAPER 101

IS REHABILITATION COST EFFECTIVE?

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ABSTRACT

It is imperative that health care resources are spent as efficiently as possible by committing them to demonstrably cost-effective treatments and procedures. The NHS reforms of 1989 aimed to help achieve this by separating out the roles of purchaser and provider. In doing so 'trade' between them will be more explicit and accountable. Both purchasers and providers therefore require information about the costs and consequences of treatment options to enable them to make informed decisions about which treatments to fund.

The current literature concerning the cost-effectiveness of rehabilitation options is, however, poor in terms of both quantity and quality. The majority of the studies reviewed evaluate rehabilitation options without first adequately establishing their effectiveness. Without such evidence rehabilitation resources are potentially being wasted.

INTRODUCTION

The custom of allocating health care resources to provide expensive patient services which are unproven is at last being challenged. In the rehabilitation services for patients after disabling events, for instance head injuries and stroke, providers are advocating enhanced funding in a humane and well intentioned fashion. However the knowledge is absent to direct that funding to those activities which can benefit patients most at least cost.

In this paper the case for improved knowledge to inform resource allocation in cost effective rehabilitation services is discussed briefly (section 1). This is followed by a review of the methods of economic evaluation which can be used to measure the costs and effects of competing health care interventions. The literature about cost effectiveness in rehabilitation is analysed in section 3 and shown to be limited in quantity and quality. The final substantive section (4) outlines the principles which should inform the development of economic evaluation in rehabilitation services. Some concluding comments are then made.

1 WHY ARE COST EFFECTIVENESS DATA NEEDED?

With the introduction of the "internal market" in the National Health Service and the development of "managed competition" in the United States, decision-makers in Government and public and private purchasers and providers of health care worldwide have focused on the need for information about the cost effectiveness of competing therapies. For decades it has been recognised that most health care therapies are unproven in terms of effectiveness, let alone cost effectiveness (Cochrane (1972), Black (1986)). An American health economist,

Victor Fuchs (1984) remarked that 10 per cent of health expenditure reduced the health status of patients, 10 per cent had no effect, and 80 per cent of expenditure improved health status. The problem was, Fuchs argued, that it was impossible to know which therapies are in the 10 and 80 per cent categories!

Such provocative assertions facilitate the identification of the central problem in making choices. Whether it is either a manager in a provider hospital deciding whether to reduce or increase investment in a particular service or a purchaser deciding whether or not to increase or decrease her expenditure on some type of care, their problem is similar: their choices are ill-informed and tend to be made on the basis of provider assertions and purchaser hopes. This is an unsatisfactory way to allocate scarce resources to competing patients. The inefficient use of resources in rehabilitation services deprives patients in need elsewhere in the health care system of care from which they could benefit.

The 1989 health care reforms in the UK separated the purchaser and provider functions in the NHS. The purchaser was required to i) identify the health care needs of the resident population, and ii) provide health care to meet these needs in a demonstrably cost effective way. The purchaser can buy care from any provider, public or private and the exchange is made explicit in a contract (not enforceable at law) which sets out financial details as well as volume and outcome characteristics.

The bulk (95%) of the contracts in the first year (1991-92) were for blocks of work at a given expenditure. This was a reflection of the "data free environment" upon which the 1989 reforms were imposed. The majority of NHS hospitals have few cost data and until recently

their financial data was organised on a functional basis which showed outlays on, for instance, beds, doctors and pharmaceuticals but gave no indications of the cost of activities (eg the cost of a hernia repair). The activity data (formerly Hospital Activity data, and now the products of the new Korner information systems) are of dubious accuracy, incomplete for some years, and produced nationally in arrears. Outcome data are few (eg, inpatient mortality) with an absence of record linkage and measurement of the quality of survival (quality of life).

To remedy these omissions there have been large investments in data collection, much of dubious benefit because of the failure to define core data collection and ensure that information systems (eg GP and hospital) can be linked. However these investments have been accompanied by recognition at all levels of the NHS of the need to enhance knowledge about the cost effectiveness of competing treatment and care options. For instance, the Department of Health's Research and Development activities are being reorganised with marginal but welcome enhancements in funding and with a focus on efficiency and effectiveness.

In the past decisions to purchase old and new health care services have been ill-informed and, at times, determined by lobbying, charisma and shroud waving. Such unchallenged and unsupportable practices are being questioned, particularly by policy makers and purchasers who are seeking evidence to support decisions to make large investments in competing forms of patient care. With managers on short term contracts and clinicians being required increasingly to agree service standards and be accountable, the case for demonstrating the cost effectiveness of rehabilitation services is clear. Unfortunately the evidence to support existing services is in short supply.

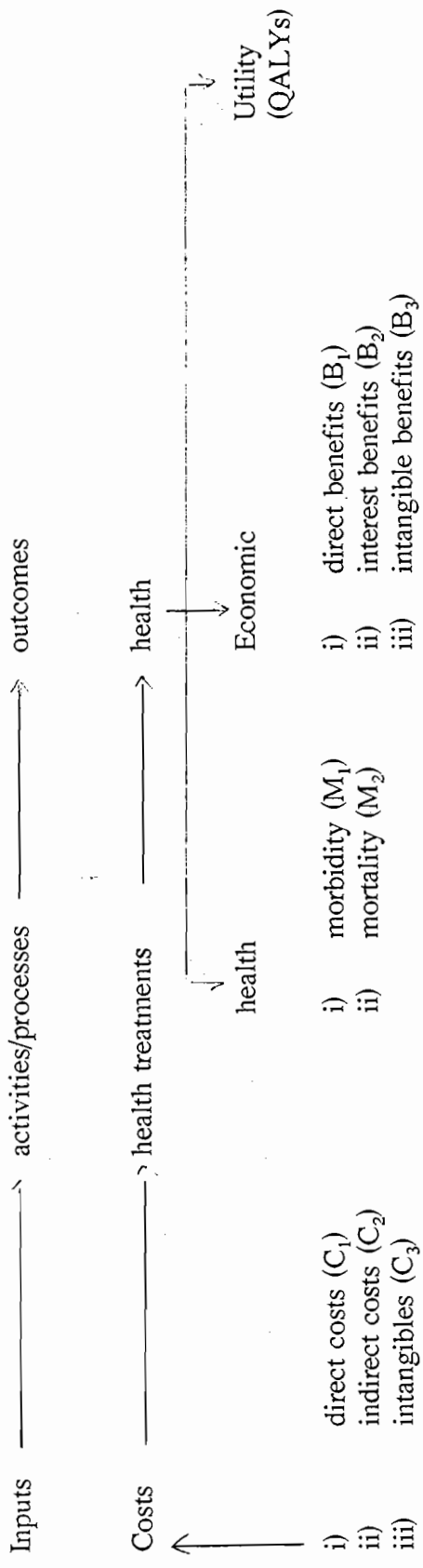
2 ECONOMIC EVALUATION: A GUIDE TO GOOD PRACTICE

2.1 Purpose

The purpose of economic evaluation is to identify, measure and quantify the relationship between the value of what is given up when, for instance, rehabilitation service is provided (ie, its opportunity cost) and what is produced (ie, the effects on the duration and quality of life, in terms of physical, social and psychological functioning).

There are three categories of opportunity cost. The direct cost (C_1 , in figure 2.1) are the costs of caring for an individual if he or she is ill. These costs might fall on the different sectors of the NHS (the hospital, primary care, and community care), on local authority social services, on voluntary agencies (eg, charities), on carers, and on patients. The second category of costs is indirect and are caused by the effects on production of patients being disabled (C_2 in figure 2.1). The measurement of these costs is problematic. The usual approach is to use earnings as a measure of lost production. Such a measure is zero for children, housewives and the elderly. They produce services which are of value but they are not reimbursed and part of Gross National Product (GNP). Indirect costs, even for those who are disabled by an accident or health event, and in the labour force initially may be low. With unemployment, the ill can be replaced in the labour force with some transitional effects but few long term consequences for the level of GNP. Intangible costs (C_3) are very difficult to value: how costly is pain and discomfort?

Figure 2.1 Input-Output Relationships



Benefits can be measured in one of 3 ways. The health effects can be measured in terms of the consequences of treatment in enhancing the length (reduced mortality) and quality (reduced morbidity) of life of the patient. The economic effects are the reverse of the economic costs (B_1 , B_2 and B_3). Because of the poor quality of health benefit data and the incomplete nature of economic outcome data, a third approach to outcome measurement has been attempted: the measurement of utility. This approach seeks to create a composite measure of enhanced duration and quality of life: the quality adjusted life year or QALY (see eg, Williams (1985)).

