

# **Real World Economic Evaluation of Rehabilitation Services**

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## Abbreviations

ADL	Activities of daily living
BMJ	British Medical Journal
CAAT	Computer-aided Assistive Technologies
CADI	Carers Assessment of Difficulties Index
CASP	Critical Appraisal Skills Programme
CBA	Cost Benefit Analysis
CCA	Cost Consequence Analysis
CEA	Cost Effectiveness Analysis
CMA	Cost Minimisation Analysis
CRD	NHS Centre for Reviews and Dissemination
CRISS	Social Services database
CSC	Community Support Centre
CUA	Cost Utility Analysis
DoH	Department of Health
EBN	Evidence Based Nursing
EED	NHS Economic Evaluation Database
HADS	Hospital Anxiety and Depression Scale
HRQL	Health Related Quality of Life
IHSS	Intensive Health Support Service
JIP	Joint Investment Plan
NICE	National Institute of Clinical Excellence
OT	Occupational Therapist
PGI	Patient Generated Index
QALY	Quality Adjusted Life Year
QoL	Quality of Life
RCT	Randomised Controlled Trial
RLT	Rehabilitation Link Team
VAS	Visual Analogue Scale
WTA	Willingness to Accept
WTP	Willingness to Pay

## Abstract

### Real World Economic Evaluation of Rehabilitation Services

This thesis seeks to explore how economic evaluations of rehabilitation services are carried out in the 'real world'. To consider whether the multifaceted components of the rehabilitation process can be, or are, meaningfully evaluated within the existing framework of economic evaluation.

Attention will focus on three areas:

- The theory and methodology underpinning economic evaluation of health interventions; elements that make up an 'ideal' or high quality economic evaluation
- How current and past economic evaluations of rehabilitation services have been carried out, the differences and similarities and how far these evaluations conform to the 'ideal'.
- A case study to identify the limitations placed upon economic evaluations of these types of service will explore how constraints shape the evaluation, influence the results and thus the conclusions that may be drawn from the study

Chapters One to Five of the thesis look at existing work undertaken in this field. It begins by giving the rationale and context of the study in the current political and health care environment. It goes on to consider the rehabilitation process, the theory and methodology underpinning economic evaluation in health care and to identify essential elements of an economic evaluation.

A literature review is carried out to identify trends in the evaluation of rehabilitation services and to explore how *actual* evaluations fit with the ideals of economic evaluation in this field.

Chapter Six to Ten present a case study that explores different scenarios when carrying out an economic evaluation of a rehabilitation service; the constraints and limitations

incurred in the evaluation design and process, how these may be overcome, how they are reflected in the results and changes in parameters within the evaluation.

Chapter Eleven draws together the evidence presented to address the study question; can rehabilitation services be meaningfully evaluated within the existing framework of economic evaluation?

## Chapter One

### Introduction

#### *Economic evaluation and health care*

Economic evaluation in the field of health has enjoyed a high profile over the last decade. In the UK, government white papers highlight the need for cost effective health interventions. Initiatives such as the National Institute for Clinical Effectiveness (NICE) provide not only a platform for cost effectiveness analysis but also tangible evidence of the acknowledged need for health interventions to be cost effective given the finite resources available to the health sector.

Although a relatively young science, health economics is firmly based in economic theory. There is an abundance of methodological research that explores and debates the tenets upon which the two main types of economic evaluation in this field, cost effectiveness analysis and cost benefit analysis, are based. Papers explore areas such as the use of mathematical modelling, the concept of quality adjusted life years and the valuation of human life.

In recent years there has been a steady increase in the number of cost effectiveness analyses of health and medical interventions published each year (Elixhauser, 1993). Within health economics the strongest area of focus is pharmaceuticals (Gold et al, 1996) and much of the work has focused upon medical interventions which lend themselves to quantitative analysis. However, recent research has also explored, both in economics and in the wider health research field, interventions that aim to affect social as well as medical changes. Indeed recent research commissioned by the Joseph Rowntree foundation, undertaken by the London School of Economics has been undertaken in order to *promote better understanding and use of economic evaluation in the social welfare field* (Sefton et al, 2002, p3).

### *Integrated services*

In the UK, one important facet of recent government initiatives is that of partnership working (DoH, 1998) with the objective of breaking down barriers between organisations to provide integrated services that meet the needs of health and social service users. It is this increased emphasis on cross boundary working, integrated services and fusion of health and social services together with the need to carry out economic evaluations of these types of service that forms the basis of the thesis.

Cross boundary working raises a number of issues for those who carry out an economic evaluation, for the value of the results and their interpretation in influencing decision making and policy. Firstly integrated services are likely to be complex. Secondly by definition inputs will span across sectors and/or agencies. Thirdly outputs are likely to affect both health and social changes and have consequences outside the immediate recipient of those services. Fourthly the outputs, especially in terms of any social changes affected, may not lend themselves easily to quantification. This complexity leads to the question of whether economic evaluation can and does meaningfully reflect the multifaceted components of integrated services and how meaningful those results are.

### *Rehabilitation*

In order to address these issues a focus for integrated working needed to be identified. Choice fell on rehabilitation. Its importance can be seen in figures collated by the World Health Organisation who estimate that at any one point in time 1.5% of the world's population (that is 90 million people) require rehabilitation services ([www.who.int/ncd/disability/trends.htm](http://www.who.int/ncd/disability/trends.htm), accessed 18.10.02). While a substantial amount of rehabilitation services has been historically provided by the health sector, rehabilitation provision in the sense of enhanced independent living is drawn from a number of sources outwith the health care sector, including social services, voluntary sector and other parts of the community. In line with the move towards integrated working rehabilitation has moved away from a traditionally medical model to one that focuses upon affecting both medical and social changes. Rehabilitation therefore

provides a platform by which to address whether economic evaluation can or does meaningfully reflect the multifaceted components of integrated working.

### *Aims*

Using rehabilitation as the focus for this type of integrated working, the aims of the study are:

- To determine if economic evaluation can and does meaningfully reflect the multifaceted components of rehabilitation interventions
- To compare *real life* evaluations with the text book *ideal*
- To explore differences between *actual* or *real life* evaluations of rehabilitation services and barriers to the evaluation process that influence the evaluation design, process and results

In order to address the study aims the first step would be to identify methodological literature in this area. The methodological literature sets out the standards for the *ideal* economic evaluation of health care interventions that ensures an accurate reflection of the health interventions under analysis.

Whilst some debate exists regarding the type of economic analysis used to evaluate health interventions and the theory underlying those types of evaluation, the text books are clear in how evaluations *should* be carried out they point to the content, perspective and inclusion/exclusion criteria and analysis that will ensure an accurate reflection of a health intervention. This *ideal* or blueprint could then be used to compare the *ideal* evaluation against *actual* evaluations of rehabilitation services.

By addressing any deviations from the *ideal* it would be possible to identify the causes of those deviations and how they influence the evaluation results and interpretation of those results. An important aspect of the study would be therefore to explore why there exists differences between real life evaluation and the *ideal* espoused in the texts and what causes them.

It was anticipated that this analysis, together with an analysis of the rehabilitation services themselves, would highlight any deviations from the *ideal* that limits evaluations and in turn evaluation results. These limitations could be explored further by way of a case study to address any barriers or constraints to the evaluation of rehabilitation services and determine whether they relate to characteristics inherent in the process or are whether they are more practical or whether they are constraints that face all economic evaluations. These two strands of the study could be brought together to determine whether the data presented show that rehabilitation can be or is meaningfully reflected within economic evaluation.

The thesis is thus set out in the following way. Chapter Two outlines the concept of rehabilitation, the structures, processes and outcomes of rehabilitation services. It draws upon work published by Wade and de Jong (2000) whose rehabilitation model provides a framework by which rehabilitation services can be clinically evaluated. The definitions posited provide a basis from which to consider constraints placed upon the economic evaluation of rehabilitation interventions. Constraints that result from characteristics thought to be inherent in rehabilitation and rehabilitation interventions that include the complexity of inputs and outputs of rehabilitation interventions, the perspective and scope of rehabilitation interventions and their time scale.

Chapter Three introduces economic evaluation in the field of health care. It provides an introduction to the theoretical bases of the two types of economic evaluation employed in this field: cost effectiveness analysis and cost benefit analysis. A number of methodological texts and published papers provide detailed analysis outlining how economic evaluations of health care interventions ought to be undertaken. These texts provide a platform from which to outline key components of economic evaluation of health interventions.

Chapter Four builds on these key components. The work explores a number of frameworks and guidelines designed to provide tools by which to judge the quality of economic evaluations in health. Together with the key components of economic evaluation identified in Chapter Three and Wade and de Jong's model of rehabilitation a framework by which to evaluate the quality of an economic evaluation in the field of rehabilitation is constructed.

The framework is used in Chapter Five to determine the trends, common factors, or differences in economic evaluations of rehabilitation interventions. It analyses how economic evaluations of rehabilitation interventions are actually carried out and how this compares to the textbook ideal and reflects the nature and characteristics of those interventions.

In order to identify the limitations and constraints placed upon the design of the economic evaluations in rehabilitation, and to explore how those constraints influence the results an economic evaluation of a case study was carried out. Chapters Six to Ten describe the case study: an economic evaluation of a rehabilitation service. The case study provides evidence of the constraints addressed and presents an analysis and discussion of how the evaluation results, and thus the interpretation of those results, can change if the parameters of the evaluation change.

The case study begins in Chapter Six by outlining how the rehabilitation intervention that forms the case study was chosen. The selection criteria are derived from the definitions of rehabilitation and Wade and de Jong's model laid out in Chapter Two. The rehabilitation service chosen is an Assessment and Rehabilitation Service for Older People based in South Cheshire. The service was developed in line with the Government's commitment to partnership working (DoH, 1998) and the provision of integrated services (DoH, 2001) spanning the health, social and voluntary sectors. The aims of the service, the structure, process and outcomes are described in detail.

The methods used to evaluate the rehabilitation service are outlined in Chapter Seven. Particular focus is given to constraints experienced within the design process itself and how these are addressed. The limitations presented themselves over a wide range of areas including the perspective the evaluation adopted, the methods by which outcomes could be measured, the type of analysis employed and the selection of alternatives for comparison with the intervention. The chapter provides an overview of how the evaluation was designed in the face of these constraints.

The results of the evaluation are presented in Chapter Eight. Chapter Nine considers the strengths and weakness of the evaluation by way of a critical discussion of the case

study in terms of the design, the data collection process, the analysis of data, the subsequent results of the evaluation and decisions based upon those results.

This discussion is continued in Chapter Ten by exploring how the evaluation results change if the parameters of the evaluation change. The analyses consider a change in the viewpoint or perspective of the evaluation, a change in the methods employed in the cost analysis, and a change in how outcomes are measured.

In conclusion, Chapter Eleven draws together the evidence presented from both the existing literature and the case study. Discussion focuses upon the difference between *textbook* evaluation and *real world* evaluation of rehabilitation interventions: that is whether the multifaceted components of rehabilitation and rehabilitation interventions can be or are meaningfully evaluated within the existing framework of economic evaluation. A developmental framework is presented by which economic evaluations of rehabilitation interventions may be carried out. A critical analysis of the strengths and weaknesses of the thesis is presented together with recommendations for future research.

## Chapter Two

### Rehabilitation

#### Introduction

In order to explore how economic evaluations of rehabilitation interventions are carried out it is necessary to understand what is meant by the term rehabilitation and to define the concept of rehabilitation and thus rehabilitation interventions. This chapter lays out those definitions and considers how the characteristics common to rehabilitation services may constrain or limit the evaluation process.

#### Rehabilitation Defined

Whilst there exists no universal definition of rehabilitation those posited now typically incorporate changes in social function as well as changes in physical and mental function. Rehabilitation may be seen as *a co-ordinated process that enhances activity and participation* (Disler et al, 2002, p385). There exists an emphasis on restoration that allows *rehabilitation to be distinguished from primary prevention and maintenance* (Nocon & Baldwin, 1998, pvi). Alternatively *any treatment aimed at reversing or stopping an underlying disease may be defined as a medical or non-rehabilitation intervention* (Wade, 1998, p363). A number of definitions illustrative of these elements are shown in Box 1.

Rehabilitation is often regarded as a function of services rather than a service in its own right (Nocon and Baldwin, 1998) but this is changing, for example, rehabilitation medicine was recognised as a principle speciality in Australia as early as 1978 (Disler et al, 2002). However, whilst rehabilitation *is* moving towards recognition as a specialised area of medicine it is important to note that the term *rehabilitation* covers a wide range of services over a large number of condition areas.

## Rehabilitation Interventions

Rehabilitation programmes may be seen as health interventions that aim to improve the health related quality of life. This dovetails with the concept of rehabilitation programmes as services that include a mix of clinical, therapeutic and social interventions and address issues relevant to a person's physical and social environment (Nocon & Baldwin, 1998).

### Box 1: Definitions of rehabilitation

*A process aiming to restore personal autonomy in those aspects of daily living considered most relevant by patients or service users, and their family carers*  
(Sinclair & Dickinson, 1998, p1).

*Restoration (to the maximum degree possible) either of function (physical or mental) or of role (within the family, social network or workforce)*  
(Nocon & Baldwin, 1998, p5).

*The management of change; a problem solving and educational process aimed at reducing the disability and handicap experienced by someone as a result of a disease, always within the limitations imposed by available resources and by the underlying disease*  
(Wade, 1992, p11).

The processes by which these aims are achieved are often complex. There are a number of elements within a rehabilitation programme that facilitate the goal of restoration. These include the attitude of staff within that process, team working between those staff and clear goal setting for and monitoring of patients (Mulley, 1994).

Wade and de Jong (2000) have developed a model of rehabilitation (Box 2), based on the International Classification of Functioning and Disability model (World Health Organisation, 1999). The model outlines a generic description of rehabilitation and provides the basis of a framework through which rehabilitation services may be clinically evaluated.

**Box 2: Rehabilitation; structure, process and outcome****Structure**

A rehabilitation service comprises a multidisciplinary team of people who:

Work together towards common goals for each patient

Involve and educate the patient and family

Have relevant knowledge and skills

Can resolve most of the common problems faced by their patients

**Process**

Rehabilitation is reiterative, active, and educational, having a problem-solving process focused on a patient's behaviour (disability), with the following components:

Assessment – the identification of the nature and extent of the patients' problems and factors relevant to their resolution.

Goal setting

Intervention, which may include either or both of (a) treatments, which affect the process of change; (b) support, which maintains the patient's quality of life and his or her safety

Evaluation – to check on the effects of any intervention

**Outcome**

The rehabilitation process aims to:

Maximise the participation of the patient in his or her social setting

Minimise the pain and distress experienced by the patient

Minimise the distress of and stress on the patient's family and carers

Taken from Wade DT & de Jong BA. 2000. Recent Advances in Rehabilitation. BMJ; 320:1385-1388

The framework outlines the aims of the rehabilitation programme, the process (which includes the input from all sectors involved in the rehabilitation programme), and the assessment and evaluation of the programme in terms of outcomes achieved. It illustrates that whilst the aim of a rehabilitation programme or intervention may be thought of in terms of degree of restoration the concept encompasses a wide range of outcomes that can fall to others beside the immediate recipient of the programme. The model reiterates the mixture of inputs, clinical, therapeutic and social, from different professions and multiple inputs from a wide range of disciplines and sectors.

## **Rehabilitation and Economic Evaluation**

*The ability to achieve the 'ideal' economic evaluation is influenced by the nature of the intervention under investigation (Byford and Sefton, 2002, p8).*

Rehabilitation and rehabilitation programmes and services are often complex. The model and definitions presented show multiple inputs and outputs that span across sectors. The movement away from a purely medical model of rehabilitation towards one in which the aims are more socially orientated makes the process of evaluation itself more complex. In addition it is often difficult to define the specific nature of interventions and to isolate the effects of specific interventions from other factors (Wade and de Jong, 2000).

Byford and Sefton (2002) outline a number of characteristics that constrain or limit the application of traditional economic techniques to more complex areas of health and social welfare. These include the degree of user involvement, the complexity of the intervention, the complexity of outcomes, the perspective and scope and the time scale. Each is considered in turn below.

These constraints are echoed by Coast et al (2000) who explore conceptual and practical difficulties relevant to carrying out an economic evaluation that is concerned with aspects of the organisation of care; in particular those crossing the interfaces between primary and secondary care and between health and social services. Whilst neither of these studies focus on rehabilitation per se the constraints outlined are relevant to the field of rehabilitation. Rehabilitation is viewed as complex and covers both health and social care and rehabilitation services are often concerned with the organisation of care.

### *User involvement*

Interventions differ in the extent to which service users are passive or active. That is the way in which the extent of the success of the intervention is dependent on that activity. Activity in service users is likely to be influenced by individuals' values, cultures, attitudes and circumstances (Byford and Sefton, 2002). For example, Petrie et al (1996)

consider the role of patients' initial perceptions of their illness in predicting return to work and functioning after myocardial infarction. They find that initial patient perceptions are important determinants of different aspects of recovery. Thus, interventions that are effective in one cultural setting or with one group of users may not work in other settings; outcomes can be highly context dependent making it harder to produce results that are generalizable (Sefton, 2000).

Typically rehabilitation requires that patients take an active rather than passive role in their rehabilitation programmes (as illustrated in Wade and de Jong's model). If activity in service users is influenced by attitudes, as Byford and Sefton suggest, then factors such as motivation can be expected to play a part in the extent to which outcomes are achieved.

Rehabilitation professionals have long held that patient motivation affects outcomes. Maclean et al (2000) in a study of stroke patients undergoing rehabilitation found that the highly motivated patients were more likely to view rehabilitation as the most important means of recovery and to accord themselves an *active* role in their rehabilitation process. However, factors such as motivation are difficult to quantify or extrapolate from other factors influencing outcomes. Studies such as Maclean's (2000) make use of qualitative data (in the form of semi-structured interviews) to explore users' motivation and how this is translated into active versus passive involvement in the rehabilitation process. Byford and Sefton (2002) suggest that in order to explore and control for the influence of users a larger sample size would be needed with the collection of a greater number of user-focused variables than would be the case in a more passive group of users.

### *Complexity*

Wade and de Jong's model outlines a rehabilitation service that comprises of a multidisciplinary team of people. A multidisciplinary team may be defined as:

*A group of practitioners with different professional training (multidisciplinary) employed by more than one agency (multi-agency), who meet regularly to co-ordinate*

*their work providing services to one or more clients in a defined area (Ovretveit, 1993, p9)*

This concept of multidisciplinary care is based on the premise that health care is delivered by a team, each member of which has a different professional training and brings different skills to bear (Nolan, 1995).

The rehabilitation process is reiterative, active, educational and problem solving and outcomes that maximise patient's participation in their social setting and minimise pain and distress to the patient, the family and carers. The model represents rehabilitation and rehabilitation services as complex interventions.

This complexity is evidenced in the literature. For example, a survey of 273 cardiac rehabilitation programmes in the UK (Lewin et al, 1998) showed that 70% of the programmes included five or more health care professions within the rehabilitation team whilst only 5% of teams comprised members from only one profession. A systematic review of rehabilitation for chronic low back pain (Guzman et al, 2001) shows rehabilitation interventions that include diverse combinations of, for example, hydrotherapy, physical modalities such as heat or cold applications, exercise, massage cognitive-behavioural therapy and psycho-physical interventions.

In addition to these multiple inputs, complexity also lies in the individualised nature of rehabilitation programmes. Programmes are tailored rather than standardised treatments/interventions. Thus, two patients undergoing a rehabilitation programme with the same diagnosis and prognosis may undertake very different programmes dependent upon factors such as age or the degree of user involvement as mentioned previously.

It is essential to understand how variations in the intervention affect outcomes (Byford and Sefton, 2002). For example, Mulley (1994) suggests that the attitude of the physician can facilitate the achievement of rehabilitation goals.

*The doctor who is successful in geriatric rehabilitation will exhibit the capacity and eagerness to be an active listener; an interest in the whole person, seeing patients as*

*unique individuals and not as cases; an appreciation that patients and their relatives are at the centre of things* (Mulley, 1994, pS28)

Following this train of thought to its conclusion, patients following identical rehabilitation programmes but who have different doctors could conceivably have very different outcomes.

It may be possible to allow for variations such as patients' motivation and attitudes of the rehabilitation team. For example, staff attitudes could be reflected in patient satisfaction surveys. However, it may not always be feasible in the context of an economic evaluation and there are limits to the number of different variables that can be incorporated (Byford and Sefton, 2002).

### *Outcomes*

For some health care interventions, outcomes are relatively easy to quantify (Byford and Sefton, 2002). However, not all the outcomes outlined in the Wade and de Jong (2000) model of rehabilitation lend themselves to numeric measurement. For example, whilst it may be possible to use a quantitative measure of pain, how can 'maximising the participation of the patient in his or her social setting' be quantified and how may the concept of distress be measured?

The concept of health related quality of life (HRQL) takes into account levels physical, mental, social, and role functioning, and includes abilities, relationships, perceptions, life satisfaction and well-being (Wood-Dauphinee, 1999). Thus, measurement of health related quality of life should encompass the outcomes resulting from a rehabilitation programme. In fact the broader construct of quality of life may be considered to be central to rehabilitation (Andresen and Meyers, 2000).

Whilst there is no definitive definition of the term quality of life it may be thought to reflect not just health status itself but also how patients perceive and value both the health and non-health related aspects of their lives (Covinsky et al, 1999). McKenna et al (1992) advocate the use of a group of quality of life measures to capture the physical, social and psychological aspects to rehabilitation.

Quality of life (QoL) measures are increasingly used to supplement clinical or biological measures of disease to assess quality of service, the need for health care, the effectiveness of interventions and in cost utility analyses (Carr and Higginson, 2001). A number of this type of measure are currently used within economic evaluations, but the majority of scales available that fulfil the needs of an economic evaluation have been developed to measure the more restricted concept of HRQL and tend to focus more on physical than psychological or social functioning (Byford and Sefton, 2002).

The debate over the use of both QoL and HRQL measures continues. Recent papers question whether QoL measures take account of expectations and can distinguish between changes in the experience of a disease and changes in expectations of health (Carr et al, 2001); whether measures are patient centred given that QoL is an individual construct (Carr and Higginson, 2001); whether they can take account of longitudinal change (Andresen and Meyers, 2000) and are sensitive to the levels of change expected as a result of a particular intervention (Byford and Sefton, 2002).

Whilst QoL or HRQL measures would appear to encompass the outcomes outlined in Wade and de Jong's model of rehabilitation there still exists some controversy.

### *Perspective*

The model of rehabilitation also shows that outcomes may fall to others beside the recipient of the rehabilitation programme. For example, there may be consequences to the patient's family and carers in the form of a reduction in stress. The National Strategy for Carers (DoH, 1999) cites evidence suggesting that the receipt of reliable and satisfactory services is one of a number of factors that help carers to cope and continue to care.

The intervention may have consequences for other sectors. For example, as a result of the rehabilitation received the patient may return to work resulting in consequences for the economy. Alternatively the programme may reduce the hours of social services home care required by the patient affecting the availability of home care for other users and the costs to the local authority.

The costs and consequences of the intervention are likely to be wide for a rehabilitation service provided across agencies and sectors. Within the UK this multi-agency approach is becoming increasingly prevalent and is illustrated in the National Service Framework for Older People (DoH, 2001) in which the following aim is laid out:

*To ensure that older people are treated as individuals and they receive appropriate and timely packages of care which meets their needs as individuals, regardless of health and social services boundaries (DoH, 2001, p23)*

Thus, even if an economic evaluation is undertaken not from a wide societal perspective but from the more narrow perspective of the service provider the breadth of costs and consequences presented are still likely to be complex.

### *Time Scale*

Rehabilitation programmes take place in a wide variety of settings. The programme may begin in the acute setting and be followed through to the patients' return to the community. This is illustrated by Stevenson (2001) who maps out local rehabilitation and intermediate care services for older people in London. The map shows care services for older people spanning institutional care, intermediate care and community health and social care.

In addition to the variety of settings, for those patients with degenerate diseases the rehabilitation process may continue over the patient's lifetime. The prolonged nature of the rehabilitation process makes the economic evaluation more difficult.

### **Conclusion**

McKenna, Maynard and Wright (1992) review literature on the cost effectiveness of rehabilitation treatments and conclude:

*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. (McKenna et al, 1992, p21).*

The McKenna et al review implies that economic evaluations of rehabilitation interventions do not conform to the methodology and techniques for economic evaluation set out in health economics texts; they fall short of the ideal economic evaluation. This gap may be, in part, due to the characteristics inherent in rehabilitation and rehabilitation interventions outlined in this chapter that constrain the application of economics techniques. As Byford and Sefton note:

*Problems are often long-term in nature and impact upon many areas of a person's life and the lives of their families. Interventions are characterised by a high degree of user involvement, significant variability across interventions and recipients, multiple and complex outcomes and multiple agency involvement. (Byford and Sefton, 2002, p11).*

Whilst this statement specifically refers to social welfare problems it may equally be applied to rehabilitation and rehabilitation interventions. The same complexities apply to rehabilitation due, in part, to the social aspects of the rehabilitation process. This complexity of rehabilitation services introduces a challenge when carrying out an economic evaluation; how may the multifaceted components of the rehabilitation process be reflected in economic evaluations? How may the constraints outlined be addressed or overcome within the evaluation process?

In order to explore whether the comments McKenna et al (1992) made a decade ago are still justified, to determine there is still a difference between actual and ideal economic evaluations Chapter Three explores the elements of an ideal economic evaluation. The chapter introduces economic evaluation in the field of health care, the theoretical basis of economic evaluation and the methodology or techniques that together form the components of the *ideal* economic evaluation. Chapter Four goes on to develop a framework by which the quality of evaluations may be judged. This framework is used to explore trends in the way in which economic evaluation of rehabilitation services are actually carried out; real world evaluation. The framework enables comparison between these real world evaluations and the ideal.

## Chapter Three

### Economic Evaluation

#### Introduction

Economics is concerned with scarcity and choice. These concepts are equally relevant to the field of health care *given that no country can afford to provide all the health care that might conceivably be of some benefit* (Dolan et al, 1996, p209).

Given that demand for health care is greater than supply decisions must be made about how available resources are allocated. Priorities should be established and choices made regarding where and to whom resources are allocated, to which interventions or programmes, and to what extent. Any decisions should be based upon the costs and consequences, the inputs and outputs of interventions.

Economic evaluation plays a role in addressing the demand/supply dilemma by providing a tool by which comparisons may be made. Evaluation facilitates comparisons between health care programmes, treatments, services and interventions in terms of both the costs and consequences of those interventions. Costs may fall to the service providers, the patient, family, and informal carers, or to society or the economy as a whole. Similarly the consequences, be they beneficial or detrimental, can fall to others beside the immediate recipient of the intervention.

Evaluation results do not provide a definitive answer to how resources should be allocated but act as a tool for use in the decision making process. This chapter introduces the theory and methodology underpinning the economic evaluation of health care interventions. It outlines the key elements of the analysis that together constitute an *ideal* economic evaluation. These key elements provide the basis with which to compare *actual* economic evaluations of rehabilitation interventions.

The chapter draws extensively upon a number of key health economics texts including *Methods for the Economic Evaluation of Health Care Programmes* (Drummond et al, 1999) and *Cost Effectiveness in Health and Medicine* (Gold et al, 1996) in addition to methodological papers published in this field.

## **An Overview**

Economic evaluation compares alternative courses of action in terms of both costs and consequences (Drummond et al, 1999). Analysis involves identification, measurement, valuation and comparison of the costs and consequences of the alternatives being considered.

There are two types of economic evaluation: cost effectiveness analysis (CEA) and cost benefit analysis (CBA). Whilst economic evaluation is firmly based in economic theory the theoretical basis of CEA and CBA differ. CEA is based on the social decision making approach which, when taking a societal approach, has its roots in production theory; CBA is based on the concept of social welfare, the Paretian approach. When carrying out an evaluation, CEA and CBA differ in how they value the consequences or outcomes resulting from of the intervention. CBA gives the consequences monetary value but CEA only requires that outcomes be assigned a quantitative value. The generic term CEA includes cost minimisation analysis (CMA), cost consequence analysis (CCA) and cost utility analysis (CUA).

Within the field of health care CEA is the most prevalent form of analysis. In recent years there has been a steady increase in the number of CEA of health and medical interventions published each year (Elixhauser, 1993). Within health economics the strongest area of focus is pharmaceuticals (Gold et al, 1996) and much of the work has focused upon medical interventions which lend themselves to quantitative analysis. Indeed economic evaluation in the field of health has enjoyed an increasingly high profile over the last decade. In the UK government white papers highlight the need for cost effective health interventions. Initiatives such as NICE provide not only a platform for cost effectiveness analysis but also tangible evidence of the acknowledged need for health interventions to be cost effective given the finite resources available to the health sector.

## Theoretical Base

The basis of CBA is the idea that social welfare exists and can be maximised by moving additional productive resources to aspects of production where there is greater social benefit at the margin. Pareto specified a condition of optimal or efficient allocation of resources. A Pareto improvement is a reallocation that makes at least one person better off and no one worse off. Pareto optimality is a distribution of resources such that no one individual can be made better off without making another worse off (Schotter, 1997).

The Pareto criterion is often considered the core of welfare economics where welfare is a function of individual's utilities (utilities may be seen as a measure of preferences). Pareto efficiency is relatively rare and as such the criterion for a potential Pareto improvement is used. There is a potential Pareto improvement if the amount by which the beneficiaries gain is greater than the amount that the losers lose. Social efficiency occurs when the value of output is maximised.

CBA thus takes a societal perspective and the CBA decision rule rests on the principle that health interventions should be provided only if the benefits of provision exceed the costs. This is equivalent to choosing the interventions that maximise net benefits in monetary terms. By choosing these interventions they may be financed in a way that everyone in society will be better off. Those who gain from the interventions can pay an amount less than the gross benefit to them and those who lose can be paid a sum to compensate their loss. If the intervention's costs exceed their benefits there is no way to finance the intervention without making someone worse off. However, welfare economics says there is no need for this compensation to be paid; *on average* every person can expect to be better off.

This decision rule assumes that it is possible to separate one intervention from another and there is the possibility of choice between them. It assumes it is possible to estimate the outcomes of each intervention, to value these outcomes and estimate the cost of providing each intervention. Given these assumptions it then assumes that these costs

and benefits can be weighed against each other. Thus if costs exceed benefits then society should stop providing the intervention.

The social decision making approach used in CEA is based on the premise that the aim of economic evaluation is to maximise whatever the decision-maker wants to maximise (Sugden and Williams, 1978). As such only those costs and benefits that the decision-maker finds relevant need be included in the analysis. The decision-maker may be society, the public sector, the NHS, the patient, their carer or family. Thus the results of CEA depend on the perspective of the decision-maker. In the health care field, this has often led to only health care costs being included in CEA, with the argument that the health care budget should be used to maximise health (Johannesson, 1996).

CEA is based on the maximisation of health effects for a given budget. A fixed budget can be used to maximise the health effects using information about the incremental cost effectiveness ratios of different health care programmes or interventions. Alternatively a price per effectiveness unit can be set and used as the decision rule. In practice a single budget used to maximise the health effects must be identified to follow the budget maximisation approach (assuming the decision-maker wants to maximise the health effects using the health care budget). However only costs that fall on this budget will be included. This can lead to suboptimisation as costs outside the budget are ignored.