2.2 Types of Economic Evaluation

The purpose of economic evaluation is to link inputs to outcomes systematically and explicitly in order to inform choices between competing treatment and care options. For a full economic analysis it is necessary that (i) there is a comparison between two or more alternatives and (ii) that both costs and effects of those alternatives are evaluated.

Some types of investigation are not evaluation. For instance in cells 1A, 1B and 2 there is no comparison of alternatives. In 1A only the outcome of a programme is considered whilst in 1B only the costs are described. In cell 2 both costs and outcomes of a service are considered but as there is no alternative it is not an evaluation of a service but a description.

Table 2.1 Distinguishing Characteristics of Health Care Evaluations

Are both costs (inputs) and consequences (outputs) of the alternatives examined?

Is there a comparison of two or more alternatives?	NO		YES
	Examines only consequences	Examines only costs	
	1A PARTIAL EVALUATION	1B PARTIAL EVALUATION	2 PARTIAL EVALUATION
NO	Outcome description	Cost description	Cost-outcome description
YES	3A PARTIAL EVALUATION	3B PARTIAL EVALUATION	4 FULL ECONOMIC EVALUATION
	Efficacy or effectiveness evaluation	Cost analysis	Cost-minimisation analysis Cost-effectiveness analysis Cost-utility analysis Cost-benefit analysis

Reproduced from Drummond et al, 1987, p 8.

The activities in cells 3A and 3B are evaluations because two or more alternatives are considered but in each only the outcomes of the service options or the costs are evaluated. In the former this represents an effectiveness evaluation and in the latter a cost analysis. Many evaluative studies fall into categories 3A and 3B. Those based on randomised clinical trials are often effectiveness studies (3A). Where the effectiveness of alternative services is not in dispute, then a cost-analysis (3B) may be sufficient to identify the efficient choice.

The cells in segments 1, 2 and 3 of table 2.2 are partial evaluations because they do not fulfil the conditions ((i) comparison between two or more alternatives and (ii) both costs and consequences of those alternatives are examined) required for a full economic evaluation. The techniques in cell 4 facilitate the answering of questions on the relative efficiency of alternative health care programmes and are therefore the most appropriate way of informing choices about treatment options.

2.3 Types of Economic Evaluation

There are four ways in which health care options can be evaluated from an economic perspective: cost minimisation analysis, cost effectiveness analysis, cost utility analysis and cost benefit analysis (Table 2.2).

Table 2.2 Measurement of Costs and Consequences in Economic Evaluations

Type of Study	Measurement/ valuation of costs in both alternatives	Identification of consequences	Measurement/ valuation of consequences
Cost-minimisation analysis	Pounds	Identical in all relevant respects	None
Cost-effectiveness analysis (CEA)	Pounds	Single effect of interest, common to both alternatives, but achieved to different degrees	Natural units (eg, life-years gained, disabled years avoided or reductions in blood pressure (m.m. of mercury))
Cost-benefit analysis (CBA)	Pounds	Single or multiple effects, not necessarily common to both alternatives, and common effects may be achieved to different degrees by the alternatives	Pounds
Cost-utility analysis (CUA)	Pounds	Single or multiple effects, not necessarily common to both alternatives, and common effects may be achieved to different degrees by the alternatives	Health days or (more often) quality-adjusted life years (QALYs)

Source: Drummond et al, 1987, p 15.

Cost-minimisation Analysis

If two health care programmes offer identical outcomes (or as close as to render the difference unimportant), then the identification of which programme is more efficient is reduced to a question of which costs the least. Whilst a cost-minimisation study may appear identical to a simple costing exercise (cell 3B) in table 3.1, the difference is that evidence must be provided to show that outcomes are identical. Ideally, a cost-minimisation study should be performed alongside a controlled clinical trial.

Cost-effectiveness Analysis (CEA)

Cost-effectiveness studies are most frequently adopted to evaluate health care options. This approach compares the costs (C_1 , C_2 and C_3 in figure 2.1) with the effects of treatments for a single condition. The outcome of a programme may be measured in a variety of ways eg, in terms of life-years gained, disabled years avoided, or reduction in m.m of mercury. Using these treatment specific indicators, the technique of cost-effectiveness analysis facilitates the costing of the treatment alternatives and the comparison of these costs in relation to the performance indicator. The measure of effectiveness does not indicate the value of the procedure and these measures cannot be used to inform choices across treatment categories.

Cost Utility Analysis (CUA)

The purpose of cost-utility analysis is to measure both the outcome of a programme by placing a value or utility on the outcome and its costs (C_1 , C_2 and C_3 in figure 2.1). Utility

is based on the value or worth of specific levels of health status and is measured by individuals or society's preferences for a particular set of health outcomes eg, quality adjusted life-years (QALYs) (see eg, Williams (1985) and Drummond, Stoddart and Torrance (1987)).

The efficiency of alternative programmes can be compared eg, in terms of their cost per QALY produced, the alternative with the lowest cost per QALY is the most efficient. This technique potentially allows efficiency comparisons to be made across a variety of treatments and conditions in medical fields.

Cost-benefit Analysis (CBA)

The use of CBA in health care is difficult because it requires that the costs (C_1 , C_2 and C_3) and the effects (B_1 , B_2 and B_3 in figure 2.1) of a particular service or programme be identified and valued in monetary units. This approach has been used to make comparisons between health care options in unrelated medical fields. These studies tend to be narrow, valuing only direct and indirect costs (figure 2.1). Intangible costs (pain and functional disability) and benefits (reduced morbidity) tend to be ignored in these studies because of the difficulties involved in valuing them.

2.4 Determining the Quality of Economic Evaluation

The quality of these alternative approaches to economic evaluation are uneven and criteria to judge their merit have been available for decades. For instance in 1974, Williams suggested 19 questions which could be asked about the validity of the methods and results of any study

(Williams (1974)).

- 1 What precisely is the question which the study was trying to answer?
- 2 What is the question that it has actually answered?
- 3 What are the assumed objectives of the activity studied?
- 4 By what measures are these represented?
- 5 How are they weighted?
- 6 Do they enable us to tell whether objectives are being attained?
- 7 What range of options was considered?
- 8 What other options might there have been?
- 9 Were they rejected, or not considered, for good reasons?
- 10 Would their inclusion have been likely to change the results?
- 11 Is anyone likely to be affected who has not been considered in the analysis?
- 12 If so, why are they excluded?
- 13 Does the notion of cost go wider or deeper than the expenditure of the agency concerned?
- 14 If not, is it clear that these expenditures cover all the resources used and accurately represent their value if released for other uses?
- 15 If so, is the line drawn so as to include all potential beneficiaries and losers, and are resources costed at their value in their best alternative use?
- 16 Is the differential timing of the items in the streams of benefits and costs suitably taken care of (eg, by discounting and, if so, at what rate)?
- 17 Where there is uncertainty, or there are known margins of error, is it made clear how sensitive the outcome is to these elements?
- 18 Are the results, on balance, good enough for the job in hand?
- 19 Has anyone else done better?

These can be reduced to eight questions and illuminate the essence of any economic evaluation (Drummond, Stoddart and Torrance (1987), and Maynard (1990)).

Table 2.3 Questions to be Asked of All Economic Evaluations

- 1 Is the research question and the trial design clearly identified and feasible?
- 2 Are both the experimental and control (comparator) arms of the trial well described?
- 3 Are all relevant costs of different decision making groups (eg, the patient, her carers, the hospital, the health care system) and society identified, quantified and valued?
- 4 Are all the relevant effects (outcomes measured in terms of enhancements in the length and quality of life) of the competing therapies identified, quantified and valued?
- 5 Is the sample appropriate and sufficient in size to ensure statistical power for costs and effects?
- 6 Are marginal (incremental) costs and effects identified?
- 7 Are costs and effects discounted (to take account of time preference) appropriately?
- 8 Are the results subjected to sensitivity analysis?

The answers to many of the questions in Table 2.3 are problematic. The measurement of the relevant costs depends on the perspective of the study. What minimises cost to the hospital, may neither minimise costs to society nor the costs to the patient's family. There are no agreed "gold standard" quality of life measures with hundreds of contenders for this accolade, both disease specific and generic (ie, usable across diagnostic categories) (Spilker et al (1990)). A widely used, simple and validated generic measure is the Short Form 36 (SF36) used in the Medical Outcomes study in the USA (Stewart and Ware (1992)). Various instruments have been used to measure the success of rehabilitation regimes (see section 3), with activities of daily living (ADL) being the most used method. Ideally psychological, physical and social functioning of patients and their carers should be used. In many studies the costs and effects which accrue over time are discounted, usually at 5 per cent, despite controversy about whether discounting is appropriate (see eg, Parsonage and Neuburger (1992) and Cairns (1992)).

A contentious issue in many evaluative trials is the selection of the comparator. The selection of an ineffective therapy may inflate the effects profile of the experimental therapy. The appropriate comparator is the best alternative. However the selection of this may be difficult and subject to debate given that medical practice shows large variations between practitioners, hospitals and health care systems.

2.5 The Current State of Economic Evaluation

The type of economic evaluation in health care used has changed over the decades. In the 1960s the fashion was a form of cost benefit analysis. This was felt to be narrow, owing to

the difficulties inherent in measuring benefits in financial terms, and was followed in the 1970s by cost effectiveness analysis. The lack of a common measure across treatment areas led in the 1980s to the development of cost utility analysis. Cost utility analysis, which requires valid, simple and robust quality of life measures, is now being criticised for methodological reasons and there is a renewal of interest in cost benefit analysis (cba) with attempts to quantify benefits by using the willingness to pay approach (eg, if, in a group of 100, one person will die in the next year, how much is the group willing to pay to remove this 1% chance of death?) The sum of the answers to such a question yields a value for life which can be used in cba.

There are disagreements about methodology in economic evaluation and any results must be interpreted with care and explicitly. There is agreement amongst economists about some aspects of economic evaluation. However, there are other areas where no consensus exists and where interpretation of trials is subjective and may be contentious. There is agreement amongst economists about terminology. There is agreement that costs should be measured from a societal perspective, with relevant component parts of the costing (eg, costs to hospitals) being made explicit. There is agreement that incremental cost and outcome data should be reported, that costs which accrue over time should be discounted and that results should always be subjected to sensitivity analysis.

However, some aspects of economic evaluation are not agreed by practitioners. There are no "gold standard" individual or portfolio of quality of life measures, and the use of QALYs is contested on empirical (the data are poor) and methodological grounds (are QALYs "good" measures of patient welfare?) There is disagreement about the discounting of benefit streams

(see Cairns (1992) and Parsonage and Neuberger (1992)) and the issue of the appropriate size of sample to ensure statistical power for economic and quality of life data is ignored in most studies. Disagreements about these areas amongst practitioners means that both purchasers and the providers must proceed with caution.

2.6 Conclusion

The role of economic evaluation is to produce knowledge to inform the choices of clinicians, providers and purchasers. Whatever the structure of the NHS in the 1990s this knowledge will be necessary if efficient practices in rehabilitation and other health care sectors is to be identified and appropriately funded.

3 THE COST EFFECTIVENESS LITERATURE IN REHABILITATION SERVICES

3.1 An Overview of the Literature

The literature on the cost effectiveness of rehabilitation services is quite small and they are reviewed in detail in the appendix to this paper.

The literature evaluates the outcomes of rehabilitation programmes in three ways:

- 1 Descriptive applications: studies which attempt to describe what happens to service recipients at one or more points following the initiation of services.
- 2 Comparative procedures and research: studies which compare groups in an experimental versus a regular programme of services.
- 3 Predictive outcomes: attempt to discover the variables associated with higher rates of successful outcomes eg, age, sex, race.

(Brown et al, 1983)

Studies which adopt a comparative approach (2) are the most useful for informing purchasing decisions in the reformed National Health Service (NHS). Using this approach alternative programmes (treatments) can be compared. Information about the costs and outcomes of

procedures can be generated to determine the cost-effectiveness of competing therapies.

The 1989 NHS reforms seek to establish the distinct roles of providers and purchasers. Purchasers must (1) measure need and (2) identify the cost-effectiveness means (treatments) to meet those needs. This distinction between the roles of provider and purchaser creates a greater 'transparency' of trading, making explicit the prices, volumes and quality of services which are exchanged. Both providers and purchasers are therefore more directly accountable for their actions.

To measure effectively need and purchase treatments to meet that need, purchasers will exploit existing knowledge and seek new knowledge about the cost-effectiveness of procedures. Without such information purchasers will be reluctant to buy and providers will find it difficult to sell. It is therefore important to identify the costs and consequences of competing treatments to facilitate purchaser choice.

The majority of the studies reviewed evaluated rehabilitation regimes but did not adequately establish their effectiveness, which is essential when undertaking an economic appraisal. The most sophisticated measure of effectiveness used is the Activities of Daily Living (ADL) scale, measured according to the Barthel Index. Of the ten studies reviewed (Appendix 1), two adopt this approach and two others used an ADL scale without the Barthel Index. Other measures include the Mental Status Questionnaire and the Brunnstrom Motor Recovery Scale. However, less scientific approaches (eg, consensus of opinion of the staff involved) are also used. While the judgement of doctors and therapists is informed their opinions cannot be wholly objective.

It is important that outcome measures are designed well and are appropriate for rehabilitation medicine but of more immediate importance is that a standard measure is adopted. If a basic 'test' of effectiveness is universally adopted then it will be possible to make consistent comparisons between alternative treatments or therapies.

It is not easy to develop measures of effectiveness. They must be sensitive because patients will usually make some degree of recovery themselves and it is important to separate this from the influence of the rehabilitation process itself. An agreed Activities of Daily Living scale as set out for assessing the needs of elderly people (Royal College of Physicians of London and the British Geriatric Society, 1992) would be an improvement on the current situation and might encourage researchers and clinicians to produce better instruments for evaluative studies.

The literature review also reinforces the need to carry out large scale, preferably multi-centre, randomised controlled trials (RCT's). It is necessary in establishing the effectiveness of a programme to make sure the subjects/patients are a standard and unbiased sample of the population.

It has been suggested that RCT's are impossible and inappropriate to establish in the rehabilitation field because such trials require that certain individuals are assigned to a no-treatment option. This approach assumes, however, that rehabilitation is currently available, which may not be the case. Additionally, where treatment is provided there is often a presumption that it is having a positive effect. Stroke and severely brain injured patients will usually make some sort of recovery or improvement and whilst the change may be small it

is important to separate this 'standard' recovery from what is subsequently gained during rehabilitation whether it is conventional care or a new procedure.

In several instances even when studies have been linked to randomised trials the results have been biased by removing individuals who are likely to be 'expensive' or unlikely to make a full recovery. Patients who are removed are in some cases the most difficult to treat but perhaps have the greatest potential to benefit. They may also therefore have the greatest potential to demonstrate the effectiveness or otherwise of treatments, as opposed to standard patients who make an expected recovery. Individuals who are included because some degree of success is expected at the expense of those whose outcome is not known, (or expected to be poor) may bias the results of trials.

One potential option to develop measures of effectiveness is to gather the descriptive, functional information contained in the Barthel Index and apply it to a quality adjusted life-year (QALY) matrix or table. The cost-utility analysis (CUA) from which QALY's are derived is currently an attractive technique to analysts because it potentially allows the quality of life of competing treatments and not just the quantity to be taken into account.

Additionally, CUA avoids monetary comparisons of outcomes by measuring them in terms of individuals or society's preferences for specific health states. There is therefore the potential to relate health treatments and options of care more directly to individuals/society's preferences.

The process compares the incremental cost of a health programme, from a particular

viewpoint, to the incremental health improvement attributable to the programme. The health improvement can be measured in quality adjusted life-years (QALY's) gained (Drummond, et al 1987). This approach has two benefits for the evaluation of rehabilitation programmes. The first is that because effectiveness data is converted to a common unit of measure, QALY's gained, then CUA enables the comparison of rehabilitation options across treatments and not simply within one field of health care. This is clearly of great benefit to health care purchasers. Secondly, QALYs are more comprehensive measures of health improvement than an ADL index on its own because it has two dimensions rather than one.