### **Use of CEA or CBA**

Given the different theoretical bases of CEA and CBA, when carrying out an economic evaluation of a health intervention when should each be used? On a basic level the answer lies in the study question or hypothesis. If the question addresses, for example, a comparison of interventions in terms of the greatest number of lives saved for a given health service budget then CEA may be thought of as the most appropriate form of analysis. Similarly, if the question addresses a comparison of interventions in terms of the costs and consequences to society then CBA may be thought of as the appropriate form of analysis as CBA typically takes a societal viewpoint. The methodological texts agree that CEA, where possible, should take a societal perspective in order to incorporate all costs and health effects regardless of who incurs the costs and who

obtains the effects (Gold et al, 1996). However analyses typically take a more narrow perspective.

In addition to the study question the nature of the outcomes or consequences of the intervention also influence the form of evaluation. CEA gives costs a monetary value and a quantitative measure of health effectiveness is defined. The analysis results may be presented as the cost per effect. Thus, CEA may be used when the effect of the intervention can be expressed in a single dimension. For example, the effectiveness of an education programme designed to decrease levels of obesity may be measured using weight lost; similarly the effectiveness of a whooping cough vaccination programme may be measured as cases of whooping cough avoided. This method of quantifying outcomes means that the analysis is limited to comparison against interventions that may be quantified using the same outcome measure. Results should be presented in the form of cost per effect or effect per cost.

When there are multiple outcomes or the effect of the intervention cannot be expressed in a single dimension CCA may be used. CCA is a form of CEA by which costs and consequences of the alternative interventions under comparison are computed separately and listed. No attempt is made to aggregate the results or indicate the relative importance of the components. The decision-maker or users of the study make any value judgement trade-offs necessary. However, concern has been expressed over whether these decision-makers are the right source of values across outcomes and whether they can cope with the cognitive burden of making all the necessary value judgements and trade-offs (Miller, 1956).

CUA overcomes the limited comparative nature across different CEA studies by providing a generic measure for comparison of costs and benefits across different interventions with different outcomes (Drummond et al, 1999). CUA is a specialised form of CEA in which the consequences are expressed as utilities where a utility may be seen as a measure of preference for a specific health outcome (Donaldson et al, 2002). Thus, consequences are measured in terms of the intervention's impact on both length and quality of life and the analysis can be used when evaluating interventions where the health related quality of life is the important outcome or an important outcome; where the intervention affects mortality and morbidity and where there is a wide range of

different outcomes. Conversely CUA should not be used when there is only intermediate outcome data available because the calculations relate to increased or decreased life expectancy due to the intervention and the quality of life during this time (Drummond et al, 1999).

If interventions have the same outcome or the outcomes are equally effective in all respects CMA may be used. Given equivalent consequences to alternative interventions CMA merely values the costs of each intervention in monetary terms and to find the least cost alternative.

Whilst CBA is often used in transport and environmental economics it is less prevalent within health and health economics. Within CBA all costs and consequences are given a monetary value. If the monetary value of an intervention's benefits is greater than the costs there is a net social benefit of the programme; the programme may be seen as worthwhile (although this type of judgement should be seen in the context of the decision making process). Thus, CBA facilitates direct comparisons between incremental costs and incremental consequences. It compares the discounted future streams of incremental benefits with incremental costs (Drummond et al, 1999) and results are presented as the ratio of benefits to costs.

Unlike CEA, CBA can be used to evaluate whether an intervention is worth undertaking. Often health interventions are considered individually and as such analysts are not making comparisons but only asking whether the intervention is worth doing. In situations of non-dominance CEA tells us the price of achieving particular goal but not whether the goal is worth achieving given the opportunity cost of the resources consumed.

### **Key Elements**

The purpose of this chapter is to determine the key elements of economic analysis that together constitute an *ideal* economic evaluation be it CBA or CEA. Whilst there is general agreement in the guidelines for the conduct of CEA and CBA there is disagreement over some aspects of methodology and inherent problems in a number of areas such as valuing human life and well being (Kernick, 1998). This thesis does not

attempt to enter into the debate regarding differences in methodological ideologies. However, in order to provide a flavour of the methodological disparities a number of the issues raised are presented alongside the key elements of CBA and CEA in this field.

### **Key Elements: CEA**

CEA employs evidence of the effectiveness and an analysis of costs resulting from the interventions under comparison. There is a broad consensus within the literature of how these analyses should be carried out and the key elements of a high quality economic evaluation.

#### *Effectiveness: identification*

In order to reflect the effectiveness of a health intervention in an economic evaluation any outcomes resulting from the intervention must first be identified. The next step is to determine how those outcomes are to be measured. The effectiveness measure used should relate to either the final output, for example life years gained, or to an intermediate output such as the number of patients treated. The measure should be easy to understand and relate to the disease/disorder in question (Kobelt, 2002).

If the CEA uses an intermediate endpoint the analysis should show that the intermediate end-point has relevance in its own right or that there is a link between the intermediate outcome and final outcome that has been established by previous research (Drummond et al, 1999). The intermediate outcome should accurately reflect the long-term benefits of the intervention. A classic example of differences between intermediate outcomes and those over a longer period is that of Thalidomide, a drug designed to reduce morning sickness in early pregnancy but subsequently found to be responsible for severe birth defects from 1956-1961 (American Academy of Paediatricians, <http://www.aap.org/visit/thalmain.htm>, accessed 21 January 2003).

Effectiveness data may be sourced from a number of areas. There may be existing studies that provide evidence of the effectiveness of an intervention compared against some alternative. If using existing evidence the analyst should consider factors such as whether the evidence is robust, if evidence relates to the same patient group or whether

other factors such as the method of service delivery will influence the effectiveness. In general economists support the quality criteria laid down by clinical epidemiologists for clinicians seeking evidence to support clinical recommendations (Drummond et al, 1999).

In the absence of good clinical evidence the evaluation may make a number of assumptions about the clinical evidence. Sensitivity analysis can then be used to allow for uncertainty by testing whether plausible changes in values affect the results of the analysis (Kielhorn and Graf von der Schulenberg, 2000).

### *Effectiveness: measurement*

Comparisons between CEAs are limited by the choice of effectiveness measure. When there is a clear trade-off between different important outcomes the analyst should use cost utility analysis or cost benefit analysis. Drummond et al (1999) suggest 'rules of thumb' that may be used when making a decision regarding which form of analysis to use that is echoed in evaluation literature. The first is to clarify the objectives of the intervention. If there is one clear, major dimension for the measurement of success of the treatment then CEA may be based on this. For example, this may be the number of lives saved or a specified reduction in blood pressure.

Alternatively the major dimension may be more general in nature, for example an improvement in mobility or reduction in stress. In order to quantify improvements a measurement tool may be employed. Any measure used should be recognised as clinically relevant and validated for use in the disease area or with a similar patient population. However, the evaluation should look out for other attributes of the alternatives assessed and record the effectiveness of alternatives judged on these extra dimensions and should consider the possibility of using more sophisticated forms of analysis.

Multiple outcomes may be reflected using a HRQL or QoL scale to assess health consequences of interventions in terms of their impact on quality of life. Scales may be specific measures, general health profiles and preference-based measures (Drummond et al, 1999).

Specific measures are designed to reflect health outcomes specific to an individual disease, medical condition or patient population concentrating on the dimensions of quality of life most relevant to the specified disease. Examples of this type of measure include the Arthritis Impact Measurement Scales (Meenan et al, 1980) and the Functional Living Index – Cancer (Schipper et al, 1984).

General health profiles are designed as measures of HRQL that typically include patients' physical functioning, ability for self care, psychological status, level of pain or distress and the amount of social integration. Examples of a general health profile include the Functional Assessment Inventory (Crewe and Athelstan, 1981) and the Quality of Life Index (Spitzer et al, 1981). In principle these can be applied across different patient populations in different disease areas.

### *Effectiveness: CUA*

CUA expresses the consequences of an intervention in utilities. In the context of health related quality of life measurement utility refers to the preference of the rater for a particular health outcome or health state (Gold et al, 1996). Preferences are elicited from individuals by asking about a certain outcome or an uncertain outcome; respondents may be asked to perform a scaling task based on introspection or be asked to make a choice (Drummond et al, 1999).

How preferences are measured will depend on the format of the question and on the nature of the outcome (certain or uncertain). The respondent may be asked to rate a certain outcome on some form of scale; this could be a rating scale, a category scale, a visual analogue scale or a ratio scale. Alternatively a time trade-off approach may be used. If the respondent is asked to make a choice that involves an uncertain outcome the standard gamble approach may be used. All these methods measure preferences but the first two formats measure values and only the latter measures utilities. Differences in preference scores may be attributed to differences in risk attitude, which is only incorporated into questions that include uncertain outcomes.

The methods to elicit preferences are time consuming and there exist a number of preference base measures that have collected and weighted preferences and may be used in effectiveness and cost effectiveness studies. Examples of HRQL preference based measures include the EuroQol EQ-5D (the EuroQol Group, 1990) or the Quality of Well-being Scale (Kaplan and Bush, 1982).

Guyatt et al (1993) provide discussion of the measurement of health-related quality of life and the choice of the appropriate HRQL measure. They suggest that the approaches are not mutually exclusive and the choice of measure will depend on the purpose of the study.

Again, any measure used should be recognised as clinically relevant in the disease area concerned and validated for use in the disease area or with a similar patient population. There should be a widely agreed interpretation of what would constitute a quantitatively important change in the dimension of HRQL measured.

### *Effectiveness: QALYs*

It may be possible to convert the information from the scales into quality adjusted life years (QALYs). A QALY is a measure of health outcome which assigns to each period of time a weight ranging from 0 to 1, corresponding to the health related quality of life during that period. A weight of 1 corresponds to optimal health, and a weight of 0 corresponds to a health state judged equivalent to death; these are then aggregated across time periods (Gold et al, 1996, p405).

QALYs are design to reflect changes in mortality and morbidity. The combination of these changes is based on the relative desirability of different outcomes. QALYs are calculated by multiplying the value of the preference of being in a certain state by the length of time in that state. The analysis uses weights derived from measurement of preferences (using one of the methods previously discussed). The weights represent the health-related quality of life of the health states under consideration.

There exists some debate over the use of QALYs. They have been criticised for both being too complex (Cox et al 1992) and for being over simplistic (Mehrez and Gafni,

1989). A range of research results have shown that the assumption that there is a constant relationship between remaining years of life and improvement in quality of life is not always empirically tenable (Keilhorn and Graf von der Schulenberg, 2000). Williams (1997) highlights the premise inherent in QALYs that older people are disadvantaged in as much as in general their life expectancy is shorter than those of younger people. Thus for similar improvements in health the QALYs gained will be higher for the latter group. This introduces a judgmental element to the use of QALYs (although Williams argues the case *for* rationing health care by age).

The assumption of constancy or stability over time raise questions over the reliability of QALYs and the different methods used to elicit the preferences upon which QALYs are based raise questions of their validity. Do QALYs measure utilities or, as suggested previously do only preferences elicited using the standard gamble, by incorporating uncertainty?

There also exists some controversy over whose valuations should be included when eliciting preferences. Should the values be representative of society or are current sufferers the best proxy for future sufferers? Do preference values differ between countries or over time periods? Studies have found few differences in preference values between locations (Patrick, 1985) or over time (Kaplan et al, 1991).

A number of alternatives to QALYs exist. The World Health Organisation (WHO) uses DALYs (disability adjusted life years). DALYs are a time-based indicator of health outcome that are composite measures of overall burden of disease due to loss from premature death and non-fatal disability ([www.who.int](http://www.who.int), accessed 21 January 2003). DALYs are used by WHO as a tool for priority setting and have two key functions: the positive exercise of measuring the burden of disease and the normative exercise of resource allocation.

*Costs: identification*

In order for an economic evaluation to be sound, all important and relevant costs and consequences need to be identified (Drummond et al 1999). Three stages can be usefully distinguished in the analysis of costs: identification, measurement and valuation (Raftery, 2000). Even though it may not be possible or necessary to measure and value all of the costs and consequences of the alternatives under comparison, a full identification of all important and relevant costs should be provided.

Costs arising from, or as a consequence of, the health care intervention will fall to the health care provider, but may also fall to patients and their families and to other sectors within the economy. The cost to the healthcare provider may include the time of health care professionals, drugs and administration costs. The costs to the patient and family may include out of pocket expenses such as the cost of transport. Other sectors, for example, social services, may be involved in patient care and these costs too should be identified in order to make any economic evaluation meaningful.

If limited resources are to be used as effectively as possible there is a need to incorporate time costs into the analysis. Time costs relate to treatments or programmes that involve the time of patients, their families and informal carers. Time costs may also include costs relating to lost or impaired ability to work or enjoy leisure activities and costs relating to lost economic productivity may be included in the analysis. However, care should be taken that they are not double counted as a consequence and as a cost.

*Costs: inclusion and exclusion criteria*

The costs that are to be included in a study will depend in part on the viewpoint or perspective of the evaluation. For example, if the evaluation is from the viewpoint of the NHS the cost of out of pocket expenditure to the patient and his family need not be included, nor the cost to other sectors such as social services. Before any economic evaluation begins the perspective of the study should be determined (Byford and Raftery, 1998).

Once the perspective of the evaluation is determined the inclusion and exclusion criteria within the bounds of that perspective should be laid out. Costs may be excluded from an evaluation because they are common to both treatments or relatively small in magnitude. These costs should be identified and their exclusion justified. Similarly, if inclusion of particular costs will only confirm the results obtained without them then they may be omitted. Once again reference should be made to them in the study including justification of their exclusion.

Once resources used in patient care have been identified a decision should be taken of how accurate the costing needs to be. For example, does each individual component of the resource cost need to be estimated or can the average cost of the resource be used?

### *Costs: measurement and valuation*

There are two elements in the estimation of costs: the measurement of quantities of resources used and the assignment of unit prices to those resources. Two strategies, representing the ends of the spectrum, can be usefully distinguished in measuring and valuation: micro-costing and gross-costing (Raftery, 2000).

Micro-costing is a 'bottom up' method of costing that begins with a detailed identification and measurement of all the inputs consumed in a health care intervention; once the resources have been identified and quantified they are then converted into value terms to produce a cost estimate (Gold et al, 1996). This method provides a detailed inventory of all separate cost items involved but tends to be costly and runs the risk of being specific to particular contexts (Raftery, 2000). Whilst being more laborious than the gross-costing method, micro-costing provides a more specific insight into the relationships between characteristics of activities and their costs, the economies of scales of a production process, and the relative importance of separate activities (Drummond and McGuire, 2001).

Gross or top down costing allocates a total budget to specific services such as hospital stays or doctors visits (Raftery, 2000). Whilst this method provides less precise estimates (Drummond et al, 1999) it has the advantages of consuming less resources and providing better opportunity for generalisation (Drummond and McGuire, 2001).

Data on quantities can be obtained from a number of sources including case report forms, case notes and hospital records or by asking patients. Although for many items market prices are available theoretically the opportunity cost of the item under consideration should be used. The opportunity cost may be defined as:

*'The value of time or any other input in its highest value use. The benefits lost because the next best alternative was not selected'* (Gold et al, 1996, p403).

Use of the opportunity cost does, however, assume that the resources can and will be switched between alternative interventions. If the market price is used and is adjusted for any reason the study must show that there is a bias introduced by leaving them unadjusted and there should be a clear and objective way of making the adjustment (Cohen et al, 1993). The viewpoint is also important when considering an adjustment. If the study is undertaken from the view of the paying patient then actual charges may be more important than costs. Details of the date of measurement of quantity and the price date should be given in the evaluation

If there is no data or imprecise data then the analyst may be required to make an estimate or informed guess. The basis for any estimates should be clearly outlined in the evaluation.

Time costs may be priced in a number of ways, for example, at the average market wage rate. Leisure time can be valued using a number of different methods that range from the average overtime wage rate to zero. It is important to note that if time costs are measured by their opportunity costs then the time of people with different opportunity costs will be valued differently. If an individual's wage rate reflects his opportunity cost then the time of people in lower paid occupations would be valued less than those in higher paid occupations. Any evaluation should make clear how time has been valued.

The choice of time period over which costs are tracked should avoid misleading the decision-maker (Drummond et al, 1999). For example, when comparing two interventions that have a common initial outcome but one intervention requires patients

to have further treatment in the future, then the time period that the analyst chooses should reflect the costs of this further treatment.

The question of unrelated future costs is a controversial area in the health economics field. For example, if an intervention saves a life should all future health care costs for that person be thought of as costs resulting from the intervention? There is no agreement of whether they should be included in analysis (see Weinstein & Stason, 1977) or not (see Russell, 1986). If evaluations of preventative programmes assign credit for life extension then it can be argued that the costs should also be assigned. Drummond et al (1999) suggest that this decision may be guided by the extent to which the provision of additional care in added years of life is considered to be a necessary consequence of the intervention and by the availability of data.

Gold et al (1996) attempt to clarify the issue. They define three categories of induced costs;

- Costs related to the intervention that are incurred during years of life that would have been lived without the intervention
- Costs unrelated to the intervention that are incurred during years of life that would have been lived without the intervention
- Costs that occur in the years of life added by the intervention

There is no agreement over which of these costs should be included. But they may be excluded if they are small in magnitude relative to other costs in the analysis and do not make a significant difference to the evaluation results (Drummond et al, 1999).

#### *Costs: capital costs*

Capital costs may be included in the economic evaluation in a number of ways. Capital costs represent investments at a single point in time (Drummond et al, 1999). The cost is the opportunity cost of the monies tied up in the asset and the depreciation of the asset over time. Drummond et al (1999, p60) suggest three methods by which capital costs may be measured:

- By annuitizing the initial capital outlay over the useful life of the asset to calculate the equivalent annual cost
- Using accounting methods to determine the depreciation cost each year. The opportunity cost is then calculated on the un-depreciated balance each year by applying an interest rate
- If market rates exist for rental of the asset these may be used instead to estimate capital costs

Overhead costs should be apportioned using marginal analysis to calculate which of these resource costs would change if an intervention were added or taken away from the overall activity (Drummond et al, 1999). Only the costs that change with the introduction or change in volume of an intervention are included. Marginal analysis is particularly important because the analyst is rarely interested in whole scale changes; costs should reflect costs on the margin (Netten et al, 1999).

When comparing interventions the consequences of increasing or reducing the output of the intervention, the marginal cost, should be considered. For example, at a given level of output the marginal cost of increasing output may be high even though the average cost of the intervention may be less than that of its alternative. This highlights the difference between average and marginal cost; for comparisons of interventions to be meaningful this needs to be considered.

#### *Costs: productivity changes*

The evaluation may consider inclusion of productivity changes. Whether these are relevant depends on the perspective of the study. A number of considerations should be undertaken when deciding whether to include them. Economic evaluations in health care should, where feasible, consider the societal viewpoint although analytical difficulties may preclude the full measurement and valuation of all costs and consequences in monetary terms.

If productivity changes are to be included in the study these will require measurement. Typically estimates use gross earnings of those in employment whilst some studies include an equivalent value for those not in paid employment such as housewives.

Estimates may be undertaken by the use of average wages, the cost of replacement or the opportunity cost of production. There has been some discussion over the estimation of these estimates (see Olsen, 1994 and Posnett and Jan, 1996). For example, it has been argued that many of these estimates are overvalued. In the short-term work colleagues often compensate for loss of production and in the long-term workers are replaced. Productivity loss at the margin is likely to be lower than the average wage.

To counteract this it is possible to use a friction cost model. This approach is based on the empirical observation that real productivity losses to a company are likely to accrue only in the period required to adjust to the new situation created by the sickness episode. After this period the worker returns or someone else is hired. There is an implicit requirement to have up to date data relating to the local labour market to estimate ease of replacement and therefore the length of the friction period. This type of data is often difficult to obtain. Care should be taken not to double count especially in relation to productivity gains (although this is more likely to be a problem in cost utility analysis and cost benefit analysis).

Drummond et al (1999) suggest that productivity changes are reported separately allowing the decision-maker to decide whether or not they be included. Quantities should be reported separately from the prices used to value them to ensure clarity. The analysis should also make clear whether the wage rate chosen reflects the value of productivity lost at the margin (and thus whether the friction approach would be more valid). Attention should be paid to equity implications arising from the inclusion of productivity changes; in cases where they are important sensitivity analysis could be used to explore the impact of more equitable estimates.

#### *Costs: discounting*

When health care spending is spread over a number of years costs should be discounted. Discounting is the process of converting a future sum of money to its present value. The choice of the discount rate may be dictated by a government-announced rate for all public sector projects. However in its absence the convention is to use a rate consistent with existing literature, which allows comparisons to be made between different studies.

If costs are discounted then consideration should be given to discounting consequences although generally this is not a consideration in cost effectiveness analysis because this type of evaluation is typically short-term.

Whether undertaking a CBA or CEA, a cost analysis must be performed. The costs that are included in the study will depend on the viewpoint that the study was undertaken from. The viewpoint may depend on the commissioners of the study. Any costs excluded from the analysis should have their exclusion justified within the study. A good study should detail quantities and prices separately and give costs in their discounted and undiscounted form where applicable.

### *Sensitivity analysis*

When carrying out an economic evaluation, components of the costs or consequences may be uncertain necessitating the use of estimates. Sensitivity analysis should be used to determine how sensitive the study results are to these estimates. Sensitivity analysis involves:

*'Mathematical calculations that isolate factors involved in a decision analysis or economic analysis to indicate the degree of influence each factor has on the outcome of the entire analysis. Specifically measures the uncertainty of the probability distributions'* (Gold et al, 1996, p407)

The economic evaluation must identify all the variables that have potential for sensitivity analysis. Once these have been identified a plausible range for the variables should be determined by reviewing existing literature, consulting expert opinion or stochastic data, by using a specified confidence interval around the mean. The sensitivity analysis may then be undertaken by varying each parameter within the identified range to observe the impact on the study results. Briggs and Gray (1999) outline a number of methods by which the sensitivity analysis may be carried out, the most common of which are one-way analysis or multi-way analysis.

### *Incremental cost effectiveness*

Incremental cost is the cost of one alternative less the cost of another. Thus incremental cost effectiveness is the difference in costs between alternatives to the difference in effectiveness between the same alternatives. Or stated another way, the additional costs that one service or programme imposes over another, compared with the additional effects, benefits or utilities it delivers. One programme can be said to dominate another if its effectiveness were higher and its costs were lower. By using incremental cost effectiveness ratios it is possible to determine, for example, how a budget could be spent between two or more programmes.

### **Key Elements: CBA**

CBA should be undertaken by systematically calculating all the costs and consequences accruing to society and expressing their values in monetary terms. This allows comparison of competing and different interventions from the same or different sectors of the economy and allows decisions to be taken on the basis of different returns from investing.

Whilst costs should be calculated using the same methods outlined for CEA the monetary value of the benefits resulting from provision of the intervention should be calculated by valuing preferences.

### *Benefits: valuation of preferences*

The methods used place a numerical value on preferences used for CUA differs to those for CBA. The aim of this monetary valuation is to assess the value of the intervention(s) to society. This value is not necessarily reflected in the market price of each resource due to imperfections in the market or because a resource is not traded. Some societal items require valuation through CBA because if an individual viewpoint is adopted the externalities that accrue to society as a whole will not be considered. For example, a breast cancer-screening unit will have no direct benefit to men but men may put a value on the provision of such a unit in their community.

*Human capital approach*

There are three main methods by which preferences may be valued in CBA: the human capital approach, the revealed preference approach and the contingent valuation approach.

The human capital approach involves valuation based on an individual's worth to society calculated on the basis of the value of their present earnings. Each person represents a productive resource to society. Illness reduces their productive capacity and this loss can be measured through loss of earnings. Thus utilisation of a health care programme is viewed as an investment in a person's human capital and this method puts monetary weights on healthy time using market wages. The value of the programme is assessed in terms of the present value of future earnings.

This method enables CBA to value all aspects of health improvements and also provides a method of valuing part of the benefits by using earnings data as a way of valuing productivity changes. However, the approach has been criticised for a number of reasons. It can be argued that a person's worth cannot be equated merely to his or her productive capacity in paid employment. The approach implies that children, older people and the low paid represent a low or even negative value to society. There is also a tendency to overestimate the value of productivity losses by valuing them with average earnings. For example, a couple of days illness is unlikely to effect productivity, as in the short term other employees will cover the absence. There is also the additional problem of double counting vis-à-vis counting loss of productivity and loss of life twice. These problems can be solved in part by using the friction cost model outlined earlier.

Further measurement difficulties are apparent when using the human capital approach. Theoretically wage rates reflect the marginal productivity of the worker. However imperfections in labour markets and wage rates may reflect inequities such as discrimination. In addition, if the viewpoint of the study is societal, consideration of the value of healthy time gained but not sold for a wage should be undertaken (Drummond et al, 1999). These measurement difficulties can be solved using shadow prices. Shadow prices can be thought of as the social opportunity costs of the resources used (Dreze and

Stern, 1994) and thus can be attached on non-marketed resources by calculating the opportunity cost of the time. The value would be calculated at the wage rate forgone. Alternatively the shadow price may be calculated at the replacement cost. This is equal to the value at cost to replace non-waged labour with services from the market.

It may be argued that the human capital approach is not consistent with the theoretical foundation of CBA from welfare economics because it offers a narrow view of the consequences of a programme restricted to impacts on labour productivity (Mishan, 1976). One of the basic concepts of welfare economics is the idea that when consumers benefit from a programme there is some measure of what they are willing to sacrifice in order to have that programme (Drummond et al, 1999). The benefits may be seen as the sum of all persons whose welfare is affected by the programme willingness to pay (WTP) for that programme (Pauly, 1996). It is this collective WTP that is the focus of CBA and WTP may be measured using a revealed preference approach or a contingent valuation approach.

#### *Revealed preference approach*

The revealed preference method considers wage-risk: pay enhancements for jobs that are risky in nature. They look at preferences regarding the value of an increased or reduced health risk as a trade-off against increased or reduced income. For example, wage enhancements (or alternatively injury compensation payments) can be said to represent the cost that individuals attach to the increased risk of a particular job. This is consistent with the welfare economics framework. By comparing these types of implicit valuations it is possible to derive risk valuations to be used in the valuation of consequences.

The advantage of using revealed preferences is that it is based on actual consumer choices not on hypothetical situations. However estimated values have varied widely and estimation seems to be very context and job specific (Drummond et al, 1999). In addition the approach assumes that individuals are fully informed about the probable risks and it does not take into account factors such as attitude to risk that vary between individuals (Kielhorn and Graf von der Schulenburg, 2000).

### *Contingent valuation approach*

Contingent valuations use explicit or direct methods to elicit individual preferences. These valuations can be measured as a WTP or willingness to accept (WTA). The classic WTP approach relies on questioning an individual's WTP to diminish the probability of a health state coming in to being.

Studies use survey methods to present hypothetical situations about the programme or problem under evaluation. Respondents are asked to think about the contingency of an actual market existing for a programme or problem under evaluation and to reveal the maximum monetary amount they would be willing to pay for a programme or benefit. This amount reflects not only their WTP for this programme but also the amount they would sacrifice in terms of other commodities for health programme benefits.

Health care programme benefits include not only improvements in health status but also the value of information and the value associated with the process of care. The aggregation of consumer surplus forms the basis of cost benefit calculus. CBA studies based on contingent valuation and statements of WTP have been described as attempts to replace missing markets, albeit hypothetically, in an attempt to measure underlying consumer demand and valuation for non-market social goods such as health care programmes (Drummond et al, 1999).

Contingent valuation studies can use the utility concept of compensating variation and ask questions of WTP when a programme is being introduced. Alternatively it may use the equivalent variation and ask questions about 'willingness to accept' if a programme is being removed.

Typically the perspective or viewpoint of the CBA study will dictate the benefits or consequences of the health care programme that are included in WTP measure. WTP can be classified as a global WTP or a restricted WTP (Drummond et al, 1999). Under the restricted measure only those benefits for which no money values exist from other market sources are included. These include the intangible benefits such as the value of improved health to individuals. Changes in productivity and cost savings are valued

using market prices. A global WTP includes these intangible benefits, health care costs avoided and increased productive output due to improved health status.

When undertaking contingent valuation, measurement of WTP should be unbiased and precise. Question formats may be opened or closed. Open questions may be cognitively difficult for the respondent. For example, an open question may ask the respondent what is the maximum he is willing to pay to achieve a cure for a specified illness? Respondents may not be used to thinking in terms of WTP and although the open question may bring in unbiased estimates it is very imprecise attracting widely varying responses, non-responses or protest responses.

Once the WTP valuation is obtained it needs to be validated. This can be undertaken by determining whether data is consistent with theoretical constructs that should be present if WTP responses are measuring the value intended (Drummond et al, 1999). For example, most goods have positive income elasticity therefore increased income should lead to an increased WTP.

WTP can be seen as a measure of the decisions regarding spending that imply expressions of time preference. Health care programmes evaluated by CBA typically extend several years into an uncertain future and have immediate sizeable effects on resources but have long term effects on health. Values are translated into a single current measure representing present values by discounting their future costs and consequences in time.

### **CEA or CBA?**

The methodological texts generally agree upon the key elements of an economic evaluation and the methods by which CEA or CBA should be carried out. However, there still exists disagreement in a number of methodological and ideological areas. The following section provides a précis of the perceived strengths and weaknesses of CBA and CEA.

CEA, in its different guises, is the most prevalent type of evaluation within the health care field; at the present time less than 5%<sup>1</sup> of the economic evaluations reviewed by the NHS Economic Evaluation Database (EED) are CBA. Of these, very few are true CBA but rather cost comparisons that consider the costs of the intervention or programme and the consequences in terms of cost savings.

The monetary valuation requirement for CBA can be seen as one of its greatest advantages; it allows comparisons between interventions with different outcomes and comparisons across sectors of the economy of health and non-health programmes. For example, theoretically it should be possible to make direct comparisons between publicly funded projects such as building a new hospital or new motorway. However, once again measurement difficulties often preclude its use in this type of situations (Drummond and Stoddart, 1995). CBA is the dominant form of analysis in other sectors and, by using CEA, opportunities to make comparisons across sectors are lost.

CBA has a closer connection with welfare economics than CEA and can consider allocative efficiency as well as production efficiency and by using WTP is able to capture externalities. However, CBA has difficult measurement issues such as assignment of monetary values to lost life, illness and leisure activities. CBA's monetary valuation of benefits has led to the broader acceptance of CEA within the health care field although it is often considered superior in areas such as generalisability to CEA. Thus the monetary valuation of benefits can also be seen to be a disadvantage.

The measurement of preferences or utilities in CUA and CBA can be a long, time-consuming and costly process. The emergence and use of multi-attribute health status classification systems such as the Health Utilities Index and EuroQol EQ-5D in CUA have meant that this process is much simplified. Standardised use of such classification systems allows greater comparison between the results of CUA. In order, however, for comparison across CUA studies to be transparent a number of issues must be resolved. These include a standardised perspective of analysis, a standardised procedure of placing components on the numerator or denominator of the cost-effectiveness ratio and inclusion of all benefits and harmful effects of alternative interventions.

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<sup>1</sup> As at 9 August 2000, 8146 studies, of these 35 were classified as CBA

CBA is often criticised because WTP is seen as a function of income and thus WTP valuations are positively correlated to income (or wealth). Thus this approach intrinsically favours programmes and interventions of the rich over those that affect the poor. A way to overcome this problem is to weight benefits differently depending on the level of income of the recipient (Stiglitz, 1988). However this can produce its own ethical dilemma. By weighting, a monetary unit of benefit to poor people is worth more to society than the same unit to rich people. Using this argument it follows that society should be redistributing more income from rich to poor. If they are not predisposed to do this then there is no justification in saying the same society would value health benefits of a given money value more if they go to poor people than to rich people (Pauly, 1996).