Current developments in quality-of-life measurement for use in the calculation of QALY's favour the use of the category rating method (CRM) as adopted by the Euroqol Group (a multi-national research group undertaking collaborative research in the quality-of-life measurement field). The CRM can employ a visual analogue scale, like a thermometer, to ascertain from individuals how they perceive and value different health states on a scale of zero to one. Participants are required to value perfect health and death and other health states relative to these extremes. Whilst quality-of-life measurement is complex and as yet far from perfected it offers an improvement upon simple ADL scales. As opposed to measuring outcome according to a unidimensional index QALY's potentially allow values to be attached to a scale, derived from individual or society preferences.

3.2 Conclusions

There is only a small amount of literature on the cost effectiveness of rehabilitation treatments. The small quantity of literature that has been published in this area demonstrates

an incapacity to design trials of adequate size and poor methodology to collect valid cost and effectiveness data. This dismal conclusion could be reversed by the application of established techniques of economic evaluation.

CLASSIFICATION OF REHABILITATION ARTICLES REVIEWED

Author(s)/Date/ Country	Programmes Assessed	Sample Treatment group (Tg) Control group (Cg)	Link to Controlled Medical Evaluation	Outcome Measures/ Timing	Major Findings
Albrecht et al 1979 US	Develop a method to evaluate the cost-effectiveness of comprehensive medical rehabilitation.	Tg - 230 patients.	Patients were randomly selected. No control group.	1 BARTHEL Activities of daily living (ADL) scores. Assessed up to 2 years.	Positive functional gain achieved 83.4% of group. Cost effectiveness differed between institutions was not all for in the method.
Aronow 1987 US	Comprehensive in-patient rehabilitation for patients with severe traumatic brain injury (TBI).	Tg - 68 patients Cg - 61 patients	Patients non-randomly allocated to in-patient rehabilitation unit or conventional care in a district where such services do not exist. Attempt was made to take into account differences between the groups before treatment.	1 number of therapy sessions 2 duration of stay 3 place of care after discharge 4 hours of daytime care required 5 mobility and residential skills 6 vocational status 7 cost/outcome index - ie, $\frac{3+4}{6}$ Assessed up to 2 years.	Rehabilitation group were average more severely injured however, the cost/outcome index. Relation the achieved a long-term outcome.
Bethell et al 1990 UK	Fitness training for coronary rehabilitation.	Tg - 99 patients Cg - 101 patients	Patients randomly assigned to treatment and control groups.	1 perceived energy level 2 maximum oxygen uptake 3 prevalence of angina Assessed up to 3 months.	A greater improvement in fitness was realised by treatment group as measured perceived energy level and maximum oxygen uptake. The prevalence of angina fell in the treatment group and not in the control.
Cole et al 1985 US	Long-term rehabilitation of brain-injured patients.	Tg - 95 patients	Not linked to controlled clinical trial because study is not comparative. Rather offers rehabilitation where there is traditionally a gap in care.	1 self-care and home making 2 social skill development 3 Physical conditioning. Individual patients treated for as long as necessary to move them onto a higher level rehabilitation scheme.	Over a period of 6 years, 47% of the 95 patients attained an improved level of functioning.

ings et al 5	The use of the day-hospital for recently disabled patients.	Tg - 48 patients Cg - 48 patients	Linked to a randomised controlled trial (RCT)	<ol style="list-style-type: none"> 1 consensus of opinion of medical and therapeutic staff involved 2 ADL scores 3 Mental Status questionnaire 4 Linkowski's acceptance of Disability Instrument 5 Dupuy psychologic well-being measure 6 Patient and family questionnaires. <p>Assessed up to 3 months.</p>	There was no significant difference between the 2 groups in terms of psychologic assessment nor in the assessment of ADL's. Cost-effectiveness of the unit was not proven.
enson et al	Inpatient rehabilitation for Multiple Sclerosis patients.	Tg - 20 patients	Not linked to a controlled medical evaluation, no control group.	<ol style="list-style-type: none"> 1 Functional motor skills 2 response to nursing, occupational and physical therapy. <p>Assessed up to one year.</p>	Patients made significant improvement in function after one year.
arlane et al	The role of the day hospital in the rehabilitation of elderly patients.	Study based on 2 surveys of the day hospital - one carried out in 1973, one in 1977.	Not linked to a RCT; the benefits of the day hospital were assessed by the consensus opinion of doctors, nurses, therapists and social workers.	<ol style="list-style-type: none"> 1 Consensus of opinion. Analysis of the service made from surveys. <p>Assessed up to one year.</p>	Rehabilitation was the main objective and achievement of the day hospital. The weekly cost of day hospital plus community care was £47 compared with a cost of £129.30 for a week's in-patient stay.
et al ralia	Acute in-patient rehabilitation for stroke patients.	Tg - 258 patients	Not a comparative study but an attempt to derive a model to predict (1) rehabilitation efficiency (2) achievement of rehabilitation potential (3) duration of rehabilitation stay.	<ol style="list-style-type: none"> 1 BARTHEL ADL 2 BRUNNSTRÖM motor recovery scales 3 consensus of opinion (doctors and therapists) <p>Follow up time was duration of acute stay.</p>	The model derived failed to adequately predict rehabilitation efficiency, achievement of rehabilitation potential or duration of rehabilitation stay.
er et al Zealand	The role of the day hospital in the rehabilitation of elderly patients.	120 Patients - not clear how many were assigned to treatment and control options.	Yes, the study was based on a clinically controlled trial.	<ol style="list-style-type: none"> 1 ADL scores 2 changes in mood <p>Assessed up to 5 months.</p>	At six weeks the treatment group showed significant improvement for ADL's. There was no such improvement after 5 months.
3	Case management of severely head injured patients.	N/A	Treatment and control group set up.	Not listed	Study results not yet published.

4 THE ECONOMIC EVALUATION OF REHABILITATION SERVICES

There is an established methodology for the practice of economic evaluation in health care services. This methodology has not been applied in the rehabilitation services where provision has been developed in the absence of relevant scientific knowledge. As in many other areas of health care practice (eg mental health, O'Donnell, Maynard and Wright (1988)) the evidence necessary to make efficient investment decisions is absent.

The way forward requires that rehabilitation specialists collaborate with researchers in trials which observe the requirements initially set out by Williams (1974) and summarised in Table 2.3; ie,

- i) is the research question and the trial design clearly identified and feasible?

After head injuries or a stroke the rehabilitation options are numerous, including doing nothing. Any trial should be designed to identify the treatment options and patients should be randomly entered (with blinding of providers and patients) into the trial so that improvements due to spontaneous recovery and therapy can be distinguished.

- ii) are both experimental and the control (comparator) arms of the trial well described?

If the results of the trial are to be replicated in practice, the alternative treatments need to be fully described so that it is clear who did what to whom, how often and when!

- iii) are all relevant costs for the alternative treatments identified, measured and valued?

The volume of activities in each part of the care system should be identified and measured, and then costed, ie

hospital care:	inpatient care outpatient visits day hospital (include the use of all capital and diagnostic equipment as well as medical personnel (doctors, nurses, social workers, occupational therapists, speech therapists, physiotherapists, counsellors etc), drugs and aids.)
community care:	local authority social services (social workers, home helps and meals on wheels) community nursing services and respite care (HCCS) primary care (GPs and nurses) voluntary agencies (eg, charities)
patient and carers:	costs to patients and carers in terms of work and leisure time foregone (financial flows to patients and carers from social security)

- iv) are all relevant effects (outcomes) for the alternative treatments identified, measured and valued?

There are a variety of physical, social and psychological aspects to rehabilitation. There is no "gold standard" activity specific or generic quality of life (QoL) and so a group of QoL measures should be used. They should be selected to measure the effects of the different problems which are produced by disabling events such as road traffic accidents and strokes. Measurement of the "user friendliness" of rehabilitation

facilities (ie, process measures) would be useful complements of outcome/effects measures. It is essential that all measures used are demonstrably sensitive to change in the respondents' functions and attitudes, as well as being valid and reliable.

- v) is the sample appropriate and sufficient in size to ensure statistical power for costs and effects?

An obvious criterion for patient selection is the appropriateness of the intervention being tested for the particular client group (identified eg, in terms of age and severity). The more specific the patient selection criterion, the less the results can be generalised to the population of rehabilitation patients. Whatever the selection criterion (criteria), it is essential that the size of the trial is sufficient to capture changes in costs and effects. The choice of sample size should be sufficient also to ensure that sub-category analysis can be carried out if that is desired.

- vi) are marginal (incremental) costs and effects identified?

How much rehabilitation should be provided? An answer to this question can be informed by data which identify the costs and effects of offering a little more or a little less rehabilitation. Such marginal analysis is important to the purchaser as the results can be compared with those of investing in activities other than rehabilitation to ensure the 'balance' of purchasing is appropriate.

vii) are the costs discounted appropriately?

For rehabilitation services, the benefits from which may occur over significant periods of time, discounting is appropriate for costs and, maybe (see section 2) benefits too.

viii) are the results subjected to sensitivity analysis?

The impact of alternative assumptions made in the evaluation should be discussed explicitly to identify the sensitivity of the results.

The economic evaluation of alternative treatments will increasingly be required by purchasers. In Australia and Ontario there are proposals to require all pharmaceutical companies to provide evidence about the cost effectiveness of new drugs. These data will be used to determine whether Government agencies will reimburse the costs of new chemical entities (Commonwealth of Australia (1990), Drummond (1991), and Ontario Ministry of Health (1991)). It is inequitable to treat the pharmaceutical industry differently from rehabilitation or any other health care services. In the future bids for new funding and the defence of existing funding will require data about cost-effectiveness but no scientific case exists for their funding. As Louis Pasteur remarked "in an experimental science it is always a mistake not to doubt when facts do not compel you to affirm"!

Rehabilitation Articles Reviewed

Albrecht G L, Harasymiw S J (1979). Evaluating Rehabilitation Outcome by Cost Function Indicators: Journal of Chronic Diseases, 32, 525-533.

Aronow H U (1987). Rehabilitation Effectiveness with Severe Brain Injury: Translating Research into Policy, Journal of Head Trauma Rehabilitation, 2 (3), 24-36.

Bethell J J N, Mullee M A (1990). A Controlled Trial of Community Based Coronary Rehabilitation, British Heart Journal, 64, (6).

Cole J P, Cope D N, Cervelli L (1985). Rehabilitation of the Severely Brain Injured Patient: A Community Based Low-cost Model Programme. Archives of Physical Medicine and Rehabilitation, 38-40.

Cummings V, Kerner F F, Arones S, Steinbock C (1985). Day-Hospital Service in Rehabilitation Medicine: an evaluation. Archives of Physical Medicine and Rehabilitation, 66, 2, 86-91.

Feigenson J D, Scheinberg L, Catalano M, Polkon L, Mantegazza P, Feigensen W D, LaRocca N G (1981). The Cost-effectiveness of multiple sclerosis rehabilitation: a model. Neurology, 31, 1316-1322.

MacFarlane J P R, Collings T, Graham K, Mackintosh J C (1979). Day Hospitals in Modern Clinical Practice - Cost Benefit. Age and Aging 8, Supplement, 80-86.

Price J (1991). A Way Through the Maze. Health Services Journal, (14/2/91), 23.

Shah S, Vanclay F, Cooper B (1990). Efficiency, Effectiveness and Duration of Stroke Rehabilitation. Stroke, 21: 241-246.

Tucker M A, Davison J G, Ogle S J (1984). Day Hospital Rehabilitation - Effectiveness and Cost in the Elderly: a randomised controlled trial. British Medical Journal, 289, 1209-1212.

APPENDIX

THE COST EFFECTIVENESS OF REHABILITATION SERVICES: A REVIEW OF THE LITERATURE

The Nature of the Review

a) the search

A search was made of the biomedical literature from 1988 concerning the rehabilitation of the physically disabled and the elderly. The search isolated those articles dealing with effectiveness and especially cost-effectiveness. The major sources for the search were:

- 1 Medical Science Weekly
- 2 Centre for Health Economics Catalogue, and
- 3 ISI search (from 1987 onwards).

The initial search listed summary details of one hundred and seven articles, of these forty were read. Subsequent reviews and searches (eg, from article reference listings) produced approximately another thirty articles. Therefore, in total, the search numbered around one hundred and forty articles of which ten are reviewed in this section.

Very few of the papers from the initial search contained any economic analysis and as this paper is concerned with economic evaluation, those articles which contained some economics were reviewed. This process demonstrated that there were no cost-effectiveness studies and so the scope of the review was broadened to include articles which dealt in some form with rehabilitation effectiveness in the areas of stroke, head injury and elderly patients. The reviews provide a cross-section of the subject matter and illustrate the quality of the research that has been carried out.

b) the format

An attempt was made to analyse the material in a standard framework. Where possible each case study sets out relevant information, where reported, about the study design, the subjects included in the trials, the instruments used to measure effectiveness and the items included in the costings and the reported results. In each case the review is concluded with conclusions and comments.

LITERATURE REVIEW

A Review of the Literature

Albrecht G L, Harasymiw S J (1979). Evaluating Rehabilitation Outcome by Cost Function Indicators: Journal of Chronic Diseases, 32, 525-533.

1 Study Design

The study has 2 objectives:

- 1 to develop a method for evaluating the cost-effectiveness of comprehensive medical rehabilitation (in-patient)
- 2 apply this to a sample of 230 spinal cord and cerebral patients treated at 10 leading comprehensive medical rehabilitation centres in the United States.

Comments: The centres used in the study are said to have 'proven track records' in effective rehabilitation and so effectiveness itself is not an issue raised.

2 Subjects

A random sample selected 230 patients, who were well educated, predominantly white males. The 2 groups consisted of focal cerebral patients who virtually all suffered a stroke, and spinal cord injury patients. 51% of the cohort were married.

The mental state of the patients was rated on a communication scale which measured listening capability, speech content, logic and speech clarity.

The length of time from occurrence of disability to hospitalisation for rehabilitation varied considerably.

Spinal cord patients	0.33 - 5.3 years
Focal cerebral patients	0.16 - 8.5 years

Most of the patients were mobility dependent.

3 Analysis Instruments

The dependent variable or rehabilitation outcome measure used was, life function change per dollar cost (LID), which was developed to take account of both effectiveness and cost. LID is calculated using;

$$\text{LID} = \frac{\text{number of functional units gained (Barthel Index)}}{\text{dollar cost of total in-patient services}} \times 1000$$

(the Barthel Index measures activities of daily living (ADL) at a point in time).

The total dollar cost of in-patient services was calculated by totalling charges per in-patient case which included day physicians services, and was used as a proxy for actual cost. NB study authors were aware that these costs could be influenced by government subsidies.

The independent variables and covariates considered were:

- number of services received
- functional level at admission
- length of time from occurrence of incident to time of entry into rehabilitation hospital
- centre where rehabilitation was received
- patient - age, sex, income, race and education.

The function level of each patient was measured using the Barthel Index at referral, discharge and at two year follow-up.

4 Results

Positive functional gain was achieved with 83.4% of the group, 10.5% achieved no gain and 6.1% suffered negative gain. 192 patients showed positive functional gains between admission and discharge from the programme.

The most important determinants of outcome for the Focal Cerebral patients were (1) treatment environment and (2) length of time from occurrence of the disability to hospitalisation. Age was the only important demographic variable. The spinal cord injury patients showed a similar result although age in this case was not significant.

Taken together the independent variables and covariates explain 35% of the variance in rehabilitation outcome for the focal cerebral sample and 19% for the spinal cord sample.

The authors were surprised to discover a wide variability in outcome between the ten rehabilitation centres. Some were more cost efficient at producing functional change than others (this may be because eg, a unit specialises in patients suffering from spinal cord injury).

Focal cerebral patients averaged 52 days in in-patient rehabilitation at a total cost of (US) \$5125 and received an average 6.7 services (ie, occupational therapy, physiotherapy etc). Spinal cord patients averaged 80 days at a cost of (US) \$6874 and used 8.6 services (1967 dollar values).

5 Conclusions

The analysis indicated that generally the process available, not the demographic variables, most influenced rehabilitation outcome for both groups. Cost effectiveness differs by disability group as well as by institution and therefore a measure of outcome should be specific and controlled for institutional and treatment variables.

6 Comments

The study was not based on a randomised controlled trial (RCT). The sample selected 230 patients who were well educated, predominantly white males and therefore not an unbiased cross-section of the affected population. The length of time from occurrence of the disability to hospitalisation varied considerably, up to 8.5 years. Patients would therefore be in varying different stages of recovery and, if this were not taken into account, then it would be difficult to isolate the impact of the new rehabilitation process.