A further criticism of CBA is the monetary valuation of health outcomes. In particular, physicians question the ethics of placing a monetary valuation on life. The health sector has traditionally favoured economic analyses that assess cost per health effect. CEA/CUA include ethical issues such as valuing time and address fairness in allocating resources but avoid placing a value on the health effect. However, it can be argued that decisions made using CEA/CUA ultimately require placing a valuation on a health outcome. When considering incremental cost effectiveness ratios the decision-maker decides the ratio level (cost per effect) at which to go ahead with interventions or programmes and in this respect they are placing a value on the health effect.

CBA, unlike CEA/CUA, may be used to evaluate a stand-alone programme or intervention without the need for a comparator or even do nothing alternative by calculating its net social benefit. CEA/CUA can be seen as more appropriate when the decision-maker wants to value outcomes relative to each other. The CEA/CUA approach is used when the main challenge to decision-makers is to find programmes that lower costs without reducing benefits. In these cases there is no need to measure the benefits in monetary terms. In addition economic evaluations are frequently undertaken from the perspective of the budget holder and as such only the budget holder's costs are included in the analysis. Under these circumstances CEA/CUA is most the appropriate type of analysis.

CBA endorses all projects that can in principle make everyone better off. There are no problems in discounting because the benefits are measured in monetary terms. When using CUA there has been some discussion of whether discounting QALYs is appropriate. If costs are discounted but consequences are not, this can lead to inconsistencies in reasoning and invalidate results. However it may be difficult to conceive that individuals invest in health or trade flows of healthy years through time. In addition discounting years of life gained in the future gives less weight to future generations in favour of the present one. Empirical evidence suggests that individuals discount health at a different rate from monetary benefits. At the present time there is no answer to this debate although Gold et al (1996) recommend that costs and benefits should be discounted and at the same rate.

The purpose of economic evaluation, be it CBA or CEA/CUA, is to inform decision-makers. The evaluation should act as an aid to decision-making rather than replace the decision-making process itself because of the limitations of economic evaluation techniques. The evaluations do not usually incorporate the importance of the distribution of costs and consequences among different patient or population groups.

There are different types of equity criteria. For example, CBA values outcomes using WTP, which may be constrained by ability to pay. Thus, valuations depend on existing income distributions. Similarly the CUA valuation of QALYs, without weighting, implies that the value of a QALY is the same no matter to whom it accrues.

A further limitation to economic evaluation is the implicit assumption that resources saved or freed will be used in alternative worthwhile programmes. If the resources are used in other programmes or interventions which are not cost-effective or have not been evaluated health costs may increase without any increase in benefit to the health of the population. CBA and CEA/CUA are not mutually exclusive. They can be seen as complementary. Use of one does not preclude the use of any of the others in a given study (Gold et al 1996).

## Conclusion

Chapter Three has provided an introduction to economic evaluation in the field of health care. Focus has lain upon the theoretical bases of CEA and CBA, when each should be used, how they should be carried out and the strengths and weakness of each form of evaluation in order to identify the elements that together make up the ideal economic evaluation.

Economic evaluations are often cited as evidence of the value (of lack of value) of an intervention or programme. However, the degree to which they influence decision-making is dependent upon the quality of the study. While no definitive worldwide guidelines or standards exist the key elements of an evaluation laid out in methodological texts are summarised in Box 3.

Although there are no definitive guidelines there are a number of tools that may be used to assess the quality of economic evaluations. Chapter Four explores a number of these tools, in conjunction with the key elements of economic evaluation laid out by the methodological texts and the model of rehabilitation presented in Chapter Two, to develop a framework by which economic evaluations of rehabilitation interventions may be compared. This framework is used in Chapter Five to explore the relationship between *actual* evaluations and the *ideal* evaluation; to determine if the complexities of rehabilitation interventions are reflected in economic evaluation; and to examine if those evaluations conform to the standards set down within economic literature.

**Box 3: Key Elements of an Economic Evaluation**

- Form of evaluation, CEA or CBA should be in line with study question, perspective or viewpoint of the study and nature of the outcomes resulting from the intervention (all of which should be clear)
- The perspective or viewpoint of the study should, where possible, be societal in order to take account of all costs and consequences
- The study should present evidence of the effectiveness of the interventions under comparison and all outcomes should be identified
- The measurement of effectiveness should reflect the outcomes; measures should be appropriate to the form of the study and should be clinically relevant and validated
- Any valuation methods for the benefits or outcomes should be clearly described and the measure recognised as clinically relevant
- All costs should be identified and in line with the perspective of the study and inclusion and exclusion criteria laid out
- The measurement of costs included in the study may use micro-costing (considered most accurate) or gross-costing (better opportunity for generalising) methods or a combination of both. The method should be clearly outlined
- Costs and outcomes should be tracked over an appropriate period and provide an accurate reflection
- Where costs are spread over a number of years they should be discounted and consideration should also be given to differences between average and marginal costs
- Sensitivity analysis should be used to take account of uncertainty in any estimates, be they costs or consequences

## Chapter Four

### A Framework for Economic Evaluation in Health Care

#### Introduction

As the number of economic evaluations of health care interventions has risen (Elixhauser et al, 1993; Elixhauser et al, 1998) so has the interest in the quality of those evaluations and attempts to produce a framework or guidelines to standardise evaluation and aid compatibility and comparability between studies.

A number of methodological reviews have been published over the last decade but the overall conclusions show that there is a long way to go before economic evaluations can be regarded as good enough to justify their use in decision making (Jefferson and Demicheli, 2002). This suggests that economic evaluations do not consistently adhere to the theoretical ideals or the methodological frameworks set out in standard health economics texts such as Drummond et al (1999) and Gold et al (1996).

In addition to such texts a number of frameworks or guidelines exist that have been developed in order to judge the quality of studies. These include guidelines for the submission of economic studies and frameworks by which to critically appraise evaluations. The audience to which these guidelines are aimed is diverse; from users of the published evaluations who have little knowledge of economics or economic evaluation (Stone et al, 2002; Hulme, 2001) to those actually carrying out an evaluation or study (Drummond and Jefferson, 1996).

These guidelines and frameworks provide a useful tool by which to judge whether *actual* evaluations of rehabilitation services or programmes coincide with the theoretical and methodological ideals underpinning economic evaluation outlined in the previous chapter. This chapter considers a number of these guidelines and frameworks for appraisal in order to identify those areas perceived to be of key importance in an economic evaluation and to determine if there is a consensus of opinion of the elements that together constitute a 'quality' evaluation.

## Guidelines and Frameworks

In order to reflect the diversity of the material in the public domain four guidelines/frameworks have been explored. Much of the work in the UK in producing guidelines for critical appraisal in this field has been carried out by members of the Centre for Health Economics, University of York. The four chosen represent only a small fraction of the research tools available to address quality of health care research (see, for example, the CONSORT tool to improve quality in RCTs, [www.consort.org](http://www.consort.org), accessed 21 January 2003). However, those chosen differ both in their target audiences and their raison d'être. Despite this there are similarities within the guidelines. This is to be anticipated in as much as the ideals expounded within standard texts would be expected to feature in economic evaluations; but, in addition, many of the same people have been involved in the development of these different guidelines.

*The NHS Economic Evaluation Database (EED) (<http://nhscrd.york.ac.uk/>)*

The database is produced by the NHS Centre for reviews and dissemination (CRD) and contains abstracts that summarise and critically appraise economic evaluations in a rigorous and systematic way. The intended audience for the database is health care professionals, managers, policy makers and academics. The abstracts aim to provide a structure for summarising the study; to facilitate an understanding of the methods used as well as the assessment of its quality; to allow comparisons across studies; and to highlight any features of special interest (NHS CRD Report 6, 1996). An example of a structured abstract included in the database together with a clear guide of the contents of the abstract structure is shown in the report (p10-11 and p36-60 respectively). Access to the database and the assessed study may be gained through its web site.

CRD provides guidance for writing these critical abstracts in the form of an extensive checklist. The checklist is divided into seven sub-headings:

- Subject of study
- Key elements of study
- Details about clinical evidence
- Economic analysis

- Results
- Conclusion and critical comment
- Implications of the study.

The first sub-heading *subject of the study* appears to be primarily interested in classification of certain details of the study for inclusion within the EED framework. For example, the disease of interest in the study is classified within a number of broad terms such as neoplasm, eye diseases and cardiovascular diseases. *Key elements of the study* include the study type, study population, setting, dates to which data relate, source of effectiveness data, modelling and the link between effectiveness and cost data.

*Details of clinical evidence* include the sample, study design, analysis of effectiveness, effectiveness results and clinical conclusion. The *economic analysis* considers areas such as the measurement of benefits and the methods used for the cost analysis. This includes discounting, presentation of quantities and costs and cost boundaries statistical analysis and sensitivity analysis. The final three sub-headings review the results presented, suggest areas that should be considered in assessing the quality of any evaluation and the implications of the study in terms of clinical practice, health policy or research.

The framework presented may be used for single studies, review/synthesis of previous published studies and estimates of effectiveness based on opinion. It is comprehensive and is in an easy to read format. The guidance notes for writing critical abstracts are, in part due to the comprehensive nature, lengthy (the guidance notes span 23 pages).

The sub divisions present the assessment in much the same order that economic evaluation studies tend to be written and therefore assessments using these guidelines as a template flow naturally. However the first section, 'subject of the study' appears to be primarily interested in details of the study for 'classification' within the EED framework; for example, the disease is classified into a disease field and the intervention is classified into an intervention type.

*Guidelines for Authors and Peer Reviewers of Economic Submissions to the British Medical Journal (Drummond and Jefferson, 1996)*

The guidelines were produced by a working party set up in January 1995 to improve the quality of submitted and published economic articles by agreeing acceptable methods and their systematic application before, during, and after peer review (Drummond and Jefferson, 1996). They are for use by economists and non-economists as a checklist for referees, authors and editors. The guidelines are presented under ten sub-headings and these are shown below together with the areas each sub-heading relates to.

- Study question: considers the economic importance of the research question, the hypothesis being tested and the viewpoint or perspective of the study
- Selection of alternatives: explores the rationale for choice of alternatives for comparison and the detail by which readers can assess relevance to his/her setting
- Form of evaluation: type of evaluation and justification for the form chosen
- Effectiveness data: includes selection of study sample, method of allocation and effect size
- Benefit measurement and valuation: primary outcome measures, valuation of health benefits, changes in productivity
- Costing: separation of costs and quantities, methods of estimation and currency and price date
- Modelling: details of and justification for models used
- Allowance for uncertainty: details of statistical tests and sensitivity analysis
- Presentation of results: incremental analysis, major outcomes, comparisons and answer to original study question

Unlike the EED database which only publishes abstracts of full economic evaluations the BMJ guidelines allow for economic studies which are partial economic evaluations (for example, clinical studies which report cost estimates), with the proviso that they should adhere to the relevant sections of the guidelines.

The guidelines are written in detailed prose and in addition they provide the reader with a basic introduction to economic analysis. For example, the guidelines explain which

units benefits are measured in CEA, CBA and CUA. They introduce the reader to some of the current debates in health economics (for example, whether productivity gains should be included alongside other measures of improved health) and introduce some of the basic methodological and theoretical issues.

The format in which the guidelines are written provide an informative insight into the BMJ's requirements for economic submissions and, for non-economists, introduce some basic methodological and theoretical issues. However as a template it is unwieldy and sprawling. When making a critical assessment the guidelines did not add significantly to the guidelines for EED; perhaps this is not too surprising given the authors' of these guidelines were also among those who wrote the EED guidelines.

*Critical Appraisal of Economic Evaluations. Public Health Resource Unit; Critical Appraisal Skills Programme (www.phru.org.uk/~casp)*

The aim of the Critical Appraisal Skills Programme (CASP) is to help health service decision makers and those who seek to influence decision makers develop skills in the critical appraisal of evidence about effectiveness, in order to promote the delivery of evidence-based health care. This critical appraisal tool is an adaptation of a critical assessment guide developed by Drummond et al (1999).

The tool consists of ten questions and addresses three broad issues. CASP suggest recording 'yes', 'no' and 'can't tell' to each question:

- *Is the economic evaluation likely to be usable?* Was a well-defined question posed? Was a comprehensive description of the competing alternatives given? Does the paper provide evidence that the programme would be effective?
- *How are costs and consequences assessed and compared?* Were all important and relevant resource use and health outcome consequences for each alternative; identified? Were they measured accurately in appropriate units prior to evaluation? Were they valued credibly? Were resource use and health outcome consequences adjusted for different times at which they occurred? Was an incremental analysis of the cost and consequences of alternatives performed? Was an adequate sensitivity analysis performed?

- *Will the results help in purchasing services for local people?* Did the presentation and discussion of the results include enough of the issues that are required to inform a purchasing decision? Were the conclusions of the evaluation justified by the evidence presented? Can the results be applied to the local population?

The intended audience for this type of assessment format is the health professional. But some knowledge of economic evaluation is necessary (for example, one question considers discounting).

The format means that the tool is very basic. The 'yes', 'no', 'can't tell' answers assume prior knowledge in order to give a considered and credible answer. The third section is useful as it focuses on what the economic evaluation can provide to the health professional – an evidence base. For example, one question asks *can the results be applied to the local population?* It tells the assessor to consider whether the patients covered by the review are sufficiently different to their population to cause concern and to consider whether the local setting is likely to differ much from that of the review.

For the purpose of developing a framework for judging the quality of an economic study, the CASP tool is useful in as much as it helps to achieve a balanced perspective when critically assessing economic evaluations. The tool is primarily for use by health professions. Thus the questions asked (and relevancy of those questions) by health economists must be compatible to those asked by health professionals when assessing a study.

*Evidence Based Nursing (EBN) user's guide: Evaluation of studies of health economics (Stone et al, 2002)*

Stone et al provide a series of questions that follow a similar format to that used by CASP. The questions aim to aid nurses appraise economic research. Each question is discussed in detail and, like the BMJ guidelines, introduces basic theoretical and methodological issues in economic evaluation.

The first section of the guidelines considers if the results of the evaluation are valid through a series of questions that the reader should ask herself/himself:

- Is the appropriate economic evaluation method used?
- Are the alternative courses of action appropriate and well defined?
- Is the perspective of the analysis stated, and are appropriate costs considered?
- If cost utility methods are used, are the utilities (patient preferences) reasonable?
- Are the events used comprehensive, and are the probabilities of events derived from credible sources?
- Are the data costs and outcomes appropriately discounted?
- Is uncertainty in the data addressed?

The next section addresses the results of the evaluation:

- How do the resulting costs or costs/unit of health gained compare with other interventions?
- Are the conclusions likely to change with sensible changes in costs and outcomes?

The final part explores how the results help in caring for the readers' patients.

- Do the costs in the report apply in my own setting?
- Will the intervention (or new model of care) be effective in my setting?

The guidelines are relatively brief in comparison to either the EED or the BMJ guidelines and have a definite clinical/ health professional slant and focus upon aspects of patient care not included in the EED or BMJ guidelines. For example, the analysis describes the relationship between levels of risk and cost:

*'The costs and consequences of treatment are likely to vary depending on the patients' risk. The greater the patients' risk the lower the cost per unit of benefit'* (Stone et al, 2002, p101).

The focus of this assessment tool is the patient and how the results of the evaluation will assist in patient care. Whilst it is important that the patient focus does not get lost when assessing clinical and economic details as a tool it is not particularly useful. It provides

a curious mix of introducing basic economic methods to providing very short explanations of more technical aspects such as the concept and measurement of utilities and patient preferences.

### *A Framework for Quality in Evaluation*

The focus of the guidelines for appraising economic evaluation differs depending upon the audience they have been written for. The CASP and EBN frameworks are intended as tools by which the evidence gained from evaluation studies may be used within practice. They provide a method of quality control for such evidence. However, the brevity of both can be seen as a disadvantage for those readers not familiar with economics or economic evaluation, who appear to be the intended audience for both.

The EED and BMJ guidelines provide a more comprehensive framework for appraising evaluations but focus less upon their use within practice. Whilst the EED guidelines do explore the implications for practice in terms of clinical practice, health policy or research the BMJ guidelines make little mention of how the published study may be used.

### **The Framework**

Within these guidelines a number of common factors arise by which the quality of evaluations may be judged. These factors, together with the key elements of economic evaluation detailed in Chapter Three are summarised in Box 4 to provide a framework to illustrate the essential elements of an economic evaluation of a health care intervention. The framework aims to allow systematic comparison between an ideal evaluation and actual evaluations of health care interventions.

#### Box 4: A framework for quality in economic evaluation

Hypothesis/Study Question: needs to satisfy three criteria:

- The question should be economically important
- Phrased in such a way that considers both costs and outcomes
- Clearly state the viewpoint or perspective of the evaluation (a societal viewpoint is advocated).

Selection of Alternatives:

- The comparator(s) should be appropriate and well defined
- Selection of alternatives should be justified

Form of Evaluation:

- The form of evaluation should be appropriate to the hypothesis

Effectiveness:

- Evidence of clinical effectiveness should be presented
- Type of study outlined (RCTs are considered the gold standard (Gold et al, 1996))<sup>1</sup>
- The sample and sample selection appropriate and transparent
- Power calculations should be used to determine study size

Benefits:

- The primary outcome measure should be clearly stated and justified
- Details given of valuation methods (if used) should be outlined
- Indirect benefits should be considered
- Modelling should be explicit and clear

Costs:

- The methods used should be clearly presented
- Costs and quantities should be presented separately
- Discounting should be used if appropriate and dates of price data outlined
- The cost boundary and basis for estimates outlined and justified
- The difference between average and marginal costs presented
- Inclusion and exclusion criteria clearly presented and justified

Results:

- Benefits used should include duration/length of follow up, summary of findings, and side effects
- Costs should include total intervention and comparator costs, statistical analysis and confidence intervals, duration and any adverse effects/knock on costs
- The results should include incremental analysis, sensitivity parameters (to allow for uncertainty) and statistical tests including differences in sub-populations
- The results should answer the hypothesis or study question

Generalizability:

- The study should provide sufficient detailed analysis to allow the reader to decide if the study results apply to other settings

<sup>1</sup> Studies not using truly random and concealed approaches may introduce bias (CRD Report 6, 1996).

### *Hypothesis/study questions*

The first component of the framework is concerned with a study question or hypothesis. The three criteria laid out for the hypothesis/study question are in line with those detailed by Drummond and Jefferson (1996) and reflect the basic tenets of economic evaluation within the health care field: ensuring the evaluation is comparative and that it reflects the costs and consequences of both the intervention and its comparator. The perspective or viewpoint of an economic evaluation should be determined before an evaluation begins (Byford and Raftery, 1998) and given the broad nature of the problem of allocation of resources the perspective of the study should be equally broad (Gold et al, 1996).

### *Selection of alternatives*

Selection of appropriate comparator(s) is crucial; what is the intervention being compared with? The ideal approach would be to identify all possible programme variations applicable to a particular problem and, thus, all possible comparator programmes including a 'do nothing' alternative (Gold et al, 1996). The rationale for the choice of intervention(s) with which to compare any intervention should be given and the intervention(s) outlined in such a way that allows the reader to assess the relevance to his/her setting (Drummond and Jefferson, 1996).

### *The form of evaluation*

The evaluation should take a form that best meets the study question. Drummond and Jefferson (1996) detail two types of question that require different forms of evaluation. The first is 'is it worth achieving this goal?' This requires a CBA. CBA allows calculation of the net benefits of an intervention by which the intervention may be analysed in isolation. The second considers 'given that a goal is to be achieved what is the most efficient way of doing so?' This requires some form of CEA. The type of CEA used will depend upon factors including the anticipated outcomes and method of measurement (is there one primary outcome or several?) and whether the interventions achieve outcomes to the same degree.

### *Effectiveness*

There is little point in undertaking an economic evaluation of an ineffective programme or service; thus evidence of effectiveness should be presented. This evidence may be derived from a single study, based upon a review/synthesis of previously completed studies or estimates of effectiveness based upon opinion (NHS CRD, Report 6, 1996). Any limitations that weaken the assessment of effectiveness weaken any economic evaluation based on it (Drummond and Jefferson, 1996).

In line with clinical guidelines, for single clinical studies the methods of establishing effectiveness should be clearly detailed and include the type of study (RCTs are generally considered the gold standard) and give details including the study population, sample numbers (determined using power calculations), sample characteristics and sample selection.

Effectiveness established using reviews of existing evidence should outline the studies included (the inclusion and exclusion criteria) and search strategies. In either case the data should show primary outcomes and how they were measured (including the appropriateness of that measure) and over what period (to provide an indication of sustainability over time).

### *Benefits*

The same principles outlined for the effectiveness data apply to the measurement of benefits within an economic evaluation. The primary outcome and outcome measures should be outlined and justified; all important and relevant health outcome consequences for each alternative should be identified. If CUA or CBA has been carried out the source and methods of valuing the benefits should be clearly presented. In line with the premise that a societal perspective is preferred analysis should consider consequences that fall to those other than the immediate recipient of the intervention. Indirect benefits, such as productivity changes, should be considered

Where possible analysis should use final end points. Modelling is used to synthesise data where relevant clinical trials have not been conducted or did not include data

capture or to extrapolate final end points where only clinical intermediate end points have been measured (Buxton et, 1997). Any modelling used should be explicit and clear; justification of the choice of model and key parameters should be given (Drummond and Jefferson, 1996).

### *Costs*

The costing methods should be clearly presented. Graves et al (2001) outline a process of review for judging the quality of cost methods that alludes to all the cost elements set out in the framework and can be distinguished in terms of identification, measurement and valuation.

All costs should be identified in line with the viewpoint or perspective of the study. The perspective should be clearly stated and justified and the cost data included in the analysis should satisfy that perspective and include all important and relevant resource use. There should also be a distinction made between short term and long term costs.

The methods used to measure the quantities of resources employed, for estimating quantities used by patients, for allocating the time of human resources between patients (variable costs), and, if relevant, for allocating the use of other resources between patients (fixed costs) should be clearly presented.

When valuing those quantities the methods for estimation of prices, unit costs or charges should be detailed. Finally all of the cost data collected should include the year(s) the data were collected, report the base year and make adjustments for costs incurred in different time periods.

### *Results*

The results presented should include a number of elements. The guidelines suggest that costs and quantities are presented separately. But a synthesis of results should be presented in the form of, for example a cost effectiveness ratio or an incremental analysis. The results should reflect all major outcomes (beneficial or detrimental).

There is often uncertainty in the evaluative process (Briggs and Gray, 1999). In order to take account of this the results should include some form of sensitivity analysis. The results of statistical tests should also be presented in order to take account of, for example, differences in sub-populations.

The duration/follow up of any costs and benefits should be included in the summary of results. The results should answer the hypothesis or study question.

### *Generalisation*

The generalisability of the study addresses the type of questions posed in the CASP and EBN guidelines: is the economic evaluation likely to be usable and will the results help me in caring for my patients? These questions address the overall quality of the study rather than the quality of the composite parts.

### **Conclusion**

The focus of this chapter has been on single studies rather than reviews or meta-analyses and the framework for economic evaluation. How evaluation should be carried out.

The published guidelines detailed a number of common elements by which to judge or appraise the quality of an economic evaluation of a health care intervention, programme or service that coincide with the theoretical and methodological ideals outlined in the previous chapter. They formed the basis of a framework for appraisal outlined in Box 4. While the type of questions in Box 4 differ from the published guidelines, the basic tenets are the same. Ultimately the appraisal process or judgement of quality can be seen to address the questions posed by CASP and the EBN guidelines: Is the economic evaluation likely to be usable and are the results of the economic evaluation valid?

Using this framework Chapter Five appraises a number of economic evaluations of rehabilitation services to determine if the evaluation of this type of service conforms to the theory and methodology outlined. In addition, particular attention is focused upon characteristics common to rehabilitation and the characteristics outlined in Chapter Two

that constrain or limit the application of traditional economic techniques. The core question is do the evaluations reflect the mix of clinical, therapeutic and social interventions that form the rehabilitation process (Nocon and Baldwin, 1998); the multiple, multi-agency inputs and multiple outputs that fall to the immediate recipient and their family and carers?

## Chapter Five

### Trends in the Economic Evaluation of Rehabilitation Services

#### Introduction

The purpose of this review is threefold:

1. To determine the trends, common factors, or differences in economic evaluations of rehabilitation programmes or services
2. To explore how published studies carry out economic evaluations of these interventions
3. To determine the nature and characteristics of the rehabilitation interventions themselves

The rehabilitation programmes, services or technologies are assessed in terms of the model proposed by Wade and de Jong (2000) whilst the economic evaluations are appraised using the framework developed in the previous chapter.

#### *Literature Search*

Papers for inclusion in the review were identified from the Economic Evaluation Database (EED) at the NHS Centre for Reviews and Dissemination (<http://nhscrd.york.ac.uk/>). The database contains structured abstracts of economic evaluations of health technologies, and covers studies in all languages published from 1994 onwards (CRD Report 6, September 1996, p1). EED identifies evaluations for inclusion in its database by regularly searching MEDLINE (1995 onwards), CINAHL (1995 onwards) and Current Contents – Clinical Medicine (1994 onwards). In addition a large number of journals are hand searched, working papers from research centres specialising in health economics are obtained and scanned, and technology assessments published by technology assessment centres around the world are identified and

assessed for inclusion (<http://nhscrd.york.ac.uk/nfaq2.htm>, accessed 12 September 2002).

The literature search was undertaken using the term rehabilitation; the truncated term 'rehab\$' was used to include any variation on the term. The original search was carried out on 25 November 1999 and updated on 12 September 2002. In total this produced 260 hits. For inclusion in the review all papers had to meet the following criteria:

- The study should be classified by EED as an economic evaluation rather than a review or cost analysis
- The 'intervention' evaluated should be classified by EED as a rehabilitation or rehabilitative intervention

The review excludes:

- Papers not written in the English language
- Meta-analysis and systematic reviews
- Papers published prior to 1994

Of the 260 papers identified 49 were classified as an economic evaluation of a rehabilitation or rehabilitative intervention. Of these papers one was written in Norwegian (Petersen et al, 1997); two were meta-analysis (Ausejo and Glennie, 1997; Ades et al, 1997); and one, curiously given the EED inclusion criteria, was published prior to 1994 (Hyde et al, 1987). Thus, 45 papers met the inclusion criteria and were subject to critical appraisal.

### *Methods of Appraisal*

A template was developed to appraise the papers in terms of the rehabilitation intervention, the methods by which the economic evaluation was carried out and how the evaluation reflects the tenets and current guidelines that outline components of a *quality evaluation*. The template is based on Wade and de Jong's model of rehabilitation (2000) and the framework for quality in economic evaluation outlined in the previous chapter. The template (appendix 1) allowed a systematic assessment of the

individual components of the rehabilitation interventions and economic evaluations. The results have been analysed using SPSS version 11.

### *Characteristics*

A number of broad classifications were established to categorise the service of interest, the year of publication and country in which the study was carried out. The classifications for the service of interest include: rehabilitation interventions for older people; those with disabilities and those with mental health problems; interventions that are post-surgical; and those developed for specific medical conditions. Whilst some of these categories overlapped the primary client classification in terms of the rehabilitation intervention was used to categorise each paper. Papers were additionally categorised in terms of the nature of the rehabilitation intervention: whether the intervention was primarily an educational programme, concerned with organisation, management or delivery issues, or a new or existing technology for use in the rehabilitation process. The final classification concerned the setting of the rehabilitation intervention be it hospital, the community or both.

### *The rehabilitation intervention*

The papers have been assessed using the framework for clinically evaluating rehabilitation interventions developed by Wade and de Jong (2000) and the definitions of rehabilitation posited in Chapter Two. The rehabilitation interventions in the studies identified were scrutinised to ascertain whether the intervention comprised a multidisciplinary team and included input across different agencies (multi-agency).

Wade and de Jong's framework describes a rehabilitation process containing assessment, goal setting, an intervention including treatment support or both, and evaluation. The studies themselves provide evidence of the evaluation component. Using the description of the interventions provided within each study, each paper was assessed to explore how well the interventions under evaluation conformed to the rehabilitation process outlined in the framework.

The appraisal sought to ascertain if client outcomes were multiple and pertained to both *function* and *role* as defined by Nocon and Baldwin (1998). In addition Wade and de Jong describe effects to clients' family and carers (minimising distress and stress) and the appraisal considered whether the studies indicated that there were outcomes accruing to this section of people and, if so, whether these outcomes had been measured.

## Results

### *Characteristics*

The studies in the review span the years 1994 to 2001. 56% of the studies were conducted in North America (21 in the USA and four in Canada), 38% in Europe (seven in the UK, four in Sweden, two in Germany, two in the Netherlands and one each in Finland and Denmark) and the remaining three India, Australia and Hong Kong respectively.

The rehabilitation interventions serve a wide area of interest. Twenty four percent of the interventions are for *older people*; 13% focus on people with disabilities; similarly, 13% focus upon post-surgical rehabilitation whilst 9% of the studies are concerned with rehabilitation in the area of mental health.

By far the largest and most diverse area was the category that focuses on medical interventions (38%). This category includes, for example, areas such as prevention of the recurrence of leg ulcers (Ruane-Morris et al, 1995), rehabilitation after fractures (Swett 1996, Cameron et al, 1994) rehabilitation after stroke (Hui et al, 1995) and pulmonary rehabilitation (Parker and Walker, 1998).

Approximately three-quarters of the rehabilitation interventions compared in the studies are concerned with the structure and process by which the rehabilitation was carried out – the way in which rehabilitation is organised or managed. This included undertaking rehabilitation in different settings: for example, in-patient versus out-patient or community based rehabilitation (Coast et al, 1998a); hospital based rehabilitation versus rehabilitation in specialist centres (Gompertz et al, 1995; Jorgensen et al, 1995).

Different methods of care management are examined, for example, self-managed care versus health agency managed (Prince et al, 1995) and rehabilitation undertaken in different time scales, for example, accelerated or intensive rehabilitation versus conventional care (Cameron et al, 1994). Many of the studies contain elements of each of these areas.

One fifth of the studies evaluate rehabilitative technologies. These include, for example, studies comparing manual versus electric wheelchairs (Brodin and Persson, 1995), technologies for administering analgesia (Chan et al, 1995) and technologies for use in physiotherapy (Timm, 1997).

Two of the three remaining studies focus primarily on the educational elements of rehabilitation: patient education programmes to prevent recurrence of leg ulcers (Ruane-Morris et al, 1995); and a programme that aims to improve clinical outcomes for outpatient pulmonary patients (Parker and Walker, 1998). The remaining study is a pharmaceutical study concerned with the cost-effectiveness of the use of a botulin toxin injection used with physiotherapy in stroke rehabilitation (Wallesch et al, 1997).

Studies are undertaken in a variety of settings. Fifty three percent of the programmes or interventions are hospital based (n=15 in-patient, n=9 out-patient). Twenty percent of the studies focus upon community based interventions and in 27% of the studies rehabilitation takes place across a number of settings (hospital in-patient, out-patient and the community).

## **Rehabilitation: Structure**

### *Multidisciplinary team*

Eighty seven percent (n=39) of the studies indicate that the rehabilitation intervention evaluated was carried out by a multidisciplinary team. Of the six interventions that did not indicate a multidisciplinary input, four of the studies evaluate rehabilitation technologies, one an educational rehabilitation programme and one is concerned with the organisation/management of the rehabilitation process.

The four 'technology' studies included a physiotherapy intervention (Timm, 1997), a comparison of different types of wheelchairs (Brodin and Persson, 1995), a computerised decision support technology (Fitzmaurice et al, 1998) and a nurse administered analgesia technology (Chan et al, 1995).

The organisation/management paper (Williams et al, 1995) is a hospital-based study of the impact of isolation after heart transplantation using only nursing care. This study provides only a snapshot of one part of the rehabilitative process and it is expected that outside this time frame others are involved in patient care. The final rehabilitation process that does not have a multidisciplinary input is a nurse led educational programme (Ruane-Morris et al, 1995).

### *Input across different agencies*

Studies show evaluations undertaken across a wide range of countries with differing health and social sectors and infrastructures. Thus, rather than determining the number and type of agencies involved in the rehabilitation process, and to enable meaningful comparison, the analysis determines the sectors involved rather than the agencies. All health care professions are classified within the *health care sector*. Strictly non-health professions such as social workers or home care workers are classified within the *social sector*. Other sectors include the voluntary sector and the informal sector (family, friends and other informal carers). Those rehabilitation interventions that include members from one or more sectors are categorised as multi-agency. This classification fits with Nocon and Baldwin's mix of clinical, therapeutic and social interventions that form the rehabilitation process.

Whilst 87% of the studies evaluate a rehabilitation process that typically consists of input across a range of professions only one third of the papers indicate that there is multi-agency working; that sectors other than the health sector are involved the rehabilitation process. The majority of rehabilitation interventions that include input from different sectors are those interventions based for all or part of the intervention period in the community (73%). Only three of the rehabilitation interventions that are hospital based included multi-agency working. These are: an evaluation of a day hospital compared to a stroke ward (Hui et al, 1995) that arranges community and

family support post discharge; a comparison of acute and sub acute rehabilitation for stroke in which a social worker is part of the rehabilitation team (Keith et al, 1995); an evaluation of case management of patients with chronic minor disease and long term absence from work (Timpka et al, 1997) in which the case management team includes social workers. Eighty percent of those interventions that include sectors other than the health sector are studies evaluating the organisation or management of a service whilst the remainder are evaluations of rehabilitation technologies.

### **Rehabilitation: Process**

Wade and de Jong's framework outlines a rehabilitation process with the following components: assessment, goal setting, an intervention which may include treatments affecting the process of change, support to maintain quality of life and safety, and evaluation.

Eighty four percent (n=38) of studies described an assessment of the patient prior to the start of the intervention. In three studies it is not clear if a patient assessment was carried out. In the remaining four studies an assessment is not applicable. Of this latter group one study is a cost minimisation analysis (Coast et al, 1998a); no significant difference was detected between effectiveness measures and thus the analysis merely outlined costs. Two are hypothetical case studies. One compares the cost effectiveness of different types of wheelchairs (Brodin and Persson, 1995), the other elective surgery for aneurysms using Markov modelling to assess the hypothetical cost effectiveness (King et al, 1995). The final study is a comparison of home care agencies for the disabled. Whilst the results of this analysis consider health outcomes no assessment was applicable other than the criteria for inclusion to the study (Prince et al, 1995).

Only 31% (n=14) of the studies indicate that there was a goal setting process. In the case of the four studies outlined above, goal setting is not applicable and in two studies it was clear that there was no goal setting process. The first of these studies evaluates anaesthetic techniques (Sherry et al, 1996), the second compares analgesia technology (Chan et al, 1995). For both these studies the rehabilitation period under investigation is very short and whilst there are outcome goals in the form of, for example, time to

extubation, goal setting in the context of Wade and de Jong's framework was not undertaken.

It is not apparent in 25 studies if there is a goal setting process within the rehabilitation intervention. A number of studies describe a monitoring process but typically the intervention is not described in sufficient detail to confirm specific goal setting for or with the patient.

Two thirds of the studies describe a rehabilitation process that consists of both treatment and support. Twenty two percent of the studies describe a rehabilitation process that focuses on treatment alone whilst two studies show an intervention in which the focus is upon support alone. The latter group consists of a study of computer-aided assistive technology for individuals with communication disabilities (Hausse et al, 1997) and an evaluation of home care agencies for the disabled (Prince et al, 1995). The group whose rehabilitation focuses on treatment alone includes a study of the effect of cochlear implants in profoundly hearing impaired children (Francis et al, 1999) and an evaluation of geriatric assessment and home intervention in the care of hospitalised patients (Nikolaus et al, 1999).

### **Rehabilitation: Outcomes**

Eighty nine percent (n=40) of the studies indicate that patient outcomes are multiple. Whilst five studies indicate a single outcome it is likely that for some of these studies the rehabilitation intervention still conforms to the rehabilitation aims outlined by Wade and de Jong. For example, Keith et al (1995) compare changes in functional ability for patients undergoing acute rehabilitation for stroke to those undergoing sub acute rehabilitation. Although functional improvement may be viewed as a single rather than multiple outcome, functional status gains, as the authors' note in their conclusion, might translate into '*greater long term benefits in terms of personal competence*' (p499). Similarly Fitzmaurice et al (1998) compare oral anticoagulation monitoring methods. The outcome is seen as the absence of adverse effects: patients who remain within a predetermined therapeutic range. Again this may be considered as a single effect but is likely to have more far reaching effects in terms of those patients' health related quality of life.

Of the 45 studies, 78% indicate that the expected outcomes of the rehabilitation intervention pertain to improvements in the patient's role and function. Only 20% of papers indicate that the expected outcomes are purely related to improvements in function. For one paper the expected patient outcomes are not clear; Jorgensen et al (1995) evaluate stroke rehabilitation in a stroke unit compared to a general neurological/medical ward. The study does not explicitly set out patients' expected outcomes but instead uses length of hospital stay as the effectiveness measure.

Of those studies that indicate patient outcomes pertaining to both role and function, 25 use outcome measures that aim to reflect both dimensions. Five of the studies use proxy measures whilst five studies measure only changes in functional ability.

### *Family and friends*

Wade and de Jong's model describes effects to patients' family and carers resulting from the rehabilitation process. Forty two percent of the studies indicate, either explicitly or implicitly, that the rehabilitation process would have effects upon friends and family (both positive and negative). However, only five of the 45 studies attempt to measure these effects. Of these five studies three considered aspects of the financial costs to family and friends (Beecham et al, 1996; Prince et al, 1995; Brodin and Persson, 1995) whilst two aim to measure carer mood and caregivers quality of life (Bratton et al, 2001; Gompertz et al, 1995).

### **Summary**

The rehabilitation interventions within the studies identified are diverse. They cross a range of medical areas, patient populations and settings. However, within this diversity a number of characteristics are evident that typically conform to Wade and de Jong's (2000) framework of rehabilitation and the various definitions of rehabilitation outlined in Chapter Two.

Wade (1992) describes rehabilitation as *the management of disability* (p11). In line with this definition approximately three-quarters of the interventions evaluate this management process – how rehabilitation interventions are organised or managed,

whether this be accelerated rehabilitation versus conventional care, rehabilitation undertaken in specialist units versus rehabilitation in general wards or community rehabilitation versus hospital rehabilitation. Similarly those classified as educational programmes can be seen to conform to this description.

Wade and de Jong (2000) describe a rehabilitation structure comprising a multidisciplinary team of people working together toward common goals, involving and educating patient and family. Eighty seven percent of rehabilitation interventions were carried out by a multidisciplinary team but only one third of interventions include input from sectors outside the health sector. Definitions of the rehabilitation process are indicative of input across sectors including changes in physical and mental function together with changes in the patient's role within his family, social network or workforce. However, a number of the studies evaluate only a small part of the rehabilitation process, especially the evaluation of those interventions that are hospital based.

The expected rehabilitation outcomes are multiple (only five studies indicate a single outcome). Eighty nine percent of the studies indicate that there are multiple expected outcomes from the rehabilitation interventions; 78% indicate that the expected outcomes pertain to the patient's role and function. In addition 42% of the studies indicate either explicitly or implicitly that the rehabilitation process affects family, friends and informal care givers.

The rehabilitation process itself is less well documented. Whilst 31% of the papers indicate there was a goal setting process it was not clear in a further 25 studies if the rehabilitation interventions included goal setting with or for the patient. This lack of clarity prohibits direct comparison between the rehabilitation process and Wade and de Jong's model of rehabilitation.

Despite these problems the over-riding impression garnered from the studies identified is that the rehabilitation interventions, despite their diversity, conform to the definitions of rehabilitation outlined in Chapter Two and fit into the rehabilitation framework described by Wade and de Jong.

## Economic Evaluation

### *Hypothesis*

Hypothesis/Study Question: needs to satisfy three criteria:

- The question should be economically important
- Phrased in such a way that considers both costs and outcomes
- Clearly state the viewpoint or perspective of the evaluation (a societal viewpoint is advocated).

In line with expectations, given that the studies identified have been peer reviewed prior to publication, in all papers the hypotheses are clearly stated and the economic importance of the question justified.

In 91% of the studies the hypotheses considers both the costs and outcomes resulting from provision of the intervention. Of the four studies that did not, one is a cost minimisation analysis (Coast et al, 1998a) and thus only considers costs whilst three studies phrase the hypotheses in a way that only considers outcomes:

*'...to determine whether breast feeding in the early postoperative period would in any way be harmful for the child and the lip repair.'* (Darzi et al, 1996, p24)

*'...to test, at a community level, whether stroke unit treatment is more effective than routine management on medical and neurological wards.'* (Jorgensen et al, 1995, p1178)

*'...to test the effectiveness of a multidisciplinary disease management intervention...'* (Riegel et al, 2000, p290)

Eighty nine percent of the studies clearly stated the viewpoint or perspective of the evaluation. Although a societal viewpoint is advocated within methodological texts only 16% of the evaluations are undertaken from this perspective. The majority of studies (67%) are evaluated from the perspective of the service provider, 13% from the viewpoint of the 'third party payer' and 4% from the perspective of the service provider and the patients' family or the service provider and the patient.

*Selection of alternatives*

## Selection of Alternatives:

- The comparator(s) should be appropriate and well defined
- Selection of alternatives should be justified

In all studies the selection of alternatives, the services or programmes against which the intervention is compared, is deemed to be appropriate and justified. In terms of effectiveness, 87% of the interventions are compared against the previous practice or current practice. Two papers compare the interventions against findings from previous studies; four use a 'hypothetical' comparison. For example, Wallesch et al (1997) consider the cost effectiveness of a botulin toxin type A injection for patients with spasticity following stroke. In order to assess the effectiveness

*'a decision tree simulating the sequence of medical interventions and health states in chronic spasticity following stroke was developed based on a Delphi Panel' (pS53).*

The expert panel draw on their medical knowledge and experience in this field together with findings from previous studies to develop the expected outcomes for different scenarios. King et al (1995) in their study of elective surgery for aneurysms use mathematic modelling techniques (a Markov model) to assess cost effectiveness. The model is based on values derived from previous studies and participants clinical judgement.

When selecting the alternative on which to base the cost comparison 84% of the studies use the cost of the current or previous practice. One study compares the costs of the intervention with costs from a previous study, one considers only the cost of the intervention and five studies use a 'hypothetical' cost comparison. This latter group consists of the same four studies that used a hypothetical situation to compare effectiveness together with a study evaluating home health care for older people (Walker, 1996). Walker's study is a single patient case study in which the effectiveness of the rehabilitation programme is measured using patient outcomes prior and post-intervention. The author hypothesises that the patient would have been admitted to a

skilled nursing facility had the intervention not been available and a comparison is made between the cost of the intervention and the cost of the skilled nursing facility.

Thirty-nine of the 45 studies use the same alternatives when comparing both costs and outcomes. Six studies use different alternatives for each. For example, Ruane-Morris et al (1995) compare the intervention costs against costs estimated in a 1989 study whilst effectiveness is compared against figures cited in a 1990 study.

### *Form of evaluation*

#### Form of Evaluation:

- The form of evaluation should be appropriate to the hypothesis

The majority of studies (58%) employ cost consequence analysis and 31% use cost effectiveness analysis. One study uses cost benefit analysis, three cost utility analysis and one study cost minimisation analysis.

Seventy eight percent of the studies outlined patient outcomes that pertain to changes in the patient's role and function. CUA allows changes in both mortality and morbidity to be incorporated in an evaluation. As such it had been anticipated that CUA would be used to quantify multiple outcomes resulting from the rehabilitation intervention. This was not so. Only three studies are cost utility analyses. Similarly, 42% of the studies indicate effects to friends and family resulting from the intervention. Use of cost benefit analysis would allow these effects to be included in the evaluation; yet only one study used cost benefit analysis.

The cost benefit analysis and two of the cost utility analyses are undertaken from a societal perspective. Four further studies use this perspective all of which employed cost consequence analysis.

The structure and methods used in the cost utility analysis differed significantly. Brodin and Persson's (1995) study is a hypothetical single person case study in which utilities are estimated using an index of health related quality of life completed by 'an informed

agent' rather than the patient himself. The scores from the index are converted into QALYs and the costs and benefits presented separately.

In contrast Goldstein et al (1997) carry out a randomised controlled trial to evaluate specialist respiratory rehabilitation (in comparison to conventional care). As in Brodin and Persson's study (1995) they use health-related quality of life as the primary measure of effectiveness but Goldstein et al elicit the values from the patients' themselves during interviews. However, these values are not transformed into QALYs but presented in their raw form as cost-utility ratios. It is also interesting to note that whilst HRQL is the primary outcome measure it is not the only outcome measure. The Goldstein et al study also measures functional exercise tolerance (the authors refer readers to another paper for the results from this measure).

The final CUA study (King et al, 1995) evaluates the cost effectiveness of elective surgery for aneurysms. The study uses a mathematical model based on existing studies and expert opinion to generate QALYs. Thus the analysis is based on a hypothetical situation.

The focus of the cost benefit analysis is long-term absence from working life in patients with chronic minor disease (Timpka et al, 1997). The time over which the study was conducted was relatively long in comparison with the other studies (six years including follow-up). However, the form of analysis is appropriate; CBA allows comparison between future streams of incremental benefits with incremental costs. The societal benefit in this study is vocational activity measured by a decrease in indirect costs (pension or sickness benefits).

The four remaining studies that carry out the evaluation using a societal approach are all cost consequence analyses. For example, Nordstrom et al (1996) compare in-patient and out-patient rehabilitation in rheumatoid arthritis. The study employs eight measures to assess patient outcomes. Whilst the economic assessment includes rehabilitation costs (salary, direct and community sponsored costs), the cost of sick days and production losses.

Of the studies carried out using CEA, eleven were undertaken from the perspective of the service provider and three from the perspective of the third party payer. This is in line with the premise that the aim of economic evaluation is to maximise whatever the decision-maker wants to maximise (Sugden and Williams, 1978). If the service provider or the third party payer is the decision-maker then this form of evaluation may be seen as appropriate.

Eighteen of the 26 CCA studies are undertaken from the perspective of the service provider, two from the perspective of the third party payer, four from a societal perspective and one from the perspective of the service provider and the patient's family. This latter study (Prince et al, 1995) includes the costs to the service provider and the costs of unpaid care from family and friends.

### *Effectiveness*

#### Effectiveness:

- Evidence of clinical effectiveness should be presented
- Type of study outlined (RCTs are considered the gold standard (Gold et al, 1996)
- The sample and sample selection appropriate and transparent
- Power calculations should be used to determine study size

Evidence of the effectiveness of the rehabilitation intervention is, in the majority of studies, collected as part of the evaluation. Typically papers cite previous studies as further evidence of the effectiveness of the intervention being evaluated. Three studies do not conform exactly to this trend; each of the studies uses modelling techniques to generate effectiveness data.

- Wallesch et al (1997) use modelling to generate effectiveness data. The model uses a technique based on expert opinion and the study cites a number of small studies indicative of the effectiveness of the intervention.
- The Brodin and Persson study (1995) forms part of a European initiative to evaluate technologies using real or potential consumers in the field. The evaluation, like

Wallesch et al, uses a model to generate the 'effectiveness' data. However, the model is based on a single patient.

- King et al (1995), as in the previous two studies, use modelling techniques to generate effectiveness. The model is based on evidence from literature as well as clinical judgement.

### *Type of study*

When evaluating the effectiveness of the interventions the only trend apparent in the way in which studies are designed is that of diversity and variety in designs employed. The type of study design has been categorised in line with the criteria laid out for writing critical abstracts for the NHS Economic Evaluation Database (CRD Report 6, p41-42). Table 1 outlines the designs used by the studies.

Whilst randomised controlled trials are considered to be the gold standard when evaluating the effectiveness of a health intervention, 62% of the studies were conducted using alternative designs. Of the seventeen studies undertaking RCTs eleven evaluate hospital based interventions, two studies evaluate community based interventions and four evaluate interventions undertaken across a number of settings.

**Table 1: Study designs**

<b>Study Design</b>	<b>% of studies</b>
Randomised controlled trial	38
Cohort study	16
Non-randomised trial with concurrent controls	11
Before and after	9
Case series	7
Non-randomised trial with historical controls	4
Case study	4
Case-control study	2
Other	9

The category 'other' contains four studies. Two of the studies use modelling techniques to generate effectiveness data and as such evidence of effectiveness was hypothetical

(Wallesch et al, 1997; King et al, 1995). The Prince study (1995) uses a quasi-experimental design by which participants meeting the study criteria were identified and invited to take part in the study. Those who participated were not randomised into the intervention or control group; allocation to the two groups was based on participants' current utilisation of services. The fourth study (Gompertz et al, 1995) uses a design described as a *prospective observational study*. The study is a comparison of different stroke services in two districts in the NorthEast Thames Region. Study participants were identified in each district using a stroke register and a comparison of patient outcomes in each district carried out.

Whilst the design of the remaining studies was relatively easy to categorise the classifications disguise the diversity and variation of methods employed within the studies. Consider, for example, two studies both classified as cohort studies. The first, Bratton et al (2001), carries out an evaluation of a day programme for children with asthma. All patients who fit the study criteria were asked to take part in the evaluation giving a sample of 114 patients. Patient outcomes were measured at admission and at one and two years after discharge. Improvements in patient outcomes were used as an indicator of the effectiveness of the programme. In addition the study details patients' utilisation of medical care (including emergency department visits and hospital days) and compares this with resources used by the patients one year prior to entering the programme. Changes in resource use provide not only an indication of cost savings but also a further indicator of the effectiveness of the service. The patients are acting as their own comparator in both situations.

The second, Keith et al (1995), evaluates two types of stroke rehabilitation: acute rehabilitation (a hospital based comprehensive in-patient service) and sub-acute rehabilitation (a less intense form of rehabilitation undertaken in a skilled nursing facility). The patient sample was obtained by retrospectively searching through both facilities records. Gains in functional impairment in each group (acute and sub-acute) provided the primary evidence of effectiveness. Analysis of the proportion of patients discharged to the community is also presented.

The differences between these two studies, both classified as cohort studies, is evident. The Bratton study is prospective, the Keith study retrospective; the former is single

centre, the latter multicentre; the Bratton study uses the cohort as their own comparator whilst the Keith study has an intervention and ‘comparator’ group within the cohort.

No trends were evident in the choice of study design relative to the area of interest, service of interest, setting or type of outcomes (function/role).

### *Sample*

The sample and details of the criteria for sample selection were typically clear and transparent. The relevant characteristics of the sample were presented in the majority of studies. However, for a small number of studies (n=3) the number of patients included in the study was unclear or not reported. For example, Swett (1996) evaluated the use of home care aides to supplement therapy services for fracture patients. The study, set in North California, explores patient outcomes and costs of treatment to the health care provider. The analysis presents the average change in ADL (activities of daily living) status for the period 1994 and 1995 (prior and post the introduction of home care aides respectively) but no details are given of the sample/population number. Similarly, Schmidt and Jerrell (1998) evaluate three case management programmes for severe mental illness and whilst the programmes are described in detail, including the number of staff involved in the programmes, no details are given of the number of patients included.

For two of studies that use modelling to predict the effectiveness of the intervention the sample size is not applicable. Details of the samples sizes in the studies are shown in Table 2.

**Table 2:** Sample size

Sample Size	% of studies (number)
0 – 50	23 (9)
51 – 100	27 (11)
101 – 150	20 (8)
151 – 200	3 (1)
200+	27 (11)

For those studies for whom the sample numbers were transparent the mean sample size was 192 (standard deviation: 256). Sample numbers ranged between 1 – 1241 patients. Fifty percent of the studies had a sample of less than 100 and 73% of less than 200. Two studies had disproportionately large samples in comparison to the other studies (1003 and 1241). This is illustrated by a median value of 101 of the sample.

Only seven of the 45 studies use a power calculation to determine sample numbers. Five of these studies are RCTs, one a non-randomised trial with concurrent controls and one a cohort study. The mean number of patients in the group of studies that use a power calculation to determine sample size was higher (247) than that of the group that did not (180). The difference between the two means is statistically significant (Mann-Whitney  $U=-2.154$ ,  $p=0.031$ ).

### *Outcome Measures*

A variety of outcome measures are used in the studies. These included the use of validated outcome measures, indicators such as weight gain and proxies such a reduction in hospital days.

No trends are apparent in outcome measurement in CEA; the primary outcome measures are diverse; they include measures of ADLs, vocational activity, abstinence, hospital readmission, recurrence rates and duration of ventilation. A similar diversity was apparent in the CCA studies.

Each study uses, on average, three outcome measures (mean and median; range 1-10). Of the fourteen CEA studies eight used only one measure of outcome, whilst the remainder used between two and five. Predictably the biggest variation is apparent within the CCA studies. For example, Gompertz et al (1995) compare patient outcomes in two health districts; one with a specialist stroke unit, one without. The evaluation uses ten measures of the outcome/consequences of the service: patient mortality at one and six months, Barthel scores, extended ADL scores, Geriatric Depression scores, Nottingham Health Profile scores and Stroke Satisfaction scores. The patients' informal carers were asked to complete the Nottingham Health Profile, the Geriatric Depression Scale and the London Carer Satisfaction questionnaire. By contrast Williams et al

(1995) undertake an evaluation of the impact of discontinuing isolation after heart transplant that uses only two outcome measures: infection and rejection rates.

### *Benefits*

#### Benefits:

- The primary outcome measure should be clearly stated and justified
- Details given of valuation methods (if used) should be outlined
- Indirect benefits should be considered
- Modelling should be explicit and clear

The studies show that typically the measurement of benefits corresponds with the measurement of effectiveness. Only one study makes a distinction between the two outcomes. Dockerell et al (1995) explore the resettlement of people with mild learning disabilities and challenging behaviour. They use two behaviour scales to measure the effectiveness of the intervention (Adaptive Behaviour Scale and the Vineland Adaptive Behaviour Scale) but explore the benefits in terms of quality of life opportunities. The study reflects quality of life opportunities using the facilities within different care settings. For example, attributes include personal privacy demonstrated by patients having a single or shared bedroom and participation in domestic activities demonstrated through patient contributions to cooking and cleaning.

Whilst the Dockerell et al study is the only one to demarcate effectiveness and benefits many of other studies note that potential reductions in costs resulting from the intervention were also a benefit. For example, von Sternberg et al (1997) evaluate geriatric rehabilitation in transition care centres against the customary care through contract services. The effectiveness and the benefits of the service are measured using changes in ADLs, reduction in length of stay and rehospitalisation rates. The study goes on to use reduced length of stay as the basis for reported cost savings.

Where applicable the primary outcome of the intervention is typically clearly stated and justified. For example, Ruane-Morris et al (1995) evaluates a programme to prevent the recurrence of leg ulcers. The primary outcome is clear: the prevention of leg ulcers and the use of recurrence rates as a measure of effectiveness is appropriate. However, in a

small number of studies patient outcomes and their measurement was less detailed. For example, Jorgenson et al (1995) compare stroke rehabilitation in a stroke unit with care in general and neurological wards. The study does not specify the patient outcomes per se but uses indicators such as discharge to nursing homes and length of hospital stay.

A further example is an evaluation comparing breast-feeding and spoon-feeding after cleft lip repair in babies (Darzi et al, 1996). The introduction to the paper cites a number of previous studies that indicate that spoon-feeding deprives babies and their mother of the various benefits of breast-feeding. The study uses a primary outcome of weight gain at six weeks after surgery and considers wound dehiscence and hypertrophy of the lip scar. Whilst the reader can determine the reasoning for choosing weight gain as the primary outcome no justification is given for the outcomes used or reference made to what the various benefits to the mother of breast-feeding may be.

Guidelines for evaluation state that all important and relevant health outcomes should be identified. Whilst it is possible to infer from many of the studies possible outcomes to, for example, informal carers or family members, without some level of expertise in the health speciality under evaluation it is not possible to determine if important and relevant outcomes have been excluded.

### *Valuation methods*

If CUA or CBA has been carried out the source and methods of valuing the benefits should be clearly presented. Within the three CUA studies and the CBA study included in the review the valuation of benefits was clearly presented. Two of the CUA studies use off-the-peg health related quality of life measures; Brodin and Persson (1995) a generic measure (the Index of Health Related Quality of Life) and Goldstein et al (1997) a disease specific measure (the Chronic Respiratory Questionnaire). The third study (King et al, 1995) uses mathematical modelling based on evidence from existing studies and expert opinion generate QALYs. Timpka et al (1997) in their CBA measure the benefits to society using the decrease in indirect costs.

*Indirect benefits*

Eleven of the studies clearly indicate that indirect benefits have been measured. For example, the Cameron study (1994) evaluates the cost effectiveness of rehabilitation after proximal femoral fracture. Whilst the paper records only changes in patients' functional ability using the Barthel Index the paper notes that the effects on carers were recorded and reported elsewhere. Studies such as those of Hui et al (1995) and Gompertz et al (1995) include indirect benefits in the form of carer satisfaction.

*Modelling*

In each of the four studies that used modelling techniques the models were clear and explicit. Justification of the choice of model and key parameters were given. Table 3 gives details of each model.

**Table 3: Studies using modelling techniques**

<b>Author (year)</b>	<b>Model</b>
Brodin and Persson (1995)	A CUA that uses expert opinion to model the benefits of an electric versus manual wheelchair. The model generates the expected changes in effectiveness in QALYs
Timpka, Leijon, Karlsson, Svenson, Bjurulf (1997)	A CBA. The analysis uses a human capital model to value of increased productivity
King, Glick, Mason, Flamm (1995)	A CUA that uses a Markov model based on existing studies and expert opinion to generate QALYs
Wallesch, Maes, Lecomte, Bartels (1997)	A CEA. The analysis uses a decision analysis model based on expert opinion and previous studies to generate effectiveness data (using the Ashworth Scale for Spasticity)

## Costs

### Costs:

- The methods used should be clearly presented
- Costs and quantities should be presented separately
- Discounting should be used if appropriate and dates of price data outlined
- The cost boundary and basis for estimates outlined and justified
- The difference between average and marginal costs presented
- Inclusion and exclusion criteria clearly presented and justified

Overall the cost analyses are typically less well presented and less clear than the analyses of effectiveness. A number of different methods of costing were used to undertake the analysis. Twenty seven percent of the studies use micro-costing methods, 13% gross costing, 11% average costs, 11% charges and 22% a combination of two or more of these methods. An example of a mixed methodology is the evaluation of self managed versus agency provided personal assistance care for people with high level tetraplegia (Prince et al, 1995). This study uses payment charges to cost paid care but uses estimates to measure and value unpaid care.

For 16% of the studies the costing methods were unclear. Insufficient details were presented to enable the reader to determine how costs were calculated. For example, Ruane-Morris et al (1995) in an evaluation of an educational programme designed to reduce recurrence of leg ulcers presents the cost of GP referrals to the programme and follow up visits. These figures are aggregated to give per patient costs of the programme for one year. No indication is given of the basis of the estimates or how they have been calculated.

The evaluation of breast-feeding compared to spoon-feeding for babies after cleft lip surgery refers to the methods by which costs are calculated only very briefly:

*'The cost and duration of hospital stay was also recorded'* (Darzi et al, 1996, p24)

Similarly, although the results section presents the duration of hospital stay, the paper reports only the following in respect of the cost analysis:

*'Because of the greater need for analgesia/sedation and intravenous fluids and also because of the additional cost of commercial feeds for the spoon fed group, the average total cost of hospitalisation was less for the breast fed group (98 Indian rupees) than for the spoon fed group (156 rupees)' (Darzi et al, 1996, p25).*

However, a number of studies report the cost analysis and costing methods clearly and in sufficient detail to allow the reader to make comparisons to their own setting or with other studies. For example, Cameron et al (1994) carry out an evaluation of accelerated rehabilitation after fracture compared to conventional care. The study uses a number of methods to enable costs to be estimated. The cost model is outlined in detail including identification, measurement and valuation of the resources used.

Similarly, Coast et al (1998a) carry out a cost analysis of acute hospital care and early discharge to a hospital at home scheme. The analysis uses a micro costing method that describes in detail the derivation of resource use for each patient, how those resources were measured and the sources of valuations used in the analysis.

Whilst for some studies the method of costing used is unclear for all studies the cost boundary appears to be in line with the viewpoint or perspective of the study. A small number of studies explore the resources used outside these boundaries. For example, one study considers but excludes time spent by family carers in line with the perspective of the study, that of the third party payer. The authors believe:

*'The time spent by family caregivers should be similar for the accelerated rehabilitation and conventional care groups as both were discharged from hospital with a similar level of physical independence as measured by the Barthel Index. Had the study shown dissimilar time periods spent by the two groups, the costs should only be included if the third party payer reimbursed the time costs of the family caregivers' (Cameron et al, 1994, p1309).*

Whilst the perspective of the studies identified is justified some studies can be seen to use a restricted viewpoint in relation to the intervention under evaluation. For example, Styrborn (1995) evaluates early discharge planning for elderly patients in acute

hospitals. The study takes the view of the service provider. This does however limit the results of the evaluation, as there are likely to have been additional costs, such as an increased cost of home care, resulting from early discharge.

In order that users of the studies may make meaningful comparisons between the results of the cost analysis, the cost and quantities of the resources used should be presented separately. Only 51% (n=23) of the studies reviewed undertook this. Two studies only report quantities. Jorgensen et al (1995) evaluate two methods of stroke rehabilitation in Denmark. The cost analysis uses length of hospital stay to illustrate differences in cost between the two interventions but does not attempt to place any value on them.

Chan et al (1995) evaluate patient controlled analgesia. The study considers only nursing time and reports results based on savings in time rather than in monetary terms. Reporting only the quantities of resource use does not in itself restrict the generalizability of the studies but rather the papers should be considered in their entirety. For example, the differences in nurse time are clearly laid out in the Chan et al study but the generalizability of the paper is restricted by not including the cost of the technology required by the intervention.

In studies where discounting was appropriate it was carried out (n=6). Overall whilst average costs are well reported only two studies reported the difference between average and marginal costs (Hauss et al, 1997; Timpka et al, 1997). The difference between marginal cost and average cost is important because at a given level of output the marginal cost of increasing output may be high even though the average cost of the intervention may be less than that of its alternative.

60% (n=27) of studies contained some form of inclusion and exclusion criteria for the cost analysis. For example, Hauss et al (1997) present a concise and clear summary of the study's exclusion and inclusion criteria:

*Cost estimations were based on the marginal costs, since opportunity costs should be considered in evaluations of different alternatives. If a new CAAT centre was opened, our estimations would only show the cost of the selection processes, after investments in buildings were made and administrative staff employed. Cost for the selection process*

*including client assessment, tryouts, usage training and selection equipment were estimated. Housing costs for the centres were not included (Hauss et al, 1997, p128).*

The generalizability of those studies that did not report inclusion and exclusion criteria is necessarily restricted. For example, Swett's study (1996) evaluates the use of home care aides to supplement the work of therapists with fracture patients. The study details the training programme undertaken by home aides in order to carry out this role but reports only average costs per patient 'episode'. It is not apparent whether these training costs have been included in these average costs.