The different centres involved in the project have different cost/effectiveness levels themselves due to a variety of factors, eg difference in length of time from onset to rehabilitation admission and also some centres are designed to treat specific conditions, they are therefore directed toward treating those conditions as efficiently as possible. The dependent variable (LID) will miss these factors as it measures functional gain against simply total cost per in-patient not allowing for institutional variation.

The study did not develop an adequate method for evaluating the cost-effectiveness of medical rehabilitation (in-patient).

Aronow H U (1987). Rehabilitation Effectiveness with Severe Brain Injury: Translating Research into Policy, Journal of Head Trauma Rehabilitation, 2 (3), 24-36.

1 Study Design

Study question: is comprehensive in-patient rehabilitation for patients with severe traumatic brain injury (TBI) effective. (US study)

Alternatives assessed: comprehensive in-patient rehabilitation versus control group in area where no such services are available.

Comments: does not claim to be a full economic evaluation of the above alternatives but rather sets out to achieve three goals:

- 1 evaluate the individual benefit derived from in-patient rehabilitation for severe TBI patients
- 2 examine the characteristics of these patients for planning purposes
- 3 estimate the benefits to society from rehabilitating this group.

2 Assessment of Costs and Benefits

The study was set up with a comparison group in an area in which comprehensive in-patient rehabilitation services are not available for TBIs. It is suggested that it is not possible to set up a randomly controlled trial in this field because individuals cannot be assigned to a no-treatment option. The study notes that it is even difficult to assign individuals to alternative rehabilitation options because of infrequency of severe injuries and the long period of time necessary to determine outcomes. Therefore a Quasi-experimental research design was used to attempt to control for differences in the 2 groups. Pretreatment differences between the groups which may be expected to be correlated with good and poor outcomes were taken into account. These 'proxy' pretest measures included age, sex, race, severity and time from injury to start of rehabilitation. The rehabilitation group consisted of 68 patients and the control group of 61 patients. The follow-up time of the study was 2 years.

Measures for evaluating the impact/effectiveness of rehabilitation were categorised as

- 1 Patient Characteristics (age, sex, type of injury, duration of unconsciousness, duration of post-traumatic amnesia (PTA)).
- 2 Treatment Characteristics
emergency/acute eg, surgeries, days in intensive care
in-patient rehabilitation eg, therapy sessions, days in rehabilitation
post-acute eg, in-patient admissions, home nursing care etc.

and

- 3 Outcome Measures eg, functional status, vocational status, daily care requirement. The specific instruments used are not named.

All patients were interviewed by telephone questionnaire. The study does not specify at what stage of treatment the questionnaire was carried out nor how regularly patients were questioned.

The cost considerations were not monetary but rather an attempt to quantify the societal benefit of rehabilitation. Therefore, individuals were viewed as productive (employed), potentially productive (students) or unproductive (unemployed or retired): the use of such measures are not useful when there are many unemployed. Their 'cost' to society takes account of vocational situation, place of residence and required assistance during workday hours from a household member. So the lowest cost individual would look like: private residence, no family care, employed, and the highest cost to society; institutionalised, disabled. From such ratings a cost outcome index was drawn up to which actual monetary estimates were attached.

3 Results and Conclusions

The author noted that the rehabilitation group suffered the greatest severity of brain injury and were therefore expected to have a lower outcome evaluation. However, with most individual variables, eg vocational status, hours of daytime care required, mobility and residential skills, there was no statistically significant differences between the groups. At the two year follow-up, individuals were asked to report problems with physical, cognitive and emotional symptoms. Whilst the problems suffered by the rehabilitation group were often not significant, the non-rehabilitation group consistently had more physical problems.

Whilst the two groups were dissimilar relative to injury severity they had similar distributions on the cost outcome index. In other words, the rehabilitation group were, on average, more severely injured but had a comparable cost outcome. They were therefore "experiencing good rates of return to productive lives and non-burdensome levels of care".

In concluding the author believed that rehabilitation patients achieved better long-term outcomes than patients with no formal rehabilitation, even though the rehabilitation patients were more severely injured.

4 Comments

In terms of outcome the two groups studied differed very little which indicates that the impact rehabilitation had was limited ie, it was ineffective. However, the fact that the trial group was on average more severely injured and yet they required similar amounts of care after two years was suggested to indicate that in-patient rehabilitation produced successful outcomes.

The study paid little attention, however, to psychosocial and psychological disabilities, focusing on physical recovery. Some critics believe the former to be the most significant of the long-term complications faced by brain-injured patients.

Bethell J J N, Mullee M A (1990). A Controlled Trial of Community Based Coronary Rehabilitation, British Heart Journal, 64, (6).

1 Study Design

Study question: What is the improvement in general health (fitness) offered by coronary rehabilitation? (UK Study)

Alternatives Assessed: Intensive rehabilitation versus exercise at home.

Comments: Study does not attempt a comparative evaluation of coronary rehabilitation options but rather tries to measure the effectiveness of a community based programme.

2 Assessment of Cost and Benefits

Study consisted of a group of 200 patients who were selected to ensure they were in similar medical condition. They were randomly assigned to (1) the treatment group - who underwent a 3 month course of 3 times a week circuit training or (2) control group - who were "given a short talk on the sort of exercise they might safely undertake unsupervised".

The groups were comparable in terms of age, presence of complications and time to return to work. Because the study is not a comparative one, there is no costing included. 73% of the treatment group completed the 3 month course.

Effectiveness of the programme was determined by a fitness test, ie perceived energy level and maximum oxygen uptake, at selection and after the full follow-up time of the trial which was 3 months.

3 Results and Conclusions

The authors concluded that "the greater improvement in fitness among the treatment group testified to the effectiveness of the exercise regime". The improvement in fitness was assessed by:

- a significant rise in the perceived energy level of the treatment group over that of the control group and also a rise in the predicted maximum oxygen uptake;
- the prevalence of angina fell by 10% in the treatment group but rose by 60% in the control patients. The results are subject to the finding that 27% of the control group exercised vigorously during the 3 months.
- There was no significant difference found in the general psychological well-being of the two groups, (it is not indicated how this was assessed), and so the overall effect of the physical training on this factor was modest.

The authors conclude that there are advantages in using community sports centres as compared to hospitals because:

- 1 there is more space available
- 2 appropriate equipment for circuit training and experienced staff are readily available
- 3 exercising in the community encourages a return to normal because patients are having fun.

The results of the study are, however, similar to the findings of earlier hospital studies unfortunately, there are no published comparative studies between community and hospital rehabilitation.

4 Comments

One measure of fitness used in the study, maximum oxygen uptake, as measured by double product ie, (heart rate x systolic pressure) is considered by others (Davies S (1991) British Heart Journal, 66, 114) to be unreliable, suggesting that the measure has a standard error of the estimate of some 15%. A proportion of the study control group biased the results by exercising themselves.

Cole J P, Cope D N, Cervelli L (1985). Rehabilitation of the Severely Brain Injured Patient: A Community Based Low-cost Model Programme. Archives of Physical Medicine and Rehabilitation, 38-40.

1 Study Design

The study describes the development, experience and outcomes of a long-term out-patient programme for the continued rehabilitation of the brain injured patient (USA). As such it describes a model in existence and does not directly evaluate it alongside an alternative. The study is still of interest, however, because it considers the effectiveness of rehabilitation.

Acute care for severely brain injured patients usually extends from six months to one year after injury. Once discharged from the acute hospital, if remaining physical, cognitive or behavioural problems are too severe to permit entry into an educational, vocational or recreational programme, then the patient is usually returned home. Cole et al explain that cognitive and social skills developed at the acute stage of care are often lost at this point which eventually leads to a decline in the condition of the patient, a worsening situation in the family home, or even patients being sent to nursing homes and institutions. There is therefore a need to fill the gap between acute care and high level traditional community care.

The programme developed was an Adult Development Centre (ADC). Whilst rehabilitation of the severely brain injured patient usually centres on nursing, speech, physical and occupational therapy, long-term it is believed psychosocial and psychological disabilities are the most afflicting for this group, therefore self-care and social skills were emphasised.

2 Subjects

Fifteen to twenty patients attended the centre, four days a week, for five hours a day. The treatment goals were individualised and the aim throughout was to achieve a higher level of function to prepare for admission into eg, a vocational rehabilitation programme. Small group instruction typically centred around basic academics, self-care and home making, social skill development and limited physical conditioning.