### *Results*

#### Results:

- Benefits used should include duration/length of follow up, summary of findings, and side effects
- Costs should include total intervention and comparator costs, statistical analysis and confidence intervals, duration and any adverse effects/knock on costs
- The results should include incremental analysis, sensitivity parameters (to allow for uncertainty) and statistical tests including differences in sub-populations
- The results should answer the hypothesis or study question

### *Benefits*

The framework states that the benefits used should include duration/length of follow up, summary of findings, and side effects. The duration of the programmes under evaluation, the studies themselves and the follow up periods presented vary considerably. The rehabilitation interventions ranges in duration from approximately 48 hours (Sherry et al, 1996) to interventions that are on-going (n=8). An example of an on-going intervention is presented in the Schiller et al study (1997). This is an evaluation of a technology-based home care for disease management. The intervention consists of a home health monitor to be used to manage disease. The monitor enables patients to measure physiological data at home. The data is automatically downloaded to a central monitoring station where it is reviewed. The review process directs the technician to call the patient immediately when an alarm is raised.

Similarly the studies vary in duration from 4 months (Kollef et al, 1997) to approximately seven years (Timpka, et al, 1997). The duration of the study is, necessarily dictated by the intervention itself. Studies of a longer duration are mainly concerned with community base interventions. For example, Beech et al (1996) compare community care to long-term hospital stays for psychiatric patients over a three year period.

Where the benefits of the intervention have been followed up, the follow up periods range from one month to five years.

The duration of benefits from the intervention and the duration of the follow up period, where undertaken, are typically well reported and clear. In fact only five studies failed to undertake a follow up of the benefits where appropriate. The duration of the study and duration of the rehabilitation intervention are not as well documented. In a number of studies whilst the duration of the programme was not explicit it is possible to extrapolate an approximate period through, for example, mean treatment periods or mean length of hospital stay reported within the results.

None of the studies reported side effects resulting from the intervention in either the period of the intervention or the follow up period.

### *Costs*

Eighty four percent of the studies report total costs for the intervention and the comparator. However only 53% carry out any statistical analysis on costs. The Fitzmaurice study (1998), a comparison of anticoagulant management methods, provides a typical illustration. Within the results section the clinical results presented show the mean percentage of patients within the appropriate therapeutic range together with the number of patients, range and standard deviation. No statistical analysis is carried out in respect of the costs, which are presented as:

*'The costs to a fund holding practice, if these patients had been seen at this frequency in the local provider unit, would have been £2290 based on six new patient appointments at £45 each and 202 follow up appointments at £10 each). The actual costs to the*

*practice were £1751. This is calculated from six new patient appointments at £7 each, 135 clinic follow up appointments at £3 each, 67 domiciliary follow up appointments at £12 (based on nursing consultation time at £15 per hour) each plus overhead costs including CDSS maintenance and quality assurance costs at £500' (Fitzmaurice et al, 1998, p145).*

Whilst only 47% of studies carry out any statistical analysis on costs all the studies report the time period to which the costs related. However studies differ significantly in the level of detail. For example, one study merely presents the average costs per episode over two separate twelve months periods (Swett, 1996). No indication is given of the duration of each episode or how many patients used the service. Conversely, Hui et al (1995), within an evaluation of day hospital and conventional medical management in elderly stroke patients, break down in detail the individual components of the two interventions being compared. The quantities of resource use are taken from the patient sample and clear duration period is outlined.

A number of studies (n=12) include some form of knock-on costs. These usually related to the follow up period following discharge from the rehabilitation service/programme/intervention. Unfortunately it is not possible to ascertain from the studies, without a more detailed knowledge of the clinical area, whether important knock-on costs have been excluded.

Despite recommendations for evaluations to compare the additional costs the one service or programme imposes over another (Drummond et al, 1999) only 31% of the studies include any incremental analysis. Similarly only 22% of studies take into account uncertainty or use sensitivity analysis. However, all the studies do, to a greater or lesser extent, answer the hypothesis posited.

## Generalizability

### Generalizability:

- The study should provide sufficient detailed analysis to allow the reader to decide if the study results apply to other settings

Of the 45 studies 34 provide sufficient detailed analysis to indicate that the results *could* apply to other settings but in a limited or restricted manner. This is for a number of reasons that typically relate to limitations in the cost analysis, the sample size and characteristics and lack of detail in, for example, description of the interventions being analysed.

For example, Przybylski et al (1996) evaluate the use of enhanced physical and occupation therapy. The study is a RCT that uses a number of different outcome measures and provides detailed statistical analysis of those outcomes. However, the results can be seen to be limited by the absence of power calculations to determine the sample size and high attrition rates.

Nordstrom et al (1996) compare in-patient and out-patient rehabilitation in rheumatoid arthritis. The study is a non-randomised trial with concurrent controls that uses a large number of outcome measures to capture the diversity of the multiple outcomes. However, the sample size is small (n=26) and the cost analysis presented lacks the clarity that would enable the reader to judge if the results could apply to another setting.

Despite these restrictions the studies, in the main, acknowledge the limitations pertaining to areas such as study design and sample numbers.

## Summary

The diversity or variety apparent in the rehabilitation interventions is also observed in the economic evaluations: in the methods used by the evaluation, the study type, the number and types of outcome measures employed. However, a number of trends are common in the evaluation design and process.

*Form of analysis and perspective*

The rehabilitation outcomes evaluated are typically multiple, pertaining to role and function and, in 42% of the studies, the intervention has consequences to family friends and/or informal caregivers. In line with economic theory this suggests that CBA, undertaken from a societal perspective, would prove the most suitable method of economic evaluation. The analysis would include costs and consequences accruing to all sectors as a result of the provision of the service.

However, 89% of studies use some form of cost effectiveness analysis rather than CBA and the perspective used in 67% of studies is that of the service provider. Only 16% of the studies adopted a societal perspective. By adopting a narrow perspective the costs and consequences outside this viewpoint are hidden and few of the studies gave mention to costs and consequences outside the perspective chosen.

Use of CEA is not unexpected given it is the most prevalent form of economic evaluation in the health care sector. However, the rehabilitation outcomes and rehabilitation interventions often cross between the health and social sectors and, given that CBA allows comparisons between interventions with different outcomes across sectors, this type of analysis can be seen as more appropriate.

The multiple outcomes also give rise a priori to the expectation of the use of CUA as the preferred method of analysis. The analysis, through the quantification of preferences or utilities, attempts to place a value on both the quality and quantity life and thus take account of changes in both function and role. However, only three studies are of this type.

CCA has been employed by the majority of studies (58%). This form of analysis is the least preferred by economic theory as no attempt is made to aggregate the results or indicate the relative importance of components. However, use of a multiple of outcome measures may aid a more comprehensive reflection of the changes resulting from an intervention than a single measure.

### *Effectiveness*

Whilst the rehabilitation intervention under evaluation is typically compared against current or previous practice (87%), the design of the effectiveness component of the evaluation is more varied. RCTs are considered to be the gold standard and 38% of the studies employ this type of design. However, the remaining studies use a number of different designs; the diversity in undertaking an evaluation of the effectiveness of the intervention followed no discernible pattern when related to setting, service area or expected outcomes.

Similarly, the sample numbers within the evaluations ranged across a wide spectrum; from single person studies to evaluations that included over 1000 patients. In addition, despite the recommendations to ensure trials of an adequate size only seven of the studies indicated that power calculations had been used to determine sample size. The mean sample size for those studies that used power calculations was statistically higher than for those who did not.

### *Outcome Measurement*

Outcomes have been measured or reflected in a number of different ways. This includes the use of validated generic and condition specific outcome measures, validated quality of life and health related quality of life scales and proxies for effectiveness such as length of hospital stay or discharge home. The number of outcome measures used in studies varies from one to ten. The mean number of measures is three.

Few studies attempted to measure the consequences accruing to family, friends or informal caregivers. Of those that did, three were concerned with costs and two used carer satisfaction indices and carer mood scales.

In general the evaluation of effectiveness was well documented in the studies. However, a particular weakness in a number of studies concerned the explanation and justification for the outcome measure used. Expected patient outcomes and the outcome measures employed were not linked.

## *Costs*

The cost component of the evaluations was typically far less detailed than the effectiveness analysis and in some cases vague (in 16% of studies costing methods were unclear). There was no dominant method of costing. Studies used a variety of different methods ranging from gross-costing to micro-costing or a combination of different methods. Despite the different methods employed cost boundaries appeared to be in line with the perspective of the study.

Only half of the studies presented costs and quantities separately whilst 60% included some form of inclusion and exclusion criteria. The lack of inclusion and exclusion criteria limits the appraisal of the evaluations in as much as it is not possible to tell if all relevant resources used have been included in the analysis.

Where discounting was appropriate for costs it was used. However, only 53% of the studies carried out any statistical analysis on costs and only 22% of studies use sensitivity analysis to take account of uncertainty in either costs or outcomes.

## **Conclusion**

The diversity found in the evaluations followed no discernible pattern. There was no link between, for example, sample size and study design or perspective and setting. The evaluations often fell short of the ideal evaluation outlined in the methodological texts. Evaluation of rehabilitation interventions in the real world deviate from this model. The trends apparent include the use of CEA, a narrow perspective or viewpoint from which the study is carried out, use of a variety of study designs and outcome measures, and an often poorly described cost analysis. Statistical analysis was typically carried for effectiveness data but not for costs. Few of the studies carried out power calculations to determine sample size and few used any form of sensitivity analysis to determine how estimates may influence the results.

Whilst the evaluations appraised give details of the methods used there is little focus upon the constraints addressed when undertaking the evaluation and how they influenced the evaluation. The rehabilitation interventions evaluated conform to the

model of rehabilitation presented in Chapter Two but the studies alone do not provide evidence of how the characteristics inherent in rehabilitation and rehabilitation interventions constrained or limited economic evaluation.

In order to address the constraints placed on an economic evaluation and to determine the how they influence the evaluation an economic evaluation of a rehabilitation intervention has been carried out. Chapter Six outlines how the rehabilitation intervention that forms the basis of this case study was chosen in line with the definitions and model of rehabilitation presented in Chapter Two. Chapter Seven describes the methods of evaluation and Chapter Eight presents the results. Chapters Nine and Ten explore how the constraints and limitations influence how the evaluation design and process.

Using evidence from the case study and the studies identified in this chapter the final chapter discusses the difference between textbook evaluation and real world evaluation and whether the multifaceted components of rehabilitation can be or are meaningfully evaluated within the existing framework of economic evaluation.

## Chapter Six

### A Case Study: Evaluating a Rehabilitation Programme

#### Introduction

As detailed in the previous chapter, the literature reveals a number of trends and commonalities in economic evaluations of rehabilitation programmes or services. These trends span a number of areas within the evaluation process in terms of the method of evaluation most commonly used, the comparator chosen, the perspective from which studies are undertaken and the outcomes identified and measured.

Whilst these papers provide details of the evaluation methods and the results drawn from those evaluations little reference is made to the processes by which those evaluations were designed, the constraints and limitations imposed upon the evaluation design and the practical limitations faced when carrying out the evaluation. In order to identify the limitations and constraints placed upon the design of the economic evaluations in rehabilitation, and to explore how those constraints influence the results an economic evaluation of a rehabilitation programme was carried out to address the issues at first hand.

#### *Criteria*

The definitions of rehabilitation and the model of rehabilitation interventions presented in Chapter Two show that rehabilitation and rehabilitation interventions require:

*...a mixture of clinical, therapeutic and social interventions that address issues relevant to a person's physical and social environment (that) needs to be responsible to users' needs and wishes, purposeful, involve a number of agencies and disciplines and be available when required (Nocon and Baldwin, 1998, p5)*

The rehabilitation intervention to be evaluated in the case study was chosen in line with these requirements. It was anticipated that an evaluation of a multidisciplinary rehabilitation service that spanned across sectors and agencies and addressed clients'

health *and* social needs would allow the most comprehensive analysis of the barriers or constraints faced when undertaking an economic evaluation of a rehabilitation service.

Whilst this criterion was of primary importance another, more practical, criterion was also implicit concerning the feasibility of any evaluation. Dictating factors included the feasibility of undertaking an evaluation of the service or programme in the time available; the geographic location of the service in terms of researcher travel time and costs; and, importantly, the willingness of the service providers to allow an evaluation to be carried out.

### *Programmes/services explored*

A number of rehabilitation programmes and services were considered. Some of the services were new, some had been in existence for some time and two were in the developmental stage. The programmes/services explored are detailed in Table 4.

Of the six rehabilitation services considered three were community based, two hospital based and one was hospital based but also had a community team attached. Three of the services dealt exclusively with neurological rehabilitation whilst the remainder provided services for clients with complex problems.

Within the context of this study all of the services showed some form of multi-agency working but the degrees of involvement and interaction between the agencies differed significantly. All stated their aim as to address health and social needs.

**Table 4: Rehabilitation programmes considered for case study**

Service	Client Group	Setting	Health & Social Needs	Multidisciplinary	Across Sector working	Description	Other
Neurological Rehabilitation Team	Neurological conditions including MS, Parkinsons and Stroke. All ages	Community	Yes	Yes	Yes	Team of health professionals	Primarily health based; no social worker attached to team but case conferences attended monthly by a social worker
Neurological Rehabilitation Unit	Neurological conditions. Adults between the ages of 16-65.	In-patient intermediate unit within hospital	Yes	Yes	Yes	Team of health professionals	Primarily health based; no social worker attached to team but use community social workers
Rehabilitation Unit & Team	Acute or complex rehabilitation needs. All ages	In-patient intermediate unit within hospital plus community	Yes	Yes	No	Team of health professionals only	
Neurological Rehabilitation Unit	Neurological conditions. All ages	Acute unit within hospital	Yes	Yes	Yes	Team of health professionals & social workers	New service at present in development stage (construction of unit in progress 5/00)
Rehabilitation Team	Complex and multiple health problems. Aged 65 or over	Community	Yes	Yes	Yes	Team of health professions including OTs employed by Social Services	Evaluation of one component of the service recently carried out
Rehabilitation Team	Complex medical/social/psychological problems. Aged 65 or over	Community	Yes	Yes	Yes	Team of health professions, social workers, home carers & voluntary agencies	New service; commencement date 7/00

Five of the services, although fitting the criteria, were deemed unsuitable as a case study. This was for diverse reasons. Three of the services were primarily health based and whilst there was interaction with other agencies (in all cases social services) this was mainly in the form of referrals. One of the services was not yet in existence and the proposed commencement date was outside the time frame of the study. Within another service an evaluation of the generic workers' role within the rehabilitation teams had recently been carried out. The practitioners felt that a further evaluation within such a short time span would be inappropriate. The fifth service appeared to fit all the criteria but another evaluation was already being carried out (exploring client, carer and referrer satisfaction with the service). The final rehabilitation service, a community rehabilitation programme for older people with complex medical/psychological/problems, appeared to fit both the primary criteria and the practical considerations outlined.

The service met the primary criterion; it aimed to provide a mixture of clinical therapeutic and social interventions that address individual's physical and social environment and would involve a number of agencies and disciplines. The service also met the practical criterion. The evaluation could be carried out in the time available, the geographic location of the service was feasible in terms of travel and the service providers were happy for the service to be evaluated.

## **The Rehabilitation Programme**

### *Background*

In 2000, a Joint Investment Plan (JIP) for older people with complex needs was introduced across South Cheshire. The programme was developed in response to national policy initiatives (DoH, 1997) increasing evidence on the potential role of rehabilitation targeted at those in need (Nocon and Baldwin, 1998; Sinclair and Dickinson, 1998) and the value of a care managed approach (DoH, 1999), and findings from local consultations with users, carers, purchasers and providers. The latter pointed to the wish of older people to remain in their own homes and the need for targeted rehabilitation following hospital admissions (Reid et al, 2002).

The JIP outlined a service that comprised a network of health, social and voluntary agencies working together across organisational boundaries. The aim of the service was to maximise older people's ability to live independently. Based on a care managed model by which care managers are responsible for identifying individuals needs, tailoring services to meet these needs (Morgan, 1996), the Assessment and Rehabilitation Service was to be delivered by three rehabilitation link teams (RLTs) with one in each of West, Central and East Cheshire.

The Assessment and Rehabilitation Service was to be evaluated in order to explore the way in which the care management model was implemented and to assess the extent to which the RLT component of the JIP achieved its aims. An economic evaluation of the Assessment and Rehabilitation Service would dovetail with the wider evaluation and the service funders were happy for it to be carried out alongside the main evaluation.

### **The Assessment and Rehabilitation Service**

#### *Aims*

The service delivered by the three RLTs was based upon evidence collated in an internal report 'A Review of Rehabilitation Services for Older People: A service without walls' carried out in East Cheshire in 1998-9. These principles informed the aims of the service, which were two-fold:

- To avoid people being admitted to hospital or long term care unnecessarily
- To enable people to remain safe and well at home by maximising their independence

*(Internal document; Rehabilitation Link Teams, 2000)*

These aims would be achieved through a multi-disciplinary assessment and rehabilitation service offered as part of an integrated service, with full multidisciplinary assessment preceding rehabilitation work. Each rehabilitation programme would be co-ordinated by a single individual (the care manager) and be time limited (approximately six weeks).

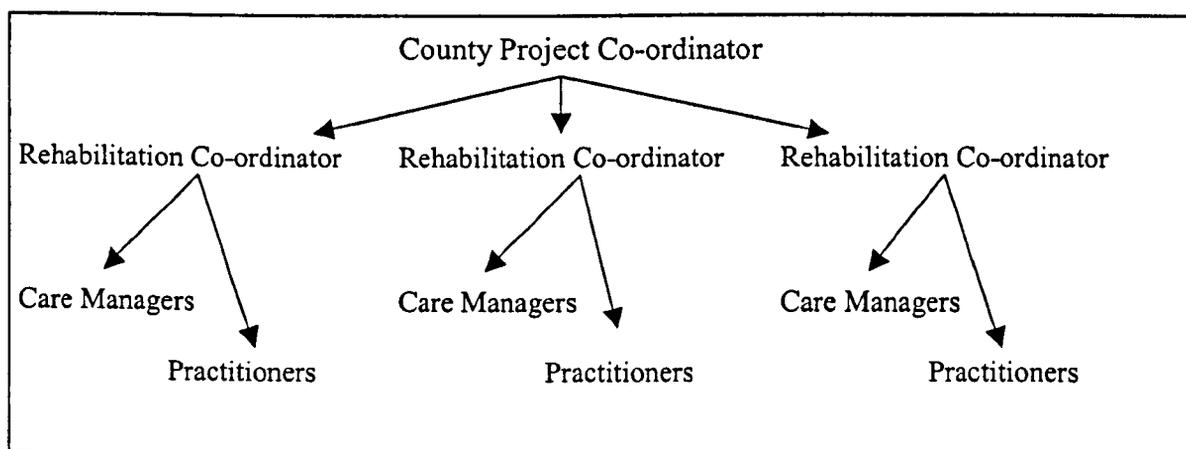
In line with the guiding principles:

- Standards for multidisciplinary assessment and rehabilitation work would be consistently implemented and monitored across all settings
- Assessment and rehabilitation would be offered to all people across a range of locations; focused on people's needs rather than around professional disciplines; broadly based, working on functional skills, motivation, confidence and the external environment

### *The structure of the RLTs*

The structure of the RLTs is shown in Box 5. Whilst the composition of the teams varied across locations the structure did not. The County Project Co-ordinator held primary responsibility for development of the service. The line manager for each team was the Rehabilitation Co-ordinator. Care managers carried out the assessments and formulated and co-ordinated clients' rehabilitation programmes.

### **Box 5: Structure of the RLTs**



Care managers were drawn from a number of professions:

- Community psychiatric nurse
- Social worker
- Occupational therapist
- Physiotherapist

- Nurse

Practitioners included physiotherapists, occupational therapists and a clinical nurse specialist (nurse consultant). In addition to these core team members a number of associate members were attached to the teams. These included therapists, administration and clerical staff and Red Cross workers. Further services were commissioned from other professions and agencies, for example, home care.

### *Acceptance criteria*

The criteria for inclusion on to a rehabilitation programme were laid out in an internal document. People referred for rehabilitation should:

- Be aged 65 years or over
- Be registered with a GP in the local area
- Have complex or varied social/medical/psychological problems that would benefit from a care managed approach offering a single assessment and co-ordinated package of care
- Be medically stable and medically fit to participate in rehabilitation
- Wish to and have potential to regain some independence through interdisciplinary assessment and rehabilitation over approximately a six week period
- Have a level of memory recall and motivation that allows active participation in an intensive rehabilitation programme.

### **Use of the Programme within the Evaluation**

Detailed perusal of the aims, acceptance criteria and structure of the RLTs indicated that the programme met all the criteria previously set down for an economic evaluation.

The multi-agency approach adopted by the RLTs meant that input originated from a number of sectors (health, social services and the voluntary sector in the guise of the Red Cross). In addition to the multi-agency and multidisciplinary approach adopted by the teams, the care managers' role aims to exemplify interdisciplinary working.

*Multidisciplinary care is based on the premise that health care is delivered by a team, each member of which has a different professional training and brings different skills to bear. The main task is therefore to co-ordinate the team effort. Interdisciplinary care, although not denying the importance of specific skills, seeks to blur the professional boundaries and requires trust, tolerance, and a willingness to share responsibility (Nolan, 1995, p305).*

This interdisciplinary approach is becoming increasingly prevalent in the health sector.

The nature of the criteria set by the teams meant that outcomes were likely to be both multiple and diverse. Through the acceptance of older people with a wide range of difficulties (social, medical and psychological) it was anticipated that changes over the course of any rehabilitation programme would be reflected in all these areas. This could be preferable to a more condition specific programme. The constraints and limitations faced in designing and carrying out an economic evaluation in a condition specific field may not be as generalisable to rehabilitation services outside that field.

In addition to the benefits derived from the anticipated multiple inputs and outputs there also exists a further advantage to using the RLTs rehabilitation programme for the evaluation. The service, whilst essentially community based, aimed to include rehabilitation for clients who are within residential community support centres that will then be carried forward by the teams into a community setting. Thus, the rehabilitation programme should allow the evaluation to cross barriers imposed by the setting and to explore constraints imposed when undertaking the analysis in the community and in a hospital type setting.

Thus, the programme delivered by the RLTs was chosen to form the basis of the case study. However, choice of this programme was not without disadvantages. Whilst the rehabilitation programme is not condition specific its *raison d'être* is to provide an assessment and rehabilitation service for *older* people. This restricts the potential economic evaluation, as it is unlikely that any evaluation will include, for example, productivity gains or losses given the probability that clients are of retirement age. The

constraints or limitations faced when carrying out an evaluation may be specific to this population.

The service was chosen to form the case study prior to its inception. This provided a number of advantages in as much as members of the RLTs were aware that the programme was to be evaluated when they were recruited and were receptive to the evaluation. However, there are a number of difficulties that arise when evaluating a new service or new policy initiative. These include, for example, deciding when the evaluation is to begin to allow a 'bedding down' period.

The 'practical' criterion was also met; the service could be evaluated in the time frame allowed; the geographical location of the teams was acceptable in terms of travel time and costs and the service providers were happy for an economic evaluation to be carried.

### **Overview of the Case Study**

Chapter Seven details the methods used to carry out an economic evaluation of the rehabilitation programme. It highlights the limitations and constraints within the design process and how they were addressed or overcome and details the methods employed to collate and record both the costs and benefits of the programme. Chapter Eight presents the results of the economic evaluation.

Chapter Nine provides an in-depth discussion of those limitations and constraints. Focus lies upon conceptual and practical difficulties; how they shaped the evaluation in terms of the study design and the data collection process and analysis; the effect upon the results of the evaluation and decisions based upon those results.

Chapter Ten considers what happens to the analysis if the parameters of the evaluation change. Three models explore a change in the perspective of the evaluation; a change to the way in which costs are calculated; and a change in the way outcomes are presented.

## Chapter Seven

### A Case Study: Methods

#### Introduction

When undertaking evaluations of new initiatives a number of issues arise. These include the absence of a baseline for comparison, the absence of randomisation, the impact of other measures, the reliance of subjective opinion and problems with generalizability (Sanderson, 2001). Given these obstacles, the economic evaluation of the RLTs adopted a pragmatic approach informed by the constraints imposed on the study.

The economic evaluation was part of a wider project commissioned by South Cheshire Health Authority and Cheshire County Council (Social Services) whose research aimed to:

- Explore the way in which the care management model was implemented
- Assess the extent to which the RLT component of the Joint Investment Plan achieved its aims (Reid et al, 2002)

#### Study Question/hypothesis

The economic evaluation has been designed with these aims in mind in order to complement the wider research project. South Cheshire Health Authority and Cheshire County Council asked that economic evaluation provide information of the costs to the service providers and the effectiveness of the programme. The economic evaluation set out to answer the following questions:

- What is the cost of the programme?
- Is the programme effective?
- How do cost and effectiveness compare with the previous practice?

Thus, the economic analysis was undertaken from the perspective of South Cheshire Health Authority and Cheshire County Council (Social Services).

### **Selection of Alternative**

The basis of any evaluation is comparison and it became obvious in the early stages of planning the evaluation that there were a number of difficulties associated with comparing the programme against the previous rehabilitation practice. This was for a variety of reasons: the rehabilitation programme was not phased in gradually, thus, all clients who fitted the criteria were accepted onto the programme; the previous practice no longer existed. In terms of the effectiveness of the programme it was not possible to use retrospective outcome data relating to clients who had undergone rehabilitation prior to the RLTs. The previous practice was disparate and client outcomes were not measured in any consistent or comprehensive manner.

Consideration was given to the use of data relating to hospital admissions, hospital readmissions, length of hospital stays and admission rates to residential care in previous corresponding time periods to provide an indication of the effectiveness of the programme and provide a basis of comparison. These types of indicator would be crude in as much as whilst they could illustrate reductions in hospital or long term care admissions they were not indicative of improvements in health and social functions; in quality of life for those clients using the service. However investigation showed that because 'rehabilitation' encompasses a number of medical conditions and in view of data indicating that the number of residential care places in South Cheshire were declining the evidence they could provide would not be robust.

The absence of data relating to the previous practice led to the effectiveness component of the economic relying solely upon a non-randomised prospective before and after type study design by which client outcomes are measured at assessment for acceptance onto the rehabilitation programme and again at discharge from the programme. Use of this type of design precludes a comparison of the effectiveness of the programme to that achieved by the previous rehabilitation practice. It is not possible to determine whether any improvements affected are better or worse than they would have been under the previous regime.

The before and after type study type of design is considered inferior to a randomised controlled trial and has implications for inferences made from the results. The internal validity of the study may be threatened by history or maturation, whilst a reactive effect to testing and selection bias pose threats to external validity (Campbell and Stanley, 1963).

For example, respondents may experience a medical crisis unrelated to the condition for which he or she was referred to the RLT that may impact on the measurement of outcome at discharge (history). Alternatively, respondents may show an improvement over time that is a result of the passage of time rather than a result of the intervention (maturation).

Selection bias may occur due to non-randomisation whilst a reactive effect (in particular, the Hawthorne effect and social desirability effects) may occur because the respondents' knowledge of the study influences their behaviour or respondents may change their behaviour simply because someone is taking an interest in them (Bowling, 1997). The use of a randomised controlled trial controls for selection and maturation effects, but like other studies is unable to control for other reactive effects; indeed the RCT is often criticised for having a contrived setting.

Whilst the effectiveness analysis uses a before and after type study the cost analysis overcomes the lack of data and evidence relating to the previous rehabilitation practice by use of a hypothetical comparator – a 'what if?' scenario. The costs of the rehabilitation programme have been compared against the cost of the likely scenario of action had the RLTs not been in place. However, as with the effectiveness component of the study, lack of data of the previous practice precludes direct comparison. Thus the scenarios merely provide a method by which to set the costs of the programme into context (for example, by comparing them with the cost of residential care or nursing home placement).

## Effectiveness

### *Outcome measures*

The aim of the rehabilitation programme is to avoid older people being admitted to hospital or long term care unnecessarily and to enable people to remain safe and well at home by maximising their independence. The rehabilitation client group was defined as older people with complex medical/social/psychological problems. As such a number of outcome measures suitable for this population were chosen in order to reflect both health and social implications of the aims of the programme:

- EQ-5D
- Modified Barthel Index
- Hospital Anxiety and Depression Scale (HADS)

Following a pilot study of the measures the care managers were instructed to administer each of the measures to clients at assessment for inclusion onto a rehabilitation programme and again at discharge from the programme. The measures were compiled in one booklet for ease of administration (appendix 2) in the following order: the Barthel was administered first, followed by the HADS then the EQ-5D.

### *EQ-5D*

Quality of life scales attempt to measure domains such as emotional and social function, well being, disability, and overall health status (Kirshner & Guyatt, 1985). Given the aims of the RLTs embrace both health and social needs, it was felt that such a measure, in conjunction with the Modified Barthel Index and the HADS, would be appropriate to reflect the extent the aims were achieved.

Any quality of life measure chosen needs to meet specific criteria, namely:

- An evaluative index (able to measure the magnitude of longitudinal change in an individual or group (Kirshner & Guyatt, 1985)).

- Validated for this population group.
- Relatively concise and easy to administer in order not to overburden respondents.

The EuroQol EQ-5D fitted the criteria. The EQ-5D has been developed as a standardised non-disease specific instrument for describing and valuing health related quality of life (Brooks & the EuroQol Group, 1996) and is for use alongside more detailed condition specific or treatment specific measures (Williams, 1995). The measure has been designed to be self-completed but may be interviewer administered.

Existing literature outlining the use of the EQ-5D to assess quality of life in older people presents a mixed picture but tends to show good evidence of validity and that the measure is simple to administer (Holland, 2002). Brazier et al (1996) conclude that the EuroQol health status questionnaire, which is short and quick to complete, appears suitable for use with older people; their study found significant correlations between the EQ-5D, SF-36 and OPCS Disability Survey. Coast et al (1998) also use the EQ-5D among older people; again, study results find high correlations between the EuroQol and other indices (in this study the Barthel Index and the COOP-WONCA).

In view of the mixed evidence when using the EQ-5D to assess quality of life in older people reported by Holland et al (2002) and to explore clients' experiences of the EQ-5D, data was collected of clients' request for help, clarification or explanation when completing the measure.

In order to collect this data a prompt was included at the end of the EQ-5D questionnaire that read 'did you need to explain any of these questions?' followed by a yes/no box. The care manager was instructed to complete this box when administering the EQ-5D. Care managers were interviewed within one week of the assessment to determine if help/clarification/explanation had been requested and their comments noted. In addition each of the EQ-5D questionnaires, at both assessment and discharge, were manually checked for written comments and to ascertain if they had been altered in any way.

### *Modified Barthel Index*

Mahoney and Barthel developed the Barthel Index in 1965 as a measure of functional independence in personal care and mobility (McDowell and Newell, 1996) for use before and after treatment; it is a widely used measure of activities of daily living (ADLs). Wade (1992) reports that the original Barthel Index's validity is well-established and, although not perfectly reliable, its reliability has been studied in several ways and settings, including rehabilitation (albeit within neurological rehabilitation). He also notes that it is:

*'extremely simple to use and, for most patients, takes no more than two or three minutes to complete'* (Wade, 1992, p75).

The Modified Barthel Index was developed to improve the sensitivity of the Barthel Index by expanding the number of categories used to record improvement in each ADL function (Shah et al, 1989). The modified version showed improved reliability (internal consistency reliability co-efficient of 0.90 compared to 0.87). The Royal College of Physicians of London and The British Geriatrics Society recommend use of this modified version for assessment for older people (1992).

In the evaluation the modified version was used in conjunction with the guidelines for its use and interpretation of the scores (Shah et al, 1989).

### *Hospital Anxiety and Depression Scale (HADS)*

The HADS was chosen to reflect changes in anxiety and depression. It was designed in 1983 as a measure of a person's present state of mind and to provide a reliable, valid and practical tool for identifying and quantifying the two most common forms of psychological disturbances in medical patients (Herrmann, 1997).

The HADS consists of fourteen items (seven for each domain) and may be used in hospital outpatient or community settings for repeat administration in order to measure outcomes ([www.nfer-nelson.co.uk/html/health/products/hads.htm](http://www.nfer-nelson.co.uk/html/health/products/hads.htm); accessed 29 July 2002). The measure may be self-administered although it is recommended that it is interviewer administered (Snaith, 1987). The HADS is an easily administered measure

which is not unduly burdensome (Johnston et al, 2000) and can be completed in two - six minutes (Herrmann, 1997).

The HADS is used extensively to identify and quantify anxiety and depression. Bjelland et al (2002) review 747 papers that used the HADS and conclude that:

*'the HADS was found to perform well in assessing the symptom severity and caseness of anxiety disorders and depression in both somatic, psychiatric and primary care patients and in the general population'* (Bjelland et al, 2002, p69).

This view is in line with a previous review of 200 published papers (Herrmann, 1997) that reports clinically meaningful results and a sensitivity to change in response to psychotherapeutic and psychopharmacological interventions. Whilst it is acknowledged that depression among older people is a significant problem (Consensus Statement, 1991) few of the published papers focus exclusively on older populations but rather condition groups. However many of the sample populations within the studies included in both reviews include older people. Flint and Rifat (2002) investigated whether the HADS functions as a bidimensional measure of anxiety and depression in older patients with major depression and found the HADS to be *'a valid instrument for measuring severity of anxiety, independent of other depressive symptoms'* (Flint and Rifat, 2002, p117) in this population.

#### *Reintegration into Normal Living Index*

In addition to the measures outlined above a further measure, the Reintegration into Normal Living Index was chosen at the outset to reflect improvements in social functions. The index was developed in 1987 and, as the name suggests, has been designed to measure reintegration into normal living patterns. Wood-Dauphinee et al (1988) define reintegration to normal living as:

*'the reorganisation of physical, psychological and social characteristics so that the individual can resume well adjusted living after incapacitating illness or trauma'* (Wood-Dauphinee et al, 1988, p583).

The content of the Index is similar to that of quality of life measures (Wood-Dauphinee and Williams, 1987) and includes: mobility, self care abilities, daily activities, family roles, personal relationships, presentation of self and general coping skills.

However, despite the appropriateness of the measure in the rehabilitation setting, the index was omitted from the study following discussion with care managers (who administered the outcome measures). The care managers perceived the measure to have limited relevance to many older people (indeed Wood-Dauphinee and Williams (1987) acknowledge the index is somewhat related to work status) and felt that the language used within the measure would cause some confusion (Reid et al, 2002).

### **Form of Evaluation**

In line with the study questions and in order to accommodate the constraints placed upon the study design, and the multiple aims of the rehabilitation programme, the analysis is in the form of a CCA by which the costs and outcomes are presented separately (no attempt is made to aggregate the results).

### **Sample and Time Scale**

Data was collected over a twelve month period between May 2001 and April 2002.

The study recruited clients referred to the RLTs over a 13-week period (21<sup>st</sup> May – 19<sup>th</sup> August 2001) who had subsequently been accepted on to a rehabilitation programme and given their consent for their records to be accessed by the research team. There was no randomised selection process – all clients who consented to take part were included in the study. Seventy three clients gave consent and formed the members of the study group. Both the cost analysis and effectiveness analysis are based upon this group.

At inception the RLTs envisaged that each rehabilitation programme would take place over a six weeks period. However, this proved to be unrealistic given the complex problems that, in line with the acceptance criteria, the clients experienced. Although a number of clients completed their rehabilitation programmes within this period many were on programmes for a longer time.

Initially the study intended to follow each of the clients within the group through assessment (for acceptance on the programme) to discharge from the programme and again at six months after discharge. It was believed that follow up at six months would provide evidence of the longer-term impact of the programme. But due to the long periods of time clients spent on the programme this proved to be unfeasible in the context of this study as of the 73 clients recruited to the study follow-up data at three months post-discharge was collected for only 18 clients. Thus, the results reported are of each of the clients recruited, tracked from assessment (acceptance on to the programme) to discharge from their rehabilitation programme.

### **Setting**

The three RLTs covered the South Cheshire area and were based in three different geographical locations across the County (East, West and Central).

The RLTs' programmes form a component of intermediate care provided by South Cheshire Health Authority and Cheshire County Council (Social Services). Rehabilitation may take place in a residential centre, day centre or in the clients' own home and, as such, was community based.

### **Cost Analysis**

The cost comparison was undertaken from the perspective of the programme providers (South Cheshire Health Authority and Cheshire County Council). The analysis uses a micro-costing method or a bottom up approach. In line with standard costing practice the resources have been identified, measured and valued (Raftery, 2000).

### **Selection of Alternative**

In the absence of data relating to previous practice and in order to be able to place the rehabilitation cost per client into context the evaluation used a 'what if?' scenario. The care managers were asked '*what would have happened to the patient in the absence of*

*the RLT?* The care managers' comments were coded using abstract categories coded into four areas:

1. Probable that the client would have been admitted to residential care
2. Likely that the client would have been discharged to social services care without rehabilitation input but with an increased home care package
3. Likely that the client would have been admitted to hospital
4. Probable that the client's discharge from hospital would be delayed

These formed the basis of the cost comparison to provide an indication of the cost of alternative courses of action. However, for analysis purposes, the latter two categories were amalgamated, as it was clear that the cost of both alternatives equated to the cost of hospital in-patient days.

## **Data**

Data was collected prospectively with details of resource use for each client being recorded and valued in order to provide a cost of rehabilitation per patient estimate.

Data on the resources used for each client's rehabilitation programme were collected from the care managers, practitioners and health and social services records (Table 5). The resources were split into two distinct areas: human resources and in-patient stays. Human resources included all services such as physiotherapy and occupational therapy commissioned by the care managers as well as the time of the care managers themselves. In-patient days included hospital in-patient days and stays in community support centres.

Data collection began once clients had been accepted onto the programme and had provided consent for the research team to have access to their records. At this time the care manager was asked to provide details of other practitioners involved in the client's care and of any other services commissioned, for example, home care or community support centres stays.

**Table 5:** Sources of the data recorded

<b>Resource</b>	<b>Source of Data</b>
Community Occupational Therapist (Health & Social Services)	Practitioner
Community Physiotherapist	Practitioner
Community Psychiatric Nurse	Practitioner
Community Support Centres	Care Manager & Social Services Data
District Nurse (Care Manager)	Practitioner
Hospital In-patient Days	Care Manager, Client records
Local Authority Home Care Worker	Care Manager, Practitioner & Social Services Data
Nurse Consultant	Practitioner
Social Work Assistant	Practitioner
Social Worker	Practitioner
Therapy Support Worker	Practitioner

The researcher recorded how much time the care manager had spent with the client (including undertaking the initial assessment), any associated travel time and time spent in client associated activities such as writing up notes, arranging appointments, commissioning services and liaising with relatives. Care managers used appointment diaries and client running notes to provide this data. This process was repeated, typically on a weekly basis until the client was discharged from the rehabilitation programme.

Other practitioners involved in the clients' rehabilitation programme (with the exception of those practitioners providing pre-RLT ongoing care or care outside the rehabilitation teams remit) were contacted in writing. Practitioners were asked to provide details of time spent with the client, any associated travel time and time spent in client associated activities such as writing up notes, arranging appointments, liaising with relatives.

At client acceptance and discharge from the rehabilitation programme the researcher recorded whether the client lived at home, in residential care or was in hospital. For

those who lived at home details of their home care packages post-discharge were recorded.

### **Inclusion and Exclusion Criteria**

Services that were on-going or had been commissioned prior to the clients' inclusion on the rehabilitation were *excluded* from the cost analysis. This embraced GP and district nurse visits and hospital outpatient visits. The exclusion for the analysis was made on the assumption that these were part of the clients' on-going health care programme and would have taken place whether or not the client had taken part in the rehabilitation programme.

For hospital in-patient days, arising from emergency admissions, for example, as a result of a fall or because of a deteriorating existing medical condition, the cost analysis presents two different scenarios, either including or excluding their cost. The analysis presents both scenarios as it is not possible to assume that these emergency admissions would or would not have occurred in the absence of the RLTs.

The cost of the initial assessment for those clients accepted onto rehabilitation programme was *included* but, the hidden cost of those clients who were assessed but *not* accepted onto the programme was *excluded*. Clients not accepted on to the programme did not complete a consent form allowing the researcher access to their records and therefore individual level data of these assessments could not be collected. However, estimates of those costs have been calculated and are explored in Chapter Nine.

There are likely to be knock on costs to community services if the programme achieves its aim of avoiding unnecessary hospital and long term care admission. Knock on costs might include the costs of sheltered housing or housing benefits. The limited time available and the lack of follow up data precluded inclusion of these costs.

## Valuation

All resources costs have estimated giving a 2000/2001 value using Unit Costs of Health & Social Care 2001 (Netten et al, 2001) with the exception of the nurse consultant. The unit cost of the nurse consultant was valued and converted to 2000/2001 prices using the formula outlined within Netten et al based upon an average basic pay of the 21 nurse consultants 1999 salary of £34,500 taken from the Department of Health NHS Staff Earnings Survey. The valuations are shown in Table 6.

Data collection at an individual level that included client contact time, non-contact time and travel time allowed use of the estimated per hour cost of the professionals involved in the rehabilitation programme. As shown in the table all costs include overheads (management, administrative and capital). The only exception to this is the valuation of private residential care where the unit cost is assumed to be the fee. For all human resources, salary oncosts include employer's National Insurance plus a percentage of salary for employer's contribution to superannuation.

The per unit cost of local authority home care is based upon a typical home care package of 5 hours per week at a cost of £54.56.

Table 6: Valuation of resources

Resource	Cost 2000/1 values	Valuation Includes:
Community Occupational Therapist (Health Authority)*	£21 per hour	Wages/salary, salary oncosts, overheads and capital overheads
Community Occupational Therapist (Local Authority)	£20 per hour	Wages/salary, salary oncosts, overheads and capital overheads
Community Physiotherapist*	£21 per hour	Wages/salary, salary oncosts, overheads and capital overheads
Community Psychiatric Nurse*	£21 per hour	Wages/salary, salary oncosts, overheads and capital overheads
Community Support Centre (local authority short term residential care)	£466 per week	Capital costs (buildings and oncosts, land, equipment and durables), revenue costs (salary costs and other revenue costs), agency overheads
District Nurse*	£21 per hour	Wages/salary, salary oncosts, overheads and capital overheads
Hospital In-patient Days (geriatrics)	£144 per day	Incorporates an overheads element to reflect the cost of capital and support services
Hospital Therapy Support Worker	£11 per hour	Wages/salary, salary oncosts, overheads and capital overheads
Local Authority Home Care Worker	£10.91 per hour	Wages/salary, salary oncosts, direct overheads and indirect overheads
Nurse Consultant	£31 per hour	Wages/salary, salary oncosts, overheads and capital overheads
Private residential care for elderly people	£278 per week	Fees
Social Work Assistant	£13 per hour	Wages/salary, salary oncosts, overheads and capital overheads
Social Worker*	£18 per hour	Wages/salary, salary oncosts, overheads and capital overheads

\* Denotes those professions from which care managers were drawn.

*Valuation of alternative scenarios*

The alternative scenarios were, again, valued in line with Netten et al (2001) with estimates given a 2000/2001 value. The values are shown in Table 7 below.

**Table 7: Valuation of Alternative Scenarios**

<b>Hospital In-patient Days (geriatrics)</b>	£144 per day	Incorporates an overheads element to reflect the cost of capital and support services
<b>Private residential care for elderly people</b>	£278 per week	Fees
<b>Independent nursing home for elderly people</b>	£384 per week	Fees
<b>Home Care Package</b>	£203 per week	Wages/salary, salary oncosts, direct overheads and indirect overheads

The home care package represents 13.25 hours of home care per week. Visits take place on Monday to Friday before 5pm (9.5 hours per week); weekday evenings (3.75 hours) and weekends (4.5 hours per week).

### **Data Analysis**

All the quantitative and cost data were analysed using SPSS for Windows version 10. Appropriate statistical tests of significance were used, with the significance level set at  $p < 0.05$ . Uncertainty has been accounted for using 95% confidence intervals.

Data has been analysed to determine if it is parametric using Kolmogorov-Smirnov test. Differences in parametric data are analysed using t-tests and ANOVA for independent samples. Non-parametric data differences are analysed using Mann Whitney U test and Kruskal-Wallis test for independent samples and Wilcoxon Signed Ranks test for repeated measures samples.

In respect of the cost data rather than use non-parametric tests such as the Mann Whitney U test, the data has been transformed into natural logs in order to report

differences between sub-groups using t-tests (independent samples) whilst the confidence intervals for these groups are reported in their original states. The data is transformed because it is suggested that non-parametric tests are inappropriate for cost data (Briggs and Gray, 1999).

Cohen's effect size index and the squared point biserial correlations are used to indicate the importance of changes in costs and outcome measures in addition to significance levels. Correlations have been analysed using Spearman's Rho.

Qualitative data for the 'what if?' cost categories and data collected relating to the experience of using the EQ-5D has been coded thematically using content analysis (Gomm et al, 2000). Themes for the cost data include admission to residential care, return home with an increased care package, delayed hospital discharge and hospital admission. Each of the themes is mutually exclusive. The EQ-5D data related to limited understanding, perceptions, unrealistic answers and answers that were qualified or contextualised.

### **Ethical Approval**

South Cheshire Research Ethics Committee gave ethical approval for the evaluation. All the data relate to clients for whom written consent was obtained. All data have been kept in accordance with the Data Protection Acts. In particular names and codes have been kept in different locked filing cabinets. Each case is given an ID number for data analysis to ensure anonymity in reporting.

## Chapter Eight

### A Case Study: Results

#### Introduction

The economic evaluation of the RLT has been carried out using the methods outlined in the previous chapter. This chapter presents the results of the study. The data relate to clients referrals to the RLTs over a thirteen-week period (21st May – 19th August 2001). The sub-set of clients who were subsequently accepted for a rehabilitation package and who gave their consent for their records to be accessed have been tracked throughout the period of their rehabilitation programmes. The results show the characteristics of the sample population together with baseline outcome measures. Client outcomes at discharge from the programme are recorded in order to provide evidence of the effectiveness of the programme. The cost analysis presents the mean costs per client of the programme. Costs are then compared against a number of hypothetical situations.

#### Referrals

##### *Age and gender*

Over the 13 weeks period 324 referrals were made to the three RLTs. The mean age of the clients was 80.83 years and 71% were female. Despite the criteria stipulation that all persons referred to the programme should be 65 years of age or over, 15 of the clients referred to the programme (4.6%) were under the required age. Of the remainder, 34% were aged 65-79 years, 60.8% were aged 80 or over (the age of two clients referred to the programme was not available).

There is no evidence of a significant difference in age of those referred to each team (Kruskal-Wallis  $\chi^2=3.46$ ,  $p=0.177$ ). However, there is a significant difference between the ages of male and females (Mann-Whitney  $U=8175$ ,  $p=0.001$ ). The mean age of females at referral was 82.03 years (median 83, range 53.92 – 96.25) and for males 77.84 years (median 79.87, range 19.50-99). The mean age for males is skewed by a

client aged 19.5 years, but when this client is excluded there remains a statistically significant difference (Mann-Whitney  $U=8175$ ,  $p=0.002$ ) in age between gender.

### *Source of referral*

Clients were referred to the RLTs from a variety of sources (Table 8). While the proportions differed between teams, this may in part be explained by geographical location. For example, teams one and two were both located on hospital sites, and 18% and 13% respectively of their referrals came from ward nursing staff. Team three was based in a community setting, and only 2% of their referrals came from ward nursing staff.

**Table 8:** Source of referral (%)

Source of Referral	Team 1 %	Team 2 %	Team 3 %	N
Community social worker	17	29	51	103
Ward nursing staff	18	13	2	36
Therapy	10	17	4	33
Hospital social worker	9	12	7	30
Intensive health support / rapid response	13	9	5	29
Liaison nurse	4	1	16	23
Other (hospital doctors, GPs, district nurses, Challenge Fund, self-referrals)	29	19	15	18
<b>Total (N)</b>	<b>115</b>	<b>98</b>	<b>111</b>	<b>324</b>

### *Primary Diagnosis*

The diagnoses of the clients referred to the programme were recorded by the RLTs (Table 9).

Initially the clients were categorised under the following headings: orthopaedic, medical, neurological, palliative, general frailty and multiple pathology. Over the course of the referral period the teams introduced further categories of falls, surgical, mental health and a category of *other* for those clients who did not readily fit into the categories

outlined. The introduction of these categories meant that the data collected was non-uniform; for example, a client referred after a fall may have been placed under the category of orthopaedic or medical if referred in May but categorised under 'falls' if referred in August. As such these data should be treated with caution.

**Table 9: Primary diagnosis of clients at referral**

Primary Diagnosis	Team 1	Team 2	Team 3	N
	%	%	%	
Orthopaedic	16.5	20.4	30.6	73
Medical	37.4	11.2	18.9	75
Neurological	3.5	7.1	3.6	15
Palliative	4.3	2	0	7
General Frailty	7	23.5	21.6	55
Multiple Pathology	6.1	15.3	9.9	33
Other	2.6	8.2	0.9	12
Falls	14.8	8.2	6.3	32
Surgical	4.3	1	3.6	10
Mental Health	3.5	3.1	4.5	12
<b>Total (N)</b>	<b>115</b>	<b>98</b>	<b>111</b>	<b>324</b>

### Acceptance onto a Rehabilitation Programme

Once clients had been referred to the RLTs an assessment was made of each client's suitability for participation in the rehabilitation programme. The RLTs outlined six alternative courses of action upon referral (description provided by the rehabilitation team co-ordinators, 2001):

- *Client not accepted at referral:* Clients who do not meet the criteria and whose needs may be better met elsewhere. Typically the referral is discussed in an allocation meeting and may involve talking to the agency/person who made the referral.
- *Client not accepted at screening/initial assessment:* Following a visit with the client to carry out an initial screening assessment the care manager decides that a care manager programme is not wanted or not needed.

- *Client assessed and given advice:* Following a screening/initial assessment the care manager offers advice. This may involve several visits.
- *Client assessed, given advice and support:* Following a screening/initial assessment the care manager offers advice and support; this will include sign posting on to appropriate services.
- *Client accepted for a rehabilitation package*
- *Client screened for nursing home placement:* this was initially undertaken by the RLTs to ensure all avenues for rehabilitation had been explored

One hundred and thirty (40%) of those referred were accepted for a rehabilitation programme. Table 10 summarises the data. There is little variation across teams.

**Table 10: Action following referral (%)**

Action	East %	West %	Central %	N
Not accepted at referral	12.2	14.3	15.3	45
Not accepted at screening/initial assessment	29.6	27.6	24.3	88
Assessed and advice	15.7	10.2	17.1	47
Assessed, advice and support	0.9	2	7.2	11
Accepted for rehabilitation programme	41.7	42.9	36	130
Screened for nursing home	0	3.1	0	3
<b>Total (N)</b>	<b>115</b>	<b>98</b>	<b>111</b>	<b>324</b>

The mean age of those accepted onto the programme was 81.6 years and there was no statistically significant difference in the age between those who were accepted and those who were not (Mann-Whitney  $U=11334.5$ ,  $p=0.162$ ).

#### *Reason for non-acceptance onto a rehabilitation programme*

A variety of reasons were given for the 194 clients not accepted onto a rehabilitation programme. This included 26.8% of clients who were seen as displaying a *lack of rehabilitation potential*, 26.3% were categorised as needing a *mainline services only*,

16% were deemed to be *medically unfit* and in 9.8% of cases the client withdrew. However it should be noted that the classifications are somewhat ambiguous. For example, the classification *lack of rehabilitation potential* included those clients who had improved to such an extent that rehabilitation was not necessary *and* those clients whose condition was such that rehabilitation would provide no benefit.

### **Consent to Participation in the Evaluation Study**

Seventy three (56%) of the 130 clients accepted onto the rehabilitation programme gave consent to participate in the study; to complete outcome measures; and to allow the researchers access to their records. While only 11 (8%) clients in fact refused consent, consent was missing for the remainder for a variety of reasons. This included: being too ill, anxious or having cognitive problems (n=18); experiencing a very short programme (n=5); withdrawal from the programme (n=3); admitted to hospital (n=3); and died (n=3). The data is not sufficient in detail to determine if there had been selection bias (if the characteristics of those who consented were different from those who did not). However, there was no significant difference in the mean age of those who consented and those that did not (Mann-Whitney U=1997.5, p=0.697).

### **Outcomes/Effectiveness**

#### *Client characteristics*

Seventy three clients were followed from assessment to discharge (team one n=27, team two n=19, team three n=27). The mean age of the clients was 82.07 years (median 82.25, range 66.08-94.92); two thirds of the clients were aged 80 or more. Seventy eight percent of clients were women. Sixty seven clients (92%) lived in their own homes prior to the episode that lead to their involvement in the rehabilitation programme, five in residential care (7%) and one client had been in hospital for approximately a year.

There is no significant difference in mean age between teams (ANOVA,  $f=0.999$ ,  $p=0.519$ ). However the difference in mean age between gender is statistically significant (t-test  $t=2.035$ ,  $p=0.046$ ). The mean age of males is 79.23 whilst the mean age of females is 82.88.

The RLTs recorded clients' primary diagnosis at referral to the programme (Table 11). However, as outlined earlier, the figures should be treated with caution as each team collated the figures in slightly different ways. The category *other* includes neurological, palliative, surgical and mental health diagnosis.

**Table 11:** Primary diagnosis of clients taking part in the evaluation

Primary Diagnosis	N
Orthopaedic	22
Medical	15
Falls	10
General frailty	9
Multiple pathology	5
Other	12

#### *Completion of rehabilitation programme*

Fifty seven (78%) of the clients completed their rehabilitation programmes, 13 dropped out and three died. Drop-out arose for a variety of reasons: admitted to hospital (n=5), non-compliance with the rehabilitation programme (n=4), deteriorating cognitive or medical condition (n=3), and admitted into residential care (n=1). While over two thirds of clients completed their programmes the data detailing those who dropped out provides mixed indications of the success of the programme for this group. For example, one client dropped out when admitted to hospital with a deteriorating medical condition and was subsequently admitted to residential care; another dropped out due to a hospital admission for an existing medical condition but was subsequently re-referred and accepted onto a rehabilitation programme.

For the 73 clients, the mean number of days spent on the rehabilitation programme is 71.19 (median 52). The range is 10-280 days. At discharge from the rehabilitation programme, 81% (n=59) lived in their own homes, 14% (n=10) were in residential care, three clients had died and one client was in hospital. No statistically significant

difference in the time spent on rehabilitation programmes was evident between teams (Kruskal-Wallis,  $\chi^2=0.503$ ,  $p=0.778$ ), gender (Mann-Whitney  $U=398.5$ ,  $p=0.443$ ) or between those aged 65-79 and those aged 80+ years (Mann-Whitney  $U=9.0$ ,  $p=0.677$ ).

There is no statistically significant difference in age (t-test,  $t=0.305$ ,  $p=0.761$ ) between those who completed the programme and those who did not. Similarly there is no statistically significant difference in the amount of time spent on the programme (Mann-Whitney  $U=414.5$ ,  $p=0.58$ ) for those two groups.

## **Outcomes**

Seventy two of the 73 clients completed outcome measures at assessment. While 57 clients completed the programme only 45 clients of these clients completed outcome measures at discharge. Outcome measures were completed at assessment *and* discharge for 44 clients (all of whom had completed their rehabilitation programmes).

## **Assessment**

### *Baseline*

For all measures baseline assessment scores are reported for four groups:

- All clients who completed outcome measures at assessment (n=72)
- The sub-group who complete outcome measures at assessment and discharge (n=44)
- The sub-group who completed their rehabilitation programmes (n=57)
- The sub-group who did not complete their rehabilitation programmes (n=16)

The sub-groups have been chosen to highlight any differences at assessment between the overall sample and those 44 clients who completed measures at both assessment and discharge. The analysis also explores any initial differences between those who completed their rehabilitation programmes and those who did not. Baseline differences between the three teams have also been reported.

### Modified Barthel Index

The Modified Barthel Index consists of a series of ten statements in which functional ability is rated; the answers are individually scored and totalled to give a score of between 0-100. The scores can be interpreted as shown in Table 12.

**Table 12:** Interpretation of Modified Barthel Index scores

Total Score	Dependency Level
0-24	Total
25-49	Severe
50-74	Moderate
75-90	Mild
91-99	Minimal/Independent

A number of clients did not complete all the statements and thus total scores could not be assigned to them. Table 13 shows the baseline assessment results including missing data rates and the number of clients to whom a score could be assigned.

**Table 13:** Modified Barthel Index scores at assessment

	All clients (n=73)	Clients who complete measures at assessment & discharge (n=44)	Clients who completed rehabilitation programme (n=57)	Clients who dropped out of rehabilitation programme (n=16)
Missing data	12.3%	13.6%	15.8%	0%
N	64	38	48	16
Mean	66.76	68.32	66.60	67.25
Median	68	69.5	67	69.5
SD	15.41	15.67	16.07	13.68
Range	23 – 100	33 – 100	23 – 100	36 – 90
CI (95%)	62.91 – 70.61	63.17 – 73.46	61.94 – 71.27	59.96 – 74.54

The baseline assessment of functional ability is indicative of moderate dependency for all groups (mean and median). There was no significant difference (Mann-Whitney  $U=379.5$ ,  $p=0.944$ ) in the baseline mean scores of those who completed the programme and those who had not nor between those who completed outcome measures at assessment and discharge and those who did not (Mann-Whitney  $U=415.5$ ,  $p=0.283$ ).

No significant difference in the mean scores between teams was detected (Kruskal-Wallis Test,  $\chi^2=1.168$ ,  $p=0.338$ ).

### *Hospital Anxiety and Depression Scale (HADS)*

The HADS consists of a series of 14 statements (seven relating to anxiety, seven to depression) in which the client ticks a box to indicate the extent to which each statement describes how they have been feeling in the past week. For example: I feel tense or 'wound up'; to which they may answer most of the time, a lot of the time, from time to time (occasionally) or not at all. Each statement is assigned a score and scores for anxiety and for depression totalled separately. Scores for each of the two areas may lie between 0 and 21. Using psychiatric diagnosis as the gold standard, ratings of each score can be interpreted in the following way:

**Table 14: Interpretation of HADS**

<b>Total Score</b>	<b>Interpretation</b>
11 or more	Definite 'case' of anxiety or depression
8 – 10	Possible 'case' of anxiety or depression
7 or less	'non case'

Again a number of clients did not complete all the statements and thus total scores could not be assigned for those clients. The results are shown in Table 15.

At baseline the mean scores of the HADS in both anxiety and depression are indicative of a 'non-case' for all groups.

No significant difference in anxiety scores (Mann-Whitney  $U=397$ ,  $p=0.994$ ) or depression scores (Mann-Whitney  $U=341.5$ ,  $p=0.464$ ) are evident between those who completed the programme and those who did not. Similarly, no significant differences are evident between those who completed outcome measures at assessment and discharge and those who did not (anxiety: Mann-Whitney  $U=455.5$ ,  $p=0.217$ ; depression: Mann-Whitney  $U=539.5$ ,  $p=0.995$ ).

The mean scores between teams showed no significant difference (Kruskal-Wallis anxiety:  $\chi^2=0.16$ ,  $p=0.992$ , depression:  $\chi^2=0.113$ ,  $p=0.945$ ) and all were indicative of a 'non-case'.

**Table 15: HADS anxiety and depression scores at assessment**

	All clients (n=73)	Clients who complete measures at assessment & discharge (n=44)	Clients who completed rehabilitation programme (n=57)	Clients who did not complete rehabilitation programme (n=16)
<b>HADS Anxiety</b>				
Missing data	8.2%	9.1%	8.8%	6.3%
N	67	40	52	15
Mean	6.64	7.22	6.67	6.53
Median	6	8	7.50	6
SD	4.25	4.15	4.30	4.20
Range	0 – 16	0 – 15	0 – 15	2 – 16
CI (95%)	5.29 – 7.46	5.90 – 8.55	5.48 – 7.87	6.53 – 4.20
<b>HADS Depression</b>				
Missing data	8.2%	9.1%	8.8%	6.3%
N	67	40	52	15
Mean	6.37	6.35	6.13	7.20
Median	6	6	6	6
SD	4.45	4.35	4.33	4.90
Range	0 – 19	0 – 18	0 – 18	1 – 19
CI (95%)	5.61 – 7.68	4.96 – 7.74	4.93 – 7.34	4.48 – 9.91

### *EuroQol, EQ-5D*

The EQ-5D consists of two parts. The first is a self-reported description containing five domains. Each domain has three possible statements and respondents are asked to indicate which statement in each domain 'best describes your own health state today'. Statements are indicative of no problem, moderate problem, and severe problem. The statements can be used to provide a profile or may be converted into a single health score. Scores can range from 1 to -0.40 (1 represents full health, -0.40 is unconscious).

The second part is a self-rated valuation in the form of a visual analogue scale. Respondents indicate how good or bad their own health is today on a scale in which 100

is the best imaginable health state and 0 the worst imaginable health state. The EQ-5D is a generic outcome measure developed to measure health-related quality of life and as such there is no interpretation of scores (other than at the extreme values).

#### *EQ-5D self-reported description: profile*

The self reported description was generally well completed with missing data of between 5.5- 6.8%. Client profiles for each domain are presented below:

#### *Mobility*

Sixty eight of the 73 clients responded to the mobility statement. Over 90% of respondents indicated that they have some problems in walking about whilst only 3% indicated that they are confined to bed. There was little variation across the sub-groups.

#### *Self-care*

Sixty nine clients responded to the self-care statement. None of the respondents reported that they were unable to wash or dress themselves but 87% reported some problems. Again there was little variation across the sub-groups.

#### *Usual Activities*

Sixty nine clients responded to the statement relating to usual activities. Over 97% of respondents reported problems with performing their usual activities (60.9% reported some problems whilst 36.2% reported extreme problems). Little variation is seen between the sub-groups with the exception of the sub-group that did not complete the rehabilitation programme. This group shows almost half of respondents (46.7%) report they are unable to perform their usual activities (extreme problems) and 46.7% report some problems (only 6.7% report no problems).

#### *Pain/discomfort*

Of the 73 clients, 69 responded to the pain/discomfort statement. Over one in five (21.7%) respondents reported that they had no pain or discomfort, whilst two thirds (66.7%) indicated moderate pain or discomfort. The sub-group of those clients who did not completed their rehabilitation programmes report similar proportions within the

group who had no problem (20%) but the percentage that report extreme pain or discomfort (20%) is higher than that of the other groups.

### *Anxiety/depression*

Of the 69 respondents who completed the anxiety/depression statements almost half (49.3%) indicated that they were *not* anxious or depressed. Only 4% report being extremely anxious or depressed. Little variation is seen across the groups.