Over a period of six years, ninety-five patients attended and 47% of them attained an improved level of functioning and moved on to higher level community rehabilitation projects. Those patients who improved did so within one year but those who did not continued within the programme to at least maintain their level of functioning or their slower rate of improvement.

3 Costing

No fee is charged to the patients and the costs presented were US (1985) \$3 per hour per patient. Other costs are not quoted but compared to institutionalisation, in-home attendant care or other treatment programmes, this is considered inexpensive. The cost of alternative treatment options were not quoted, however. The study concludes that ADCs are a more efficient and cost-effective approach to the long-term treatment of brain-injured individuals.

4 Comments

The programme approach outlined is interesting because it questions what is considered effective rehabilitation. Maintaining a level of functioning in a patient is considered reason enough to continue long-term rehabilitation. In other programmes or rehabilitation environments when a patient shows no improvement after a period, they may be deemed failures and intensive rehabilitation of this sort is stopped. The study does not allow a consideration of the cost-effectiveness of the service to be undertaken.

Cummings V, Kerner F F, Arones S, Steinbock C (1985). Day-Hospital Service in Rehabilitation Medicine: an evaluation. Archives of Physical Medicine and Rehabilitation, 66, 2, 86-91.

1 Study Design

Study question: Is day-hospital care an efficient alternative to in-patient care for recently disabled patients (US Study)

Alternatives assessed: Day hospital rehabilitation versus intensive in-patient care.

Comments: Study stated that if day-hospitals are to be considered a substitute for in-patient care they should meet the following 2 criteria:

- 1 reduce the cost of conventional hospital treatment
- 2 demonstrate the quality of care is at least equal to conventional hospital treatment as determined by objective results of treatment outcomes.

2 Assessment of Costs and Benefits

As the day hospital unit had been established for over a year, costs were drawn from the previous year's report with the following additions:

- 1 depreciation of building and fixtures
- 2 employee health and welfare benefits
- 3 intern and resident physician professional and administrative support
- 4 paramedical financial support.

An adjustment was also made to the overhead costs to equate the day-hospital, 8 hour day, with the in-patient, 24 hour day, ie, divided by 3.

The study was based on a randomly controlled trial with 48 patients assigned to each group. There is no indication of a drop-out rate.

Effectiveness was measured by consensus of opinion of the medical and therapeutic staff involved in the treatment as well as activities of daily living (ADL) ratings. Additionally, three measures were used to assess psychologic status and outcome these were The Mental Status questionnaire; Linkowski's Acceptance of Disability Instrument, and a modification of the Dupuy psychologic well-being measure. Questionnaires were used to establish patient satisfaction and the impact on the family. These data were collected at intake, on discharge and after three months, which was the full follow-up time of the study.

A sensitivity analysis measured the impact of varying assumptions on the cost-effectiveness of the day-hospital programme. Firstly, research costs were removed from the cost estimate and secondly, adjustments were made to simulate 90% occupancy of the unit. Finally the two adjustments were combined.

3 Results and Conclusions

In all aspects of psychologic assessment and in the assessment of ADLs, there was no major difference between the 2 groups. Initially the day-hospital proved more expensive, however, after adjusting for 90% occupancy, day hospital costs were reduced to (US, 1985) \$369,944 compared to inpatient costs of (US, 1985) \$634,144, for the duration of the treatment. With 90% occupancy and research costs removed, the day-hospital represented a 65% saving of inpatient costs. The facility was therefore cheaper but produced the same medial results.

4 Comments

The analysis presented was more rigorous than most. However, the procedure for selecting individuals excluded certain patients and it is doubtful that under such circumstances the results could be generalised. Recent spinal cord injury and head injury patients were excluded and patients accepted were required to be medically stable. The exclusion of such groups casts doubt upon the outcome and cost-effectiveness conclusions of the study as such groups are usually the most demanding of time and the most costly.

Cost-effectiveness of the unit requires a 90% occupancy rate which is high and may not be regularly achievable. There will inevitably be busy and quiet periods. Perhaps more flexible staffing of the unit is a more realistic approach to achieving cost-effectiveness. If all nursing, medical and therapeutic services responded to the actual occupancy level rather than the potential capacity of the unit then more efficient cost levels may be achieved.

Feigenson J D, Scheinberg L, Catalano M, Polkon L, Mantegazza P, Feigensen W D, LaRocca N G (1981). The Cost-effectiveness of multiple sclerosis rehabilitation: a model. Neurology, 31, 1316-1322.

1 Study Design

Study question: Is intensive rehabilitation for multiple sclerosis (MS) patients -effective and cost-effective? (US Study)

Alternative assessed: Intensive in-patient rehabilitation versus nursing home care.

Comments: The alternatives are compared in terms of cost only because the patients referred had 'long-standing disabilities which had not yet yielded to regular intensive comprehensive out-patient treatment'. The measures by which treatment success is gauged are described below.

2 Costs and Benefits Assessed

Costs arising from hospitalisation were calculated as were the costs of maintaining the patient at home shortly before admission to the programme. This led to an estimate of the total number of hours per year for which assistance would be required. One year later a similar investigation was carried out to determine how much assistance individuals were actually receiving. Data about the cost of nursing home care were gathered using a telephone survey. Average costs were used throughout.

The study was not linked to a controlled clinical trial. The sample size was 20 individuals and the follow-up time of the study was one year.

Effectiveness was measured by functional status for several major functional categories (eg, balance, self-care, bladder incontinence, bed mobility). An average 'category rating' was derived from each subcategory as well as an average response to nursing, occupational and physical therapy. These were combined to produce the overall functional status. This approach was adopted because direct comparison of all the functional deficits encountered by the patients were considered too numerous and complicated.

3 Results and Conclusions

The study found that statistically significant improvements were made for balance, self-care, ambulatory transfers and the general ability to perform real-life activities. No significant improvement was made for primary neurologic functions eg, cognitive and communication abilities.

The average cost per year for in-patient rehabilitation and subsequent home care was (US, 1981) \$18,342. Nursing home care for the same period ranged from (US, 1981) \$18,250 to \$36,500. The study showed that for the one year follow-up the amount of help required to maintain the patient at home decreased substantially and would be expected to do so in subsequent years (although no evidence is provided to support this) leading to greater savings

(for the in-patient group) in the future.

4 Comments

The authors believe that the setting up of a multi-disciplinary rehabilitation programme for MS patients is justified by future savings. In other words, the reduced subsequent dependency of individual patients on care in the community is significant.

As the study is not based on a RCT it is not possible to be sure that the individuals who were selected for in-patient treatment were not more likely to succeed in this environment than others. It is questionable whether a comparison with nursing home costs is useful. The method used to determine these costs was not rigorous and resulted in the comparisons being made with a range of nursing home costs. Calculations were made using before and after snapshots of care required in the home. However, the level of care received is not necessarily indicative of the level of care required. A sample of twenty individuals is an inadequate basis for research.

MacFarlane J P R, Collings T, Graham K, Mackintosh J C (1979). Day Hospitals in Modern Clinical Practice - Cost Benefit. Age and Aging 8, Supplement, 80-86.

1 Study Design

Study question:	To what extent does the day-hospital achieve its objective of rehabilitation; what are the costs of the day hospital and supporting community care; how do these compare with in-patient costs? (UK Study)
Alternatives appraised:	Day hospital care plus community support for the elderly <u>versus</u> in-patient care.
Comments:	Study is mainly a survey of day hospital practices although a simple costing exercise was included. The authors did not claim to present a cost-effectiveness analysis of day hospital care <u>versus</u> in-patient care.

2 Assessment of Costs and Benefits

Total costs of the day hospital (DH) were expressed: per annum, per week and per patient visit, assuming a 82.5% occupancy. The total weekly cost of DH care was calculated by including the cost of community support and was compared to in-patient costs by weekly episode of care.

DH costs were broken down into costs of salaries, laboratory tests, drugs, general services, catering and ambulance services. In-patient costs were not similarly broken down. All costs used were average costs. The sample size was not quoted and as only weekly costs were considered there is no follow-up time of the study.

Effectiveness of the service was measured against criteria internally set, ie consensus of opinion from all who participated in the treatment. The study was not based on a randomly controlled trial.

3 Results and Conclusions

DH costs was in total £2,254 per week or £13.60 per patient visit. Community support was an additional £13 per week so the per patient weekly cost of DH and community care was calculated to be £47 (2.5 visits to the DH per week). In-patient cost for the same period was £129.80.