### *EQ-5D self-reported description: single health score*

A single health score derived from the statements on the self reported description was assigned for 66 clients of the 73 clients. The results for this and the other sub sets are shown in table 16.

**Table 16:** EQ-5D self-reported description; single health score at assessment

	All clients (n=73)	Clients who complete measures at assessment & discharge (n=44)	Clients who completed rehabilitation programme (n=57)	Clients who dropped out of rehabilitation programme (n=16)
Missing data	9.6%	6.8%	10.5%	6.3%
N	66	41	51	15
Mean	0.42	0.45	0.44	0.34
Median	0.52	0.52	0.52	0.26
SD	0.27	0.26	0.27	.029
Range	-0.24 – 0.81	-0.24 – 0.81	-0.24 – 0.81	-0.07 – 0.85
CI (95%)	0.35 – 0.48	0.37 – 0.53	0.36 – 0.51	0.18 – 0.50

There were no significant differences between those clients who had completed the programme and those who had dropped out (Mann-Whitney U=324.5, p= 0.276) or between those who completed outcome measures at assessment and discharge and those who had not (Mann-Whitney U=477, p=0.334).

Analysis showed no significant differences between teams (Kruskal-Wallis  $\chi^2=1.186$ , p=0.553).

*EQ-5D self-valuation (visual analogue scale)*

Table 17 shows the results of the EQ-5D self-valuation (visual analogue scale).

**Table 17: EQ-5D self-valuation at assessment**

	All clients (n=73)	Clients who complete measures at assessment & discharge (n=44)	Clients who completed rehabilitation programme (n=57)	Clients who dropped out of rehabilitation programme (n=16)
Missing data	9.6%	6.8%	10.5%	6.3%
N	66	41	51	15
Mean	58.00	59.83	58.35	56.80
Median	50.00	55.00	50.00	50.00
SD	20.54	21.11	21.24	18.57
Range	5 – 100	5 – 100	5 – 100	30 – 82
CI (95%)	52.95 – 63.05	53.17 – 66.49	52.38 – 64.33	46.51 – 67.09

Whilst the confidence interval for the sub-group who did not complete their rehabilitation programmes is larger than that of the other groups this may be explained by the small sample number. No significant difference was apparent between those clients who had completed the programme and those who had not (Mann-Whitney  $U=367.5$ ,  $p=0.731$ ) or between those who completed outcome measures at assessment and discharge and those who had not (Mann-Whitney  $U=426$ ,  $p=0.161$ ). Nor were differences between team mean scores statistically significant (Kruskal-Wallis  $\chi^2=2.139$ ,  $p=0.343$ ).

However it is interesting to note that of the overall sample four clients rated themselves at 100 (best imaginable health state) and 28.8% ( $n=21$ ) of respondents rated themselves at 50 - in the middle of the scale. Using Spearman's Rho the correlation between the self-reported single score and self-valuation is significant ( $p=0.004$ , correlation coefficient  $\rho=0.352$ ).

## Discharge

Forty four clients completed outcome measures at assessment and discharge (n=27 team one, n=7 team two, n=14 team three). All had completed their rehabilitation programmes (mean number of days on the programme 75.27, median 58.5). At discharge from the programme 42 were resident in their own homes and two were in residential care. The mean age at referral to the programme of this sub-group was 81.38 years (68.2% were aged 80 or over).

Limited data were available to determine whether the characteristics of those completing the measures at assessment and discharge were different from that group that did not; whether there was selection bias. Data available showed there was no significant difference in age between those who completed both measures and the group who had *not* (t-test=-1.135, p= 0.26). Neither was there a significant difference between the amount of time spent on the programme (Mann-Whitney U=589.5, p=0.584). However, of those who did not complete the measures, 90% lived in their own homes prior to referral to the programme but this fell to only 59% at discharge. Conversely 93% of the group who completed both measures lived in their own home prior to referral and this had increased to 95% at discharge indicating the possibility of selection bias.

No significant difference in age (ANOVA  $f=0.981$ ,  $p= 0.384$ ) was found between clients referred from different teams but there is evidence of a significant difference in the time spent on rehabilitation programmes (Kruskal-Wallis  $\chi^2=6.141$ ,  $p= 0.046$ ). The mean time for team two was 117 days whilst teams one and three were much lower (69.78 and 63.43 respectively). However given the small sample number (team 2, n=7) these figures should be treated with caution.

Seventy seven percent of clients in this sub-group are female. There are no significant differences in either age (t-test=1.026, p=0.311) or time spent on rehabilitation programmes (Mann-Whitney U=151.5, p=0.610) between gender.

## *Outcomes*

In this section all outcome measures relate to the sub-group of 44 clients who complete outcomes at both assessment and discharge (missing data refers to this sub-group only). Both assessment and discharge measures are reported for ease of comparison.

### *Modified Barthel Index*

The Barthel showed more missing data at discharge than at assessment and thus scores for only 34 of the 44 clients could be assigned. The mean and median scores of the Barthel at discharge are indicative of mild dependency and show an improvement from moderate dependency at assessment (the mean score has increased from 68.32 to 84.47, the median from 69.5 to 88). The results are shown in Table 18. There is no evidence of a significant difference in discharge scores between teams (Kruskal-Wallis  $\chi^2=0.511$ ,  $p=0.775$ ), gender (Mann-Whitney  $U=84.5$ ,  $p=0.428$ ) or those aged between 65-79 years and those aged 80 and over (Mann-Whitney  $U=81.5$ ,  $p=0.145$ ).

**Table 18:** Modified Barthel Index scores at assessment & discharge

	Assessment	Discharge
<b>Missing data</b>	13.6%	22.7%
<b>N</b>	38	34
<b>Mean</b>	68.32	84.47
<b>Median</b>	69.5	88.00
<b>SD</b>	15.67	13.31
<b>Range</b>	33 – 100	44 – 100
<b>CI (95%)</b>	63.17 – 73.46	79.83 – 89.11

The improvement between scores at assessment and discharge is statistically significant (Wilcoxon Signed Ranks  $Z=-4.91$ ,  $p=0.00$ ).

### *Hospital Anxiety and Depression Scale (HADS)*

The HADS anxiety and depression measures show mean discharge scores indicative of a 'non case' (as are the assessment scores). The results are shown in Table 19. However whilst both scores are indicative of a 'non case' the improvement in both anxiety and

depression scores between assessment and discharge is statistically significant. (Wilcoxon Signed Ranks  $Z=-2.192$ ,  $p=0.028$  and  $Z=-2.8$ ,  $p=0.005$  respectively).

There are no significant differences in the anxiety and depression scores between teams (Kruskal-Wallis  $\chi^2=0.306$ ,  $p=0.858$  and  $\chi^2=0.573$ ,  $p=0.751$  respectively), gender (Mann-Whitney  $U=92.5$ ,  $\rho=0.103$  and  $U=119.5$ ,  $p=0.514$ ) or between those aged 65-79 years and those aged 80 or over (Mann-Whitney  $U=148$ ,  $p=0.454$  and  $U=131$ ,  $p=0.271$ ).

**Table 19:** HADS anxiety and depression scores at assessment & discharge

	Assessment	Discharge
<b>HADS Anxiety</b>		
Missing data	9.1%	13.6%
N	40	38
Mean	7.22	5.84
Median	8	5.5
SD	4.15	4.31
Range	0 – 15	0 – 17
CI (95%)	5.90 – 8.55	4.43 – 7.26
<b>HADS Depression</b>		
Missing data	9.1%	13.6%
N	40	38
Mean	6.35	4.79
Median	6	4
SD	4.35	3.27
Range	0 – 18	0 – 13
CI (95%)	4.96 – 7.74	3.71 – 5.86

*EQ-5D self-reported description: profile*

The profiles of each statement (mobility, self-care, usual activities, pain/discomfort and anxiety/depression) at assessment and discharge show a shift representing improvement between assessment and discharge.

*Mobility*

Of the 44 clients included in the sample, 41 clients completed the description of mobility at assessment and 43 at discharge. At assessment 95% of respondents reported problems in walking. By discharge this had decreased to 81%.

*Self-care*

Forty two clients completed the statement in respect of self-care at assessment and 43 at discharge. None reported that they were unable to wash or dress themselves. However, whilst 86% of respondents reported some problems at assessment only 51% reported problems at discharge.

*Usual activities*

At assessment 42 clients completed the statement relating to usual activities (42 at discharge); 31% of respondents reported they were unable to perform their usual activities; this had decreased to 16% at discharge.

*Pain/discomfort*

Of the 42 clients who completed this statement at assessment almost 10% reported extreme pain or discomfort and 74% reported moderate pain/discomfort. By discharge, of the 42 clients, none reported extreme problems and only 60% reported moderate problems.

*Anxiety/depression*

Forty two clients completed this statement at assessment and 43 at discharge. At assessment 45% of respondents reported no anxiety or depression. This had increased to 72% at discharge.

*EQ-5D self-reported description: single health score*

The single health score shows an improvement (Table 20) between assessment and discharge, from 0.45 to 0.62, that is statistically significant (Wilcoxon Signed Ranks  $Z=-3.644$ ,  $p=0.00$ ).

**Table 20:** EQ-5D self-reported description; single health score at assessment & discharge

	<b>Assessment</b>	<b>Discharge</b>
<b>Missing data</b>	6.8%	9.1%
<b>N</b>	41	40
<b>Mean</b>	0.45	0.62
<b>Median</b>	0.52	0.69
<b>SD</b>	0.26	0.21
<b>Range</b>	-0.24 – 0.81	-0.06 – 0.88
<b>CI (95%)</b>	0.37 – 0.53	0.56 – 0.69

There are no significant differences in discharge scores between teams (Kruskal Wallis  $\chi^2$ 3.108,  $p=0.211$ ), gender (Mann-Whitney  $U=107.5$ ,  $p=0.487$ ) or those aged 65-79 years and those age 80+ (Mann-Whitney  $U=125$ ,  $p=0.295$ ).

*EQ-5D Self-valuation (visual analogue scale)*

In line with the other measures the self-valuation shows an improvement between assessment and discharge (Table 21). The mean score moves from 59.83 to 67.16 but unlike the other measures the improvement is not statistically significant (Wilcoxon Signed Ranks  $Z=-1.711$ ,  $p=0.087$ ).

**Table 21:** EQ-5D self-valuation at assessment & discharge

	<b>Assessment</b>	<b>Discharge</b>
<b>Missing data</b>	6.8%	0%
<b>N</b>	41	44
<b>Mean</b>	59.83	67.16
<b>Median</b>	55.00	70
<b>SD</b>	21.11	19.22
<b>Range</b>	5 – 100	2 – 100
<b>CI (95%)</b>	53.17 – 66.49	61.31 – 73.00

There is a statistically significant difference in discharge scores between teams ((Kruskal Wallis  $\chi^2=9.021$ ,  $p=0.011$ ); team one has a mean discharge score of 61.70 and

team three a mean score of 67.79. However, the mean discharge score of team two is much higher at 83.86.

There is no statistically significant difference in gender (Mann-Whitney U=119, p=0.150) or between those clients aged 65-79 years and those age 80+ (Mann-Whitney U=198, p=0.760).

#### *Use of the EQ-5D with older people*

Of the 73 clients in the sample, 55% (n=40) asked for help, explanation or clarification of the EQ- 5D. Care managers report that 27% (n=20) of the sample experienced some form of difficulty either in understanding or completing the EQ-5D self-valuation (the visual analogue scale). There is no statistically significant difference in age of those who asked for help and those who did not. The care managers' comments were coded thematically using content analysis. The results are shown in Table 22.

**Table 22:** Help/explanation/clarification of EQ-5D: the care managers' comments

- |  |
|--|
| <ol style="list-style-type: none"> <li>1. Limited Understanding of the EQ-5D (n=10)</li> <li>2. Whose Perceptions? (n=7)</li> <li>3. Unrealistic Answers (n=10)</li> <li>4. Answers qualified/contextualised (n=11)</li> </ol> |
|--|

The first category (limited understanding) includes comments made by the care managers that indicate that they felt the client had a limited understanding of the questions asked. This may be illustrated using some of the comments made:

*'cognitive impairment meant the client had a limited understanding'*

*'...placed herself at 100 (on the visual analogue scale) but says she feels she can't do anything'*

*'I had to help a lot – (he) didn't really understand the questionnaire much'*

*'client didn't understand – she felt her health was good and although the fracture in her leg was a problem it didn't really affect her health.'*

A common comment from the care managers who administered the EQ-5D was the difficulty clients has in grasping the concept of using a 'snapshot' of their health state; asking about their health state *today*. One care manager noted:

*'(I) needed to clarify the 'today' part – this comes up a lot especially at discharge (from the rehabilitation programme) when the client tends to look back.'*

Another noted when the client was choosing a statement in the pain/discomfort domain:

*'she felt this fluctuated – didn't know which to go for but settled for moderate.'*

Another client chose the moderate statement in the same domain but added:

*'some days feels extreme'.*

The second category (whose perceptions?) includes comments made by the care managers that indicate that the answers may not be the clients' own perceptions of his/her health related quality of life. Again, this may be illustrated using examples of the comments made by the care managers:

*'I had to stop input from client's wife.'*

*'.... (he) kept asking what I thought - for my opinion'*

*'...found the thermometer (the visual analogue scale) difficult to answer, her daughter helped her fill it in'*

The next classification (unrealistic answers) includes cases in which the care managers indicated that the clients' answers may be unrealistic in as much as they did not reflect the care managers' perceptions of the client's health related quality of life. Examples of this are:

*'...whether the information gained is accurate; she has more problems than she thinks she has – lack of insight ( into her condition)'*

*'(he) is very anxious and concerned about his wife who has Alzheimer's – he related all the questions to his wife'*

The final classification includes those cases in which answers were qualified or contextualised. This includes alterations to statements on the self-reported description and comments that have been written or made verbally to the care manager. From the self-reported description, data showed that in all domains, with the exception of self-care, statements had been qualified or contextualised. For example, in the domain of mobility one client chose the statement 'I am confined to bed' but added '*to an electric wheelchair*'; in the domain of anxiety/depression a client chose the statement 'I am moderately anxious or depressed' but added '*because I am worried about my wife*'. In one case the care manager wrote

*'(client) found the statements restrictive – didn't always apply to the situation.'*

#### *Self-rated valuation*

In contrast to the self-reported description, comments or observations made in respect of the self-rated valuation (the visual analogue scale) related to limited or even non-understanding of the scale. Care managers felt that clients did not understand the visual analogue scale for a number of reasons. In three cases the client had marked himself/herself at 100 on the scale despite '*lots of problems*'. One care manager writes:

*'Mrs X describes being 100 despite having numerous longstanding and recent physical problems that do impact upon her independent living'*

In one case a care manager noted that the self-rated valuation scores had decreased between assessment and discharge indicating a fall in self-rated quality of life. The care manager writes:

*'(I'm) not sure she understood this as she said the score reflected her improvement but she scored really low (at discharge). (Yet) she said she felt much better than when we started.'*

The valuation had fallen from 30 at assessment and 25 at discharge.

In addition there were problems of a more practical nature associated with the use of the VAS. One care manager writes next to a VAS that had not been completed:

*'Mrs X was too deaf to understand what I was asking (in relation to the visual analogue scale) – but she answered the questions ok'*

In four cases the care managers noted that clients' failing eyesight made completion of the VAS problematic:

*'Client found the thermometer difficult because (her) sight was not good – uses a magnifying glass'*

## **Relationship between Outcome Measures**

### *Correlation between EQ-5D measures*

In line with a priori expectations (given both measures are health related quality of life measures) the EQ-5D self-reported description and self-valuation show a significant correlation both at assessment and discharge.

The correlation co-efficient at assessment (Spearman's Rho) is 0.352 ( $p=0.004$ ). The sub-group of 44 clients who completed outcome measures at assessment and discharge show similar results ( $\rho=0.351$ ,  $p=0.026$  at assessment and  $\rho=0.383$ ,  $p=0.014$  at discharge).

### *Correlation between EQ-5D measures and Modified Barthel Index*

It is feasible to expect a relationship to exist between a person's health related quality of life and their functional ability and therefore a correlation between the scores derived from the Barthel and those from the EQ-5D measures. The EQ-5D self-reported description itself contains statements directly related to function: mobility, self-care and usual activities. Indeed other studies of older people have found a significant correlation between the two measures (see for example Coast et al, 1998).

The Barthel scores for clients who completed outcome measures at assessment show evidence of a significant correlation with both the EQ-5D self-reported description single health score (Spearman's Rho  $\rho=0.361$ ,  $p=0.005$ ) and the EQ-5D self-valuation ( $\rho=0.280$ ,  $p=0.032$ ). However, for the sub-group of 44 clients at assessment there was no evidence of a statistically significant correlation between the Barthel and either of the EQ-5D measures.

At discharge Spearman's Rho shows a significant correlation ( $\rho=0.357$ ,  $p=0.045$ ) between the Barthel scores and self-reported single health score.

### *Correlation between the HADS and EQ-5D self-reported single health score*

McDowell and Newell (1996), in their review of leading health measures report tests of validity that show that the EQ-5D self-description single health score correlates with anxiety scores and with depression scores from the HADS. This holds true at both assessment and discharge within this study. At assessment the correlation co-efficient for the EQ-5D and the HADS anxiety score is  $\rho = -0.434$  ( $p=0.00$ ) and for the depression score  $\rho = -0.402$  ( $p=0.001$ ). Similar results were seen for the sub-group of 44 at assessment. At discharge the correlation co-efficients are  $\rho = -0.461$  ( $p=0.003$ ) and  $\rho = -0.606$  ( $p=0.00$ ) respectively.

### *Other relationships*

No significant correlation was evidenced between the HADS scores and the Barthel scores (nor was any expected).

There is evidence of a significant correlation between the HADS depression scores and the EQ-5D self-valuation scores at both assessment and discharge. Within the total sample (n=73)  $\rho=-0.552$ ,  $p=0.00$  (Spearman's Rho) and within the sub-sample (n=44)  $\rho=-.626$ ,  $p=0.00$  (Spearman's Rho) at assessment. At discharge  $\rho=-0.394$ ,  $p=0.12$  (Spearman's Rho).

### **Summary of Effectiveness**

For the clients who completed outcome measures at assessment and discharge (n=44) there are mean improvements in all indicators over the period of the programme. The Modified Barthel shows an overall move from moderate to mild dependency and a statistically significant improvement in the mean Barthel scores. Although the HADS scores indicate, on average, a 'non-case' in both time periods, again the scores show a statistically significant improvement between assessment and discharge.

Both scores derived from the EQ-5D show improvements over the time of the programmes but only those of the self-reported description are statistically significant. The profiles show movements away from extreme/moderate problems to no problems in each of the five domains. However, the results show that 40% of the respondents included in the study required some form of help, clarification or explanation from the care manager when completing the EQ-5D. Areas of concern lay in a limited understanding of the statements contained in the EQ-5D, whether the answers reflected the respondents own perceptions, whether the answers were a realistic view of the respondents' condition and that the EQ-5D statements were too restrictive.

Of the 73 clients included in the study only 44 completed the outcome measures at assessment and discharge. Whilst the results are open to charges of bias in as much as those clients who did not complete the discharge assessment were primarily those who did not complete the programme it is interesting to note that there were no statistically significant differences in age, time on the programme, or initial assessment scores between those who completed the programme and those who did not. The EQ-5D profile shows slightly higher proportions of the clients recording extreme problems with usual activities and extreme pain/discomfort in the sub-group of those not completing

the programme at assessment than the whole sample; but the scores derived from these profiles show no statistically significant difference.

There are no statistically significant differences evident at the initial assessment between those who completed measures in both time periods and those who did not.

## **Cost Analysis**

### **Sample**

Of the 73 clients who consented to take part in the evaluation, data was available to enable the cost of the rehabilitation programmes to be calculated for 71. Access to social services data for one client was denied and resource use was unavailable for another due to a change in personnel within the RLTs.

The mean and median age of the clients (n=71) is 82.13 years (median 82.67; range 66.08-94.92), two thirds were aged 80 or over; 55 are female. Prior to referral to the RLTs 92% of clients lived in their own home and 7% in residential care; the remaining client had been in long-term hospital care. At discharge 80% of clients lived in their own homes, 14% in residential care, three clients had died and one was in hospital. The mean number of days spent on a rehabilitation programme is 70.23 (median 49; range 10-280).

### **Resource Use**

Client level data of resource use was collected from the care managers, practitioners and health and social services records. Clients were drawn from each of the three teams (team one n=26, team two n=19, team three n=26).

The interdisciplinary nature of the programme meant that care managers were drawn from a variety of professions but undertook the same role. However in many instances there was a blurring of the role of care manager and their own specialism. For example, the resource use reported for an occupational therapist (OT) would include work undertaken in the role of OT and in the role of care manager. It is not possible to report

these separately, as there is no clear demarcation of roles. In addition the teams operated with different numbers of members and different team compositions which were themselves dynamic over the course of the evaluation as staff left and replacements were found.

However, all teams had access to the same type of services (for example, physiotherapy and home care) and could commission those services as required.

Due to the differing staff composition within the teams there is considerable variation in mean resource use and as such Table 22 reports the mean resource use for each of the teams separately in addition to the overall mean resource use.

Valuation of resource use has been estimated using Unit Costs of Health and Social Care 2001 (Netten et al, 2001) (with the exception of the Nurse Consultant) as outlined in the previous chapter..

### **Overall Cost of Rehabilitation Programme**

The data illustrated in Table 23 forms the basis for the mean costs of the rehabilitation programmes. Data presented in Table 24 show the mean cost of programmes with and without client financial contributions to the cost of home care and residential stays. In addition, the table shows the mean cost of the rehabilitation programme if hospital in-patient stays are excluded. The cost per successful intervention has not been calculated due to the limited data available indicating the success or otherwise of the programme for those who dropped out.

The costs for each individual's package were calculated and these total costs added together to find the mean cost. Thus Table 24 shows the range of costs for individual rehabilitation programmes (the lowest being £298 and the highest £12967).

**Table 23: Resource use per client over the term of the rehabilitation programme**

<b>Resource</b>	<b>Cost 2000/1 values</b>	<b>Team 1 Mean use (SD)</b>	<b>Team 2 Mean use (SD)</b>	<b>Team 3 Mean use (SD)</b>	<b>All teams Mean use (SD)</b>
<b>Community Occupational Therapist (Health Authority)*</b>	£21 per hour	8.79 hours (13.73)	8.90 hours (12.42)	8.18 hours (12.18)	8.60 hours (12.65)
<b>Community Occupational Therapist (Local Authority)</b>	£20 per hour	0.09 hours (0.47)	Nil	0.26 hours (1.34)	0.13 hours (0.86)
<b>Community Physiotherapist*</b>	£21 per hour	5.26 hours (6.07)	1.78 hours (2.40)	5.89 hours (6.98)	4.56 hours (5.91)
<b>Community Psychiatric Nurse*</b>	£21 per hour	2.64 hours (6.89)	3.39 hours (9.26)	2.09 hours (6.13)	2.64 hours (7.26)
<b>Community Support Centre (local authority short term residential care)</b>	£466 per week	2.36 weeks (4.27)	2.03 weeks (2.48)	2.36 weeks (2.81)	2.27 weeks (3.31)
<b>District Nurse*</b>	£21 per hour	Nil	10.14 hours (16.53)	4.45 hours (9.18)	4.34 hours (10.79)
<b>Hospital In-patient Days (geriatrics)</b>	£144 per day	0.31 days (1.12)	6.74 days (13.35)	1.65 days (5.61)	2.52 days (8.03)
<b>Hospital Therapy Support Worker</b>	£11 per hour	Nil	0.87 hours (2.33)	Nil	0.23 hours (1.24)
<b>Local Authority Home Care Worker</b>	£10.91 per hour	32.36 hours (52.05)	73.91 hours (97.65)	40.42 hours (52.00)	46.43 hours (68.39)
<b>Nurse Consultant</b>	£31 per hour	0.23 hours (0.52)	Nil	Nil	0.08 hours (0.33)
<b>Private residential care for elderly people</b>	£278 per week	0.19 weeks (0.98)	Nil	Nil	0.07 weeks (0.59)
<b>Social Work Assistant</b>	£13 per hour	4.05 hours (9.93)	Nil	Nil	1.48 hours (6.25)
<b>Social Worker*</b>	£18 per hour	8.63 hours (18.75)	2.92 hours (7.94)	4.94 hours (9.45)	5.75 hours (13.39)

\* Denotes those professions from which care managers were drawn.

The cost data is non-parametric (Kolmogorov-Smirnov test,  $p < 0.05$  in all models) and thus differences in costs have been analysed using transformed data (natural log transformation) in order to overcome problems associated with non-normality and unequal variance; confidence intervals have been reported using the original data (Briggs & Gray, 1999).

Non-parametric cost data that is skewed to the left is a common problem in cost analysis. The use of the mean is often justified because although the data is skewed the total cost to the service provider includes those outliers at either end of the spectrum and the providers are interested in total costs (i.e. the mean multiplied by the number of cases). The use of the median would not provide useful data in terms of the total cost of providing the service.

There is no statistically significant difference in mean costs between the teams (ANOVA). Similarly, the transformed data shows no statistically significant difference in costs of the programme between men and women (t-test). There is however a statistically significant difference (t-test,  $p < 0.05$ ) between the mean programme costs (including in-patient days) for those clients aged between 65-79 and those over the aged of 80 (including and excluding client contributions). The squared point biserial correlations ( $r^2_{pb}$ ) are around 0.06 and thus (using Cohen's guidelines) indicative that the effect could have some importance<sup>1</sup>.

The cost of the rehabilitation programme is higher for those in the 65-79 years age group. The mean cost of the rehabilitation programme (including client contributions to their care package) for those in the 65-79 age group is £2962.83; the mean cost for those aged 80 or over is £1846.88. However, there is no statistically significant difference between the groups if hospital in-patient days are excluded.

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<sup>1</sup> A full explanation of 'importance' versus 'statistically significant' is given in Chapter Ten.

**Table 24: Costs of rehabilitation programme**

	Cost of Programme including hospital in-patient stays	Cost of Programme excluding hospital in-patient stays	Cost of Programme including hospital in-patient stays, less client contribution	Cost of Programme excluding hospital in-patient stays, less client contribution
Mean	£2500.28	£2137.23	£2224.11	£1861.07
SD	£2504.44	£2094.11	£2058.79	£1537.94
Median	£1630.24	£1586.57	£1360.11	£1347.81
Range	£298.51 – 12967.57	£298.51 – 12967.57	£267.95 – 9200.19	£267.95 - 7425.30
CI (95%)	£1907.49 – 3093.07	£1641.57 – 2632.90	£1736.80 – 2711.41	£1497.04 – 2225.09

### Uncertain Parameters/Estimates

When calculating the cost of the rehabilitation programmes full data available was available for 66 clients. Client financial contributions towards their care packages were not available for five clients and estimates were used.

#### *Home care*

During rehabilitation programmes 46 clients received home care that was chargeable (i.e. not in the free period allocated by RLT as part of programme). Clients' financial contributions to that home care was available for 42 clients. Using this sub-sample the clients' contribution as a percentage of the full fee was calculated for each (mean 38%, median 10.86%, range 0-100%). Given the small sample number it was felt that the median, rather than the mean would provide a better representation of the missing contributions and thus estimates assume that each of the four clients pay 10.86% of the home care fee.

### *Community support centres*

Seventeen clients spent time in a CSC that was outside the free period allocated by RLT as part of programme. Data showing the monetary contribution to those stays was available for 16 clients. Using this data the clients' contribution as a percentage of the full fee was calculated for each of the clients (mean 45.14%, median 36.78%, range 16.45-100%). Again, given the small sample number, the missing data for client contributions to chargeable CSC time was calculated using the median percentage (i.e. estimate that clients pay 36.78% of the CSC fee).

### *Client notes and memory recall*

As previously outlined, client level data was collected. Practitioners provided details of all human resources used in provision of the rehabilitation programmes but did not keep detailed diaries recording exact times; they merely used client notes and memory recall to estimate quantity of time spent 'after the event'. As such they may be considered estimates.

In order to take into account uncertainty the study uses 95% confidence intervals of the mean costs.

### **Selection of Alternative for Cost Comparison**

In the absence of a data relating to the previous practice, and in order to be able to place the rehabilitation cost per client into context, the evaluation used a 'what if?' scenario. The care managers were asked '*what would have happened to the client in the absence of the RLT?*' Their responses were recorded and coded into three areas:

- Probable that the client would have been admitted to residential care (n=35)
- Likely that the client would have been discharged to social services care without rehabilitation input but with an increased home care package (n=15)
- Likely that the client would have been admitted to hospital or that the client's discharge from hospital would be delayed (n=14)

Originally the data was coded into four categories: residential care, increased home care package, delayed hospital discharge and hospital admittance. However it was felt that the latter two scenarios both equated to the cost of hospital in-patient days and thus have been amalgamated. For seven clients the care managers' responses did not readily fit into any category and the cost rehabilitation for this group has been included in the group 'other' (table 23). It was not possible to determine the cost of the hypothetical alternative course of action for this group. For example, in one case, the care manager response was:

*'Mrs X would have continued living at her daughters leading to huge stress'*

Using the coded responses the mean cost of the actual rehabilitation programmes were then calculated for each group (Table 25). Calculations include hospital in-patient days and clients' financial contributions to the care package.

**Table 25: Cost of rehabilitation programmes categorised by counterfactual**

£	Residential Care	Increased home care package	Hospital admittance/ delayed discharge	Other
Mean Cost	2722.24	1377.02	2361.06	1274.72
SD	2363.43	969.13	2174.99	1009.78
Median	1726.02	1131.43	1354.41	1036.15
Range	267.95-9200.19	287.91-3936.14	441.40-7969.18	417.05-3325.56
CI (95%)	1910.37-3534.11	840.34-1913.71	1105.26-2616.86	340.83-2208.62
Mean number of days on programme	66.31	74.67	75.78	69.14

In order to detect any differences between the mean costs of these groups, the data was again transformed using natural logs. The transformed data shows no statistically significant difference in cost between counterfactual groups (ANOVA). Similarly no statistically significant differences in age were evident between the groups (ANOVA) and no statistically significant differences in the mean time spent on the programme was found between the groups (Kruskal-Wallis Test  $\chi^2=2.532$ ,  $p=0.47$ ).

A priori expectations were that the lowest rehabilitation programme costs be associated with those clients who would be sufficiently able to be at home with some form of social services input and the highest to those who would have required some form of residential care or hospital stay. The table confirms this expectation. The highest mean cost is associated with those clients who, it was thought probable, would have been admitted to residential care; the lowest to those clients who were likely to have gone home with an increased home care package. The mean costs thus lend weight to the accuracy of the care managers response to the hypothetical question 'what would have happened to the client in the absence of the RLT?' However, the difference is not statistically significant.

### **Cost of Hypothetical Scenarios**

Each of the costs (with the exception of the category 'other') was then compared against the cost of probable/likely alternative course of action; again estimates were calculated using Unit Costs of Health and Social Care 2001 (Netten et al, 2001).

#### *Admitted to residential care*

In this scenario 35 clients were hypothesised by the care manager as being admitted to long-term care in the absence of the RLT. The total cost of the rehabilitation programme over 66 days was estimated as £2722 per person (this includes clients' financial contributions to their rehabilitation package).

Residential care may take a number of forms, for example, local authority residential care, private residential care, and independent nursing homes. Within South Cheshire there are no local authority long stay residential homes and thus comparison is based upon the fees of independent nursing homes and private residential care over the same period (66 days). The analyses estimate clients' contributions to their residential care using the median percentage of the fee paid by this group (37.6%).