The average number of reasons for attending the day hospital was five. If there had been as few as one or two reasons then this would imply a more economic placing as an out-patient.

More than one third of patients discharged were considered to have improved and a further quarter were maintained in the face of advancing disease. So, a majority were considered to have benefitted from the DH.

The authors believe that day-hospital is cost-effective and provides "an effective therapeutic service".

4 Comments

The study claims to be a vindication of day-hospital use for elderly patients but as it stands is not comprehensive enough in its approach to derive significant policy implications. The use of average costs is again a problem. A controlled comparison of the benefits of day hospital care versus inpatient care would be advisable. The number of patients in the trial is not recorded.

(Source: Drummond, 1986, p 230-232.)

Price J (1991). A Way Through the Maze. Health Services Journal, (14/2/91), 23.

1 Study Design

The article describes the setting up of a model of how case management (CM) can help severely head injured (HI) people through the various stages of recovery. The research is taking place at St Bartholomew's Hospital, London and as yet the results are not known. The study therefore outlines some expected benefits and potential improvements for head-injury patients.

Case management is believed to be a commonsense approach to the treatment of HI patients because at the moment "services are fragmented and ineffectual and the quality of rehabilitation is poor".

In the acute stages of care the case manager coordinates the established clinical services ensuring a team approach is not just theoretical. This should improve throughput of patients in acute sector beds. Where CM is expected to be of maximum benefit is at the 12-24 months after injury stage. It is at this point that traditional clinical services begin to break down and services become fragmented. From then on the patients requirements are likely to be more subtle and diverse and less likely to be affected by traditional clinical rehabilitation. The case manager therefore develops the necessary social and vocational re-entry programme, which reflects the patients ability.

In simple terms the CM approach aims to succeed by ensuring the right sources of help are available at the right time throughout the patients recovery.

2 Subjects

The initial study was set up in March 1987 and was to continue until August 1991. The patients were aged 16-60 and had been in a coma for at least six hours. The effects of CM on the long-term outcome of patients was to be measured in comparison with a control group of similar clients. Each of the two groups consist of the HI patients from three district general hospitals (DGH's). The number of patients in each group is not indicated.

The patients and their main carers, in both groups, were to be regularly assessed using several psychometric and social outcome scales (no details given).

3 Study Conclusions

The major benefits of case management are expected to be

- reduction in hospital stay
- increase in the amount of formal rehabilitation
- an improvement in the uptake of services and resources of potential value to HI patients

and to the patient;

- reduced disability and handicap
- reduction in family burden
- improvement in employment outcome
- improvement in quality of life.

4 Comments

The approach to rehabilitation outlined is interesting because it focuses not only on the physical recovery of patients but accepts that long-term help is needed if patients are to achieve their maximum level of functioning. Rehabilitation traditionally slows when an individual moves from the acute stage of care, however, long term it is believed that psychosocial and psychological disabilities affect the patients recovery most. It is necessary to develop a social and vocational re-entry programme for an individual which suits their ability level and is maintained long enough to enable each individual to reach his/her maximum level of functioning within the community.

Shah S, Vanclay F, Cooper B (1990). Efficiency, Effectiveness and Duration of Stroke Rehabilitation. Stroke, 21: 241-246.

1 Study Design

Whilst resources available for comprehensive in-patient rehabilitation are limited it is important that those referred for such care are those likely to benefit most. How great an influence do the major medical, rehabilitative and demographic variables have in predicting:

- 1 rehabilitation efficiency?
- 2 achievement of rehabilitation potential? and
- 3 duration of rehabilitation stay?

The study does not present any costing but directly considers rehabilitation effectiveness. (Australian Study)

2 Methodology

The study looked at 258 first-stroke patients whose acute (hospital) care ranged from 1 to 79 days. The patients were assessed on admission and at discharge.

Effectiveness was measured as an improvement in the ability to perform Activities of Daily Living (ADL) scored according to the Barthel Index. Neurological Recovery was measured using the Bruunstrom motor recovery scales. Patients were discharged when a multi-disciplinary team (doctors and therapists) considered they had achieved their maximum benefit.

A regression model was adopted using the three dependent variables below with "all medical, rehabilitative, demographic and attribute variables available at rehabilitation commencement as independent variables".

Rehabilitation Efficiency:	is the amount of improvement in a patient divided by the rehabilitation stay. The amount of improvement is measured using the Barthel Index. This measures functional independence at a point in time so the change in the index from the start of rehabilitation to discharge measures the improvement gained.
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Achievement of Rehabilitation Potential:	measured by the actual improvement gained divided by the potential improvement.
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Duration of Rehabilitation Stay:	measured in days.
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3 Results

All three dependent variables were poorly predicted, indicating a lot of unexplained variance which could not be explained by the independent variables used. The next step would normally be to broaden the range of independent variables considered, however, the authors

believe their approach to have been as comprehensive as possible. The lack of explanatory power offered by the model is therefore attributed to social, personal and family factors that are unrelated to the rehabilitation process.

The independent variables which were significant for each dependent variable are as follows:

Rehabilitation Efficiency	-	Age Brunnstrom Arm Recovery Level Initial Barthel Index Score (Initial Barthel Index Score) ²
Achievement of Rehabilitation Potential	-	Age Brunnstrom Arm Recovery Level Myocardial Infarction Onset-Admission Interval Admission-Rehabilitation Interval Bladder Control
Duration of Rehabilitation Stay	-	Age Initial Barthel Index Score Bladder Control Peripheral Vascular Disease Diabetes Mellitus

4 Comments

Part of the explanation for the poor prediction results may be due to the rehabilitation referral system in Australia where the study was carried out. In Australia any member of a medical team can recommend that a patient be referred for rehabilitation whereas in other countries it is usually the domain of one specialist. Because the funding system operates on a patient-day basis rehabilitation units are unlikely to turn away patients, who in fact may be unlikely to benefit.

Mass referral subsequently occurs with comprehensive in-patient rates double that of other countries. If a more selective procedure was adopted for patient referral then models like the one described may have more explanatory success. Also, more importantly, the resources which would be freed could be used to develop more appropriate rehabilitation facilities for those unlikely to benefit from in-patient care.

Tucker M A, Davison J G, Ogle S J (1984). Day Hospital Rehabilitation - Effectiveness and Cost in the Elderly: a randomised controlled trial. British Medical Journal, 289, 1209-1212.

1 Study Design

Study question: Are day-hospital rehabilitation centres clinically effective and cost-effective care centres for the elderly? (New Zealand study)

Alternatives assessed: Day-hospital rehabilitation versus in-patient care.

Comments: The study group were the first intakes to a new geriatric rehabilitation centre in Auckland, New Zealand.

2 Costs and Benefits Assessed

The costs considered are those arising from changes in health service resources only; for the day-hospital (DH), staffing, transport and overheads. For in-patients cost estimates were used from other sources and confirmed by the authors study. Average costs were used throughout. Total costs for DH care was expressed per patient and per patient day. Notably, costs for the day-hospital were not adjusted for full-occupancy.

A comparison with in-patient care was made at referral, after six weeks and after five months. Some account was taken for both groups of the cost of at home services but the calculations were not detailed as they were believed to be similar.

The study was based on a clinically controlled trial. One hundred and twenty patients were selected and randomly assigned to one of the groups. The DH provided intensive physiotherapy, occupational and speech therapy, medical and nursing assessment. Five months was the full follow-up time of the study. Effectiveness was measured in terms of physical dependency (activities of daily living (ADL)) and changes in mood.

3 Results and Conclusions

The study concluded that in terms of both the cost of the new facility and its success with treatment the programme was unjustified. Whilst improvements were noted at the six week stage for ADLs, these were attributed to early intensive rehabilitation and did not prove significant with the five month time gap. A significant improvement in mood was sustained after five months but it is believed that this could be achieved as well and more cheaply using day-care centres which in New Zealand are staffed by volunteers.

Average cost per five months' assessment period per patient for the day hospital was (NZ, 1982) \$3,052 and for the control group (NZ, 1982) \$2,083. The figures are for a 58% occupancy rate.

4 Comments

The trial questions the role of the day-hospital as a means of rehabilitating the elderly. It was found to be no more effective on medical grounds than in-patient care and was more

expensive. The authors suggest that a more efficient use of rehabilitation resources would be more "... combined use of in-patient care, domiciliary services and day care centres".

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