- Fees for independent (private and voluntary) nursing home for elderly people are estimated to be £384 per week (Netten et al, 2001). Thus, the fee chargeable for this type of nursing homes for elderly people over 66 days equates to £3620.57

gross. This is reduced to £2259.24 when estimated client contributions are deducted.

- Private residential care for elderly people is estimated to be £278 per week (Netten et al, 2001). Over a period of 66 days this equated to £2621.14 gross and £1635.85 when estimated client contributions are deducted.

Thus over the period of the rehabilitation programmes both private residential care and independent nursing care is estimated to be less expensive than the rehabilitation programme. However, at discharge from the rehabilitation programme two thirds of the sample (n=23) were resident in their own homes (three clients had died, one was in hospital and eight were in residential care). If the rehabilitation programme prevented admission into some form of long-term residential care there may be a point at which the financial cost of residential care exceeds that of the rehabilitation programme – a break-even point at some time in the future after which a net saving will accrue.

Table 26 illustrates the costs of the rehabilitation programme and residential care after discharge from the programme. The additional costs to the rehabilitation programme post discharge represent the net cost of a home care package of 3.5 hours per week. The home care package has been estimated using the group sub-sample. The median hours of home care for those clients at home post discharge is 3.5 hours per week; the unit cost is estimated as £10.91 per hour. The median client contribution is 10.82% of the fee (the fee charged by Cheshire Social Services is £9.75 per hour).

**Table 26:** Hypothetical alternative: admitted to residential care

n = 35	Discharge (66 days)	2 weeks after discharge	4 weeks after discharge	3 months after discharge
Rehabilitation Programme	£2722	£2790	£2859	£3134
Independent (private & voluntary) nursing homes	£2259	£2738	£3217	£5135
Private residential care	£1635	£1983	£2330	£3717

The results show two weeks after discharge the rehabilitation programme is still the more expensive option. However, three months after discharge both independent nursing homes and private residential care are more costly, on average, than the rehabilitation programme followed by on-going home care provision.

If comparison were made between the rehabilitation programme and local authority residential care the break-even point would occur even earlier. The cost of independent/private residential care to the Health Authority/Social Services is assumed to be the fee paid less the clients' financial contribution. However the cost of local authority residential care is higher, due in part to the inclusion of overhead costs such as buildings and land. Netten et al (2001) estimate the weekly cost of per permanent resident week to be £449. Over the period of the rehabilitation programme the cost is less than the programme (£2642) but two weeks after discharge the estimated cost of local authority residential care (£3202) exceeds that of the rehabilitation programme followed by a home care package (£2790).

In order to ensure that the estimates do not significantly affect the results presented 95% confidence intervals of the mean cost of the rehabilitation programme at discharge have been presented. The confidence interval for this sub group is £1910 – £3534. The lower bound shows the rehabilitation programme to be the least expensive of all alternatives at two weeks after discharge however, the higher bound shows the same result only at fourteen weeks.

It should be noted that whilst the costs of the rehabilitation programme include services such as physiotherapy the cost of the alternative, residential or nursing care, does not (although clients admitted to residential care may still utilise these types of services). Unfortunately the absence of evidence regarding previous practice precludes estimates of the utilisation of this type of service.

#### *Increased homecare package*

This scenario relates to the 15 clients who the care manager indicated would be 'taken on' by social services with an increased home care package. Prior to referral to the

RLTs all clients lived in their own homes; post discharge 14 clients lived in their own home whilst one client was admitted to residential care.

The alternative of an *increased home care package* is relatively vague and in order to make an assumption about what this package would include the home care provision or short term residential care during the first two weeks of the rehabilitation programme for each client in the group was examined. Almost half of the clients (n=7) spent five days or more in a residential community support centre. The remaining clients (n=8) all received home care packages that ranged from one hour per week to 19.25 hours per week. Five clients received over ten hours of home care per week. Given the high level of support required a very high cost, home care package (13.25 hours per week) was chosen as a comparator. Anecdotal evidence from the care managers suggests that social services care packages are typically reviewed annually and thus once in place the package is unlikely to be changed for a considerable time. Netten et al (2001) estimate the cost of this type of package to be £203 per week.

The median percentage of the home care fee paid by this group of clients is zero thus over the 75 days of the programme this would have resulted in a cost per person of £2165. The estimated cost per person of the rehabilitation programme was £1377. This indicates a net resource saving of £788 per client over the term of the programme.

The 95% confidence intervals for the mean cost of the rehabilitation programme for this group are £840.37 – £1913.71. The bounds show that the cost of the alternative, an increased care package, is higher than that of the rehabilitation programme.

The net savings of the rehabilitation programme are based upon the assumption that an increased home care package is defined as very high cost. If the alternative was, for example, a 'median' cost community care package (7.25 hours of home care per week, cost £58 per week, Netten et al, 2001), over the same period the cost would be lower (£618.69) than that of the rehabilitation programme.

As in the previous scenario, whilst the costs of the rehabilitation programme include services such as physiotherapy the cost of the alternative, an increased care package, does not.

*Admitted to hospital/delayed hospital discharge*

This scenario relates to 14 clients who in the absence of the RLT would have been admitted to hospital or had their hospital discharge delayed. The estimated cost of the rehabilitation programme for the group is £2361 per person. The estimated NHS cost per geriatric in-patient bed day is £144 (Netten et al, 2001). This cost is equivalent to 16.4 days in hospital. Given this break-even point a net resource saving would accrue for those clients admitted to hospital for a time period in excess of this or those for whom hospital discharge was delayed for a period in excess of this time.

The 95% confidence interval for the mean cost per rehabilitation programme for clients within this sub group is £1105.26 - £3616.86. At the lower bound this is equivalent to 7.67 days; at the upper, 25.11 days.

**Summary**

For this sample, residential care is less costly to the service provider (the Health Authority and Social Services) than the rehabilitation alternative over the period of the programme. However, post-discharge the balance changes. At three weeks after discharge the cost of a rehabilitation programme followed by home care provision (£2824) is less than the cost of a nursing home (£2977) over the same period. The break-even point for the rehabilitation programme and private residential care is at eight weeks after discharge. This indicates that over a relatively short term net savings will accrue to the service providers.

The second scenario shows the cost a home care package of 13.25 hours per week as an alternative to the rehabilitation programme to be more costly over the period of the programme (net savings to the service provider will accrue during the programme).

For those clients who were likely be admitted to hospital or have had their hospital discharge delayed, the service providers would accrue net savings if the mean number of days in hospital is 16 days or more.

## **Conclusion**

The results presented show mean improvements in all client outcome indicators between assessment and discharge. The cost of the programme, using a micro-costing method, is presented together with the cost of possible alternative hypothetical scenarios. These alternative scenarios attempt to give an indication of the 'previous practice' and allow the cost of the programme to be set in context. The resultant CCA while attempting to conform to the key elements of an economic evaluation set out in Chapter Four does not conform to the text book ideal of economic evaluation in this field.

In order to carry out the evaluation a number of compromises were made in the face of constraints placed upon the evaluation process. Chapter Nine explores these constraints and how they influenced the economic evaluation.

## Chapter Nine

### A Case Study: The Influence of Constraints and Limitations

#### Introduction

The economic evaluation adopted a pragmatic approach in response to the constraints imposed on the study. The constraints, although unique in as much as they pertain to this particular study, are prevalent in many economic evaluations. Constraints can be conceptual and/or practical. Conceptual difficulties are primarily associated with issues of context and related to the choice of comparator, capacity constraints, the size of the service and choice between a short or long run perspective. Practical constraints are connected to the time at which schemes are evaluated, the clinical study alongside which studies are connected and data available (Coast et al, 2000).

Each of the constraints, problems or difficulties faced had particular relevance to the way in which this evaluation was designed and conducted, and therefore necessarily to the results of the evaluation and any decisions made on the basis of those results. Whilst the evaluation has attempted to be transparent in the identification, measurement and valuation of costs and to accurately reflect the outcomes arising as a consequence of the programme, it is acknowledged that it has limitations. These limitations, and the way in which the constraints were overcome or addressed, are explored here in order to highlight the reasons why the economic evaluation does not conform to the text book ideal.

The constraints or difficulties are presented in approximately the same chronological order that they presented themselves during the course of the study, although some of the areas relating to aspects of the study design occurred contemporaneously.

## Evaluation Design

### Perspective

The economic evaluation was part of a wider project commissioned by South Cheshire Health Authority and Cheshire County Council (Social Services) whose research aimed to:

- *Explore the way in which the care management model was implemented*
- *Assess the extent to which the RLT component of the Joint Investment Plan achieved its aims* (Reid et al, 2002, piii).

The economic evaluation was designed with these aims in mind in order to complement the wider research project and provide additional information of the costs and outcomes of the programme to the project commissioners. Thus, the analysis was undertaken from the perspective of South Cheshire Health Authority and Cheshire County Council (Social Services).

This necessarily limits the study. Any economic evaluation that confines itself to a narrow perspective could determine the mix of interventions that would maximise health outcomes within that budget but this would not necessarily maximise the welfare of society within the resources available (Byford & Raftery, 1998). However, the cost analysis was commissioned to reflect the cost of the service to the service providers whose interest lay with their own budgets rather than in a wider, societal perspective. This narrow perspective meant that the evaluation would take the form of a CEA in as much as CEA employs a social decision approach based on the premise that the aim of economic evaluation is to maximise whatever the decision-maker wants to maximise (Drummond et al, 1999).

The narrow viewpoint means that important costs and benefits resulting from provision of rehabilitation programmes may have been ignored. The rehabilitation service is an interdisciplinary interagency programme whereby a network of health, social and voluntary agencies works together across organisational boundaries in order to maximise older people's ability to live independently (Reid et al, 2002). The cost to

voluntary organisations, such as the Red Cross, has not been included in the analysis nor has costs to clients and their informal carers.

## Outcomes

If economic evaluation is a method by which to assess costs and benefits of alternative health strategies (Kielhorn & Graf von der Schulenburg, 2000) then it is implicit that the outcomes of those health strategies must be measured in some way. Thus, one of the first questions addressed when deciding upon the method of evaluation to be used is *what are the outcomes and how can we measure them in the framework of a cost effectiveness analysis?*

The overall aims of the JIP were to avoid older people being admitted to hospital or long term care unnecessarily and to enable people to remain safe and well at home by maximising their independence. In order to determine if the rehabilitation service was effective any measure should reflect the extent to which the RLTs met those aims. Was there a fall in the number of older people being admitted to hospital or long term care unnecessarily? Did the programme enable older people to remain safe and well at home by maximising their independence? However, these questions are somewhat vague. For example, what constitutes unnecessary hospital admittance or how may *maximising independence* be defined?

### *Measuring the extent to which the aims are met*

The first step in the evaluation process was to explore how the aims of the RLTs intervention could be reflected and how those outcomes could be measured. A number of possible options were explored. The first, and probably most obvious measures, were statistics tracking changes in hospital admission or readmission rates during the life of the RLTs; changes in the length of hospital stays and admission rates for long term care between corresponding periods prior to the introduction of the RLTs (previous practice) and during the RLT programmes. It was thought that these statistics may be indicative of a reduction in *unnecessary* admissions representative of the endpoints of the programme.

Despite the likelihood of the confounding variables that may influence these figures discussion took place with professionals in the IT and Public Health departments of the Health Authority and with the County Care Manager for Older People (Cheshire County Council) to discuss the feasibility of using this type of data. These discussions showed that the evidence the data could provide was unlikely to prove robust for a number of reasons. Outlined below are a précis of the data considered and the practical difficulties of obtaining or using this data.

- Was there any change in hospital admission rates following the introduction of the RLTs? If clients were being taken on by the rehabilitation teams rather than being admitted to hospital would this show as a reduction in hospital admissions? Scrutiny of the referrals to the RLTs showed that in many cases the clients admitted to the RLT came *from* hospital rather than being accepted as an alternative to admission to hospital. In addition the data collated by the Health Authority was muddled in as much as each client transfer between consultants or departments within a hospital is categorised a new admission even though it may be part of one continuous client stay.
- Would data reflecting where clients were admitted to hospital *from* and where they were discharged *to* reflect the success of the RLTs? If clients were discharged from hospital and returned home under the care of the RLTs rather than leaving hospital and going into residential care then this would indicate avoiding unnecessary admission to long term care. Unfortunately the data collated by the Health Authority showing these statistics was sparse and would not provide a comprehensive picture.
- Could readmission rates provide indicators of ‘people remaining safe and well at home by maximising their independence’? At the time of the study the Public Health Department was undertaking an IT project to enable them to collate hospital readmission rates. However the data was not available during the lifetime of the evaluation.
- The final statistic considered was the time clients spent in hospital. Has the length of hospital stay changed as a result of discharge to the RLTs? Did the RLTs facilitate

earlier discharge from hospital and thus avoid problems inherent in longer hospital stays? It was possible to obtain data on the length of hospital stay but this data is inextricably linked to hospital admission rates. As hospital admission rates rise, and there is no increase in the availability of beds, the average hospital stay must decrease. In addition, hospital beds generally work at full capacity thus, any reduction in, for example, length of stay will not reduce the number of clients being admitted to hospital but will be more likely to increase hospital admissions as beds become available earlier.

Whilst it was possible to obtain data by age or age groups, for example, admission rates for clients aged 65-79 years and 80+ years, data could not be obtained exclusively for those undergoing some form of rehabilitative programme or process. Data collated by the Health Authority was categorised by medical condition, for example stroke. The RLTs acceptance criteria was such that the rehabilitation programmes cover a number of medical and social conditions which makes data specific to this group, under the current data collection regime, impossible to obtain.

In respect of residential care, over the past 10 years the number of long-term residential care beds in the Cheshire area has experienced a steady decline (at the time of writing there are no Local Authority long-term residential homes). Statistics are collated of the number of beds available in the Cheshire area and Social Services have details of the number of older people in residential care for those clients that receive a contribution to the cost of that care; but not for those who pay the full fee themselves. In addition data only relate to those admissions within the Cheshire boundaries and did not include Cheshire residents admitted to residential care outside this area. It was felt that general data relating to admissions to long-term residential care would not provide evidence of changes in residential placements resulting from the RLTs due to the lack of complete data and confounding variables influencing the downward trend in bed numbers.

Thus, the statistics currently available did not meet the needs of the evaluation and, whilst these types of measure could possibly have reflected the overall aims, a measure of clients' health and social status was deemed to be the best indicator of the effectiveness of the programme.

*Effectiveness at an individual level*

The underlying aim of the RLTs is to maximise older people's ability to live independently and a person's health status will have a bearing on that ability. But, tied to this are other factors such as how a person adapts to changes in health and the level of social support available. The definitions of rehabilitation posited in Chapter Two focus on restoration of function and role to the best possible degree; rehabilitation services that require a mix of clinical therapeutic and social interventions (Nocon and Baldwin, 1998). In line with these definitions, the rehabilitation programme aimed to affect improvements in a wide range of areas. The focus of clients' rehabilitation included not only changes in health such as improved functional ability but also upon improvements in social function. In order to reflect these changes a number of measurement tools were considered.

*Standardised measures*

A wide range of measures were explored to reflect the range of possible client outcomes and, whilst this included discussion between all those involved in the wider evaluation project, three of the measures to be used in the economic evaluation were, in part, dictated by those undertaking the wider evaluation project. These included a measure of functional ability (the Modified Barthel Index), a measure of anxiety and depression (the HADS) and the Reintegration to Normal Living Index (RNLI), chosen to further reflect improvements in social function (outlined in Chapter Seven).

In terms of the economic evaluation the EQ-5D was added as a further outcome measure. The EQ-5D aims to be a measure of quality of life designed to measure domains such as emotional and social function, well being, disability and overall health status and, as such, was thought to reflect the multiple aims of the rehabilitation programme. Although a relatively new measure, the EQ-5D is often used in economic evaluations (the single index can be used to calculate QALYs). However, whilst the EQ-5D has been designed to value health related quality of life (Brooks and the EuroQol Group, 1996) it is for use alongside more detailed condition specific or treatment specific areas (Williams, 1995).

Once the evaluation was underway the EQ-5D was in fact the only measure that was designed to reflect social function. Despite the appropriateness of the RNLI measure in the rehabilitation setting, the index was not used following discussion with care managers (who administered the outcome measures). The care managers perceived the measure to have limited relevance to many older people. This view is confirmed by Wood-Dauphinee et al (1988) who acknowledge the index is somewhat related to work status. Care managers also felt that the language used within the measure would cause some confusion (Reid et al, 2002). However, the three remaining measures were thought to cover all relevant client outcomes.

The wider research project also used the Carers Assessment of Difficulties Index (CADI) to explore caring difficulties. It was intended that this tool would explore the experiences of being a carer prior and post the RLTs involvement and thus capture any effects or consequences resulting from their intervention. However, the CADIs were poorly completed and did not produce sufficient data for meaningful analysis.

### *Individualised measures*

Whilst the study used the standardised measures detailed above, an alternative was considered at the design stage: the use of some form of individualised measure. Many widely used standardised measures are not considered patient centred because of the way in which items were generated, because a questionnaire may restrict a patient's choice, and because of the weighting system used (Carr and Higginson, 2001). Although a number of individualised measures of quality of life and health status exist (for example, the patient generated index (PGI)) there are disadvantages to their use. These type of measures often require clients to weight experiences or area of their lives which can be difficult and patients may not always readily volunteer factors that are important to them (Carr and Higginson, 2001). Given that the care managers were to administer the measures it was felt that this would prove burdensome to both interviewer and respondent.

Goal setting was an important aspect of the rehabilitation programmes. Clients and their informal carers identified goals to work towards. These included starting to drive their car again, to start to walk more, to shop or to get home (Reid et al, 2002). The use of

these individualised goals and their achievement to determine the effectiveness of the programme was considered. It quickly became apparent that for some clients the discussion of goals at acceptance on to the programme or in the early stages of their rehabilitation was not appropriate. For example, one client indicated that he had initially been too ill and low in mood to discuss goals or participate in the full assessment process. However, with time the client felt much stronger and more confident/involved.

*'(The care manager) didn't actually discuss goals because I don't think I was fit enough...I wasn't taking it in what he was trying to tell me, but towards the end...I was capable of facing up to answering these questions (in the assessment). Before I'd just start crying'* (Reid et al, 2002, p59).

Other clients' goals evolved over the course of the programme. Due to the diverse nature of goals, the differences in the stage of the rehabilitation programme in which they were introduced and changes during the course of rehabilitation programmes the achievement of goals set was not used as an outcome measure for the evaluation.

### **Cost Consequence Analysis**

The multiple outcomes and absence of a principle effect that could be expressed in a single dimension meant that the analysis would take the form of a CCA. CCA does not combine the costs and consequences of the analysis but merely present the analysis and allows users of the study to make decisions about the relative importance of the disaggregated results.

This form of analysis allowed the evaluation to present a comprehensive outline of outcomes resulting from the programme but assumes that users of the study can make the necessary judgements about the relative importance or value of the individual results. This forms part of a larger theoretical and practical argument, about whether decision-makers are the right people to be making these value judgements. Who decides which of the outcomes is most important? Are improvements in functional ability more or less important than improvements in anxiety or depression?

Whilst this is an important area of debate, for the commissioners of the study, it held little relevance. In line with the study question focus lay upon three questions: what is the cost of the programme? Is the programme effective? How do cost and effectiveness compare with the previous practice? The effectiveness results showed improvements in all indicators between assessment and discharge and no judgements were placed on their relative importance. However, it is acknowledged that as the study reaches a wider audience this may change.

## **Selection of Alternative**

### *Effectiveness analysis*

Evidence of the effectiveness of the programme compared to some alternative is the necessary foundation of an economic evaluation (Drummond et al, 1999) and RCTs are generally accepted as the most powerful tool for assessing the effectiveness of interventions, medications, or procedures (Gold et al, 1996). Ideally the evaluation, both in terms of effectiveness and costs, would have been a randomised controlled trial that compared the RLTs against the previous rehabilitation practice. Unfortunately it was obvious in the early stages of planning that this would not be possible for a number of reasons.

The RLTs accepted all referrals that met the rehabilitation programme criteria from the start; the scheme was not introduced gradually. There was no period of time in which the previous rehabilitation practice ran concurrently with the new rehabilitation programme. Those clients not referred to or accepted on the new programme did not meet the criteria of the scheme. To use this group as a control group would result in an inappropriate comparison (comparing different populations). This meant looking elsewhere for an alternative control group. A number of options were considered.

*Previous practice*

An historical control group or time series using different samples involves using a similar group of clients as a control group; clients that had gone through some form rehabilitation process in a corresponding previous time period. This type of control group has a number of disadvantages. There may have been changes over time in the way data is collected or changes in referral patterns. There may be a selection bias if, for example, inclusion criteria for rehabilitation have changed over time. There may be an experimental bias as previous recorded data available for the controls are likely to be inferior and subject to missing information (Bowling, 1999). Within the context of this evaluation these disadvantages became apparent very quickly.

Prior to setting up the RLTs no formal rehabilitation service existed for this client group. There was no referral procedure for rehabilitation and clients were referred to a number of services and agencies; for example, clients may have been referred to the community therapy services for physiotherapy and to 'panel' at social services who would then make a decision on their 'social services' needs. Client outcomes were measured on a very ad hoc basis and in those areas where client outcomes *were* formally measured they were measured primarily at the outset of treatment, often using locally customised measures, but not at discharge.

This was illustrated in July 2000 by a RLT co-ordinator during an exploratory discussion of the way in which outcomes would be measured in the RLTs. Therapy Services within the co-ordinators area were, at that time, using the Therapy Outcome Measure (TOMs). The measure was enjoying a trial period of six months and, prior to its introduction 3 months earlier, practitioners had used a number of different measures. The TOMs measure was being used in this locality but not the other two RLTs locations.

The lack of transparency in identifying those clients in the past who would have met the RLTs criteria, identifying rehabilitation programmes (if any) undertaken and determining outcomes meant finding a comparable sample group was not feasible.

### *Rehabilitation practice in another location*

In the absence of data relating to rehabilitation outcomes prior to the RLTs a further alternative was considered; a rehabilitation service in a different location similar to the service provided prior to the RLTs inception, a geographical comparison. A geographical comparison uses people who live in another area without the service/treatment or with a different mix, these people act as the comparison group to people in the area with the experimental service/treatment. This type of comparator is particularly suited to studies in which small numbers are being recruited to an experimental service (Bowling, 1999). For the purposes of this study time constraints meant that recruitment would take place over a relatively short period (13 weeks) and thus, this type of comparison group may be suitable.

Thus, the use of a comparable group of clients in another area with similar socio-economic characteristics and demographics was explored. However, budget constraints proved this option unfeasible. The cost of undertaking the study in two separate geographic locations, in addition to the cost and time involved in evaluating a rehabilitation programme that was itself based in three different geographic locations, was prohibitive. Many of the problems faced when using an historical control group were also apparent in this choice of comparator, this included identifying clients who met the RLT criteria and ensuring referral criteria did not change over the period of the study. In addition it was felt that it might be difficult to obtain agreement from another health authority/social services service to use their rehabilitation programmes in this way.

### *Sample as their own control group*

In the absence of an obvious control group the possibility of using the sample as their own control, a before and after type study, was considered. This design of study is also known as the One Group Pre-test Post-test and observes one group prior to exposure to the intervention and after exposure. Inferences are made from the observed differences between pre and post testing (Campbell and Stanley, 1963).

This proved feasible; client outcomes could be measured at assessment, discharge and (in the original design) six months after discharge. Any changes over the period of the programme would provide evidence of effectiveness over the short term. Changes recorded between discharge and the follow-up period would provide evidence that outcomes were sustained over a longer term. However, the weakness of this design is that it does not tell us whether the outcomes are better or worse than outcomes would have been had clients undertaken an alternative rehabilitation programme or even had no rehabilitation. Extraneous confounding variables, such as time, can jeopardise internal validity (Campbell and Stanley, 1963); would clients have shown the same improvements over time without rehabilitation input?

The before and after type study was chosen as the only feasible option despite the weakness in design. However, within the larger project, interviews were undertaken with a number of clients to explore their experiences of the RLTs. It was felt that these interviews would complement evidence derived from the before and after study of effectiveness.

### **Type of Study**

The design by which the effectiveness of the rehabilitation programme would be measured was therefore to be a before and after study using clients as their own comparator. The extent to which the rehabilitation programme met its aims was reflected by three outcome measures (the Modified Barthel Index, the HADS and the EQ-5D) administered at assessment for acceptance onto the programme and again at discharge. In order to determine if the outcomes were sustained the measures would be administered again at six months after clients' discharge.

The next stage of the evaluation development was to consider the methods by which the cost analysis would be undertaken.

### **Cost Analysis**

The constraints faced in obtaining a group with which to compare the effectiveness of the rehabilitation programme were no less relevant to the cost analysis. Use of a before

and after design to measure client outcomes meant looking elsewhere for a cost comparator. Whilst using this design was feasible for the effectiveness measure this would only allow the costs of the programme to be calculated for that sample group. What would these costs be compared against? A cost analysis has little context to decision makers if it does not show whether the rehabilitation programme is more or less expensive than an alternative course or courses of action.

## **Counterfactuals**

The use of a hypothetical comparator, a counterfactual, was explored. The concept of the counterfactual has been used widely in areas of economics such as economic history and evolutionary economics; there also exists an abundance of literature relating to counterfactuals in the disciplines such as philosophy and psychology. The counterfactual may be thought of as the 'what if?' option; for example, within the context of economic history, what would have happened if an event had not taken place? How would the course of history altered? Within psychology, counterfactual thinking may be thought of as thoughts of how things might have been (Mandel and Lehman, 1996) and as mental representations of alternatives to the past (Roese, 1997). Counterfactuals are often used to explore causal relationships; the 'what if?' condition is known as the counterfactual conditional.

Views of counterfactual analysis are divided into two camps; the philosophical view sees a counterfactual conditional as describing a possible but not an actual world (Lewis, 1974) and the view of history as a tree with decisions branching points (Elster, 1978). Counterfactual analysis involves examining a branching point and exploring the decision not taken (Cowan and Foray, 1999). The branching theory may be seen in the same way as decision tree analysis when setting out complex sequences of alternatives beginning with an initial choice or decision. As a result of that decision there will be outcomes (with given prior probabilities); these may lead to further decision points and so the process continues until all decisions are exhausted.

The counterfactual conditional used in the study asks what would have happened to the client in the absence of the RLTs. It was thought that this would provide an indication of the previous rehabilitation practice and thus associated costs. The initial choice or

decision thus occurs at acceptance onto a rehabilitation programme. This type of hypothetical comparator has been used in a number of previous studies in the area of rehabilitation (see for example, Walker, 1996; Brodin and Persson, 1995).

Unlike decision tree analysis used for clinical outcomes, the study did not assign given probabilities to alternative courses of action, nor were probable answers or outcomes suggested; instead the 'what if?' question was asked and the responses recorded in free form. The responses were then coded thematically using content analysis.

### **Response Bias**

The counterfactual conditional used in the study asks what would have happened to the client in the absence of the RLTs; but from whom should the response be elicited? Two options were considered: responses could be elicited from the person who had referred the client to the RLT or from the person who carried out the assessment of the client for acceptance onto a rehabilitation programme. The advantages of using the referrer are clear; the study would be less open to accusations of bias as the referrer is not part of the RLT (no vested interest). The person or agency that made the referral will know the procedures and options open to them as referrers; where and to whom they would refer clients. However, once the referral has been made they may have little interaction with the client or knowledge of what would happen to that client once their input finished; the likely course of action. In addition, referrals come from a number of different professions and agencies; these include health care professionals, social care professionals and even self-referrals. Whilst these professions and agencies may have a clear and informed knowledge of many aspects of the clients' medical or social status it was felt that the care managers, having undertaken a comprehensive single assessment of both the medical and social needs of the client, would be ideally placed to answer this question in the most informed way.

### **Counterfactual as a Measure of Effectiveness**

The responses to the question have been used to undertake the cost analysis. They provided the basis of the costs of 'hypothetical' alternative course of action.

Responses to the counterfactual conditional (what would have happened to the client in the absence of the RLT?) were analysed and placed into three categories:

1. Probable that client would have gone into residential care
2. Likely client would have gone home with an increased home care package
3. Likely the clients hospital discharge would be delayed/likely to have been admitted to hospital

A further category of 'other' included those responses that did could not readily be categorised.

Given the aims of the programme were to avoid unnecessary admission to hospital or long term care and to enable people to remain safe and well at home the extent to which then programme met these aims could be demonstrated using the responses elicited from the hypothetical question. This could be undertaken by comparing clients' probable or likely destination in the absence of the RLT and clients' actual residence at discharge from the programme. This comparison is shown in figure 1 (both (a) and (b) relate to the 73 clients accepted for a rehabilitation programme who gave written consent for their records to be used).

The comparison appears favourable. Almost 80% of the clients in the sample are resident at home when discharged from the programme, whilst in the absence of the RLTs it was thought probable that only 20% of clients would be in their own homes. However, the comparison was not used as an indicator of the effectiveness of the programme for a number of reasons.

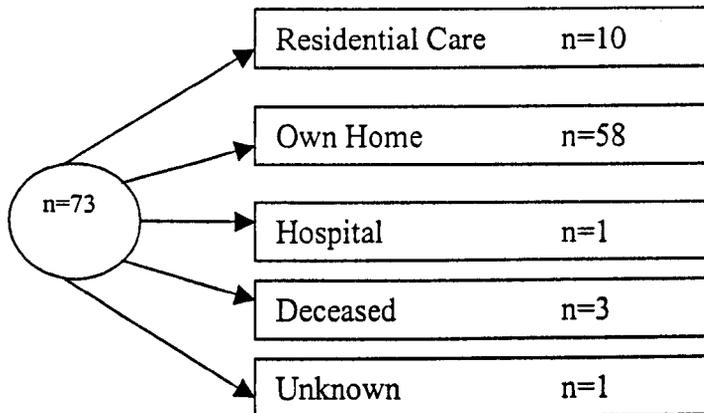
The question asked to the care managers was 'what would have happened to the client in the absence of the RLT?' When the responses were analysed the categories, although pertaining to destination did not specify residence. For example, a care manager responded:

*Client had been having a lot of falls; there was a strong possibility of fractures and a hospital admission*

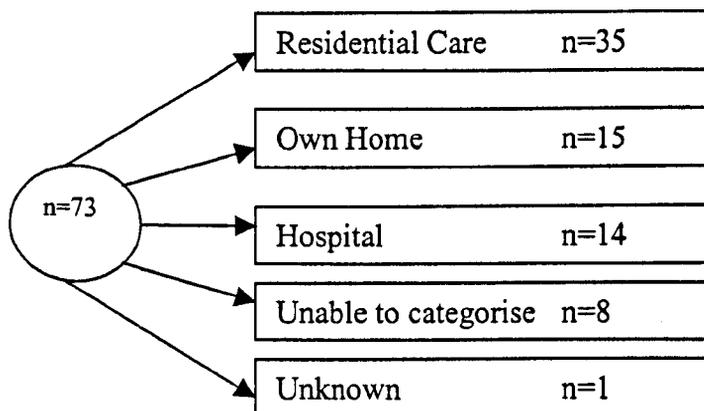
Hospital is the likely destination but would not be this client's permanent residence. In addition responses did not indicate the time period of these likely courses of action. For example, respondents indicated that 20% of clients were likely to have a delayed hospital discharge or be admitted to hospital, but no conclusions can be drawn over the length of that time in hospital or their destination upon discharge.

**Figure 1:** Residence comparison; expected and actual

(a) Actual Residence at Discharge from the Rehabilitation Programme



(b) Probable Residence in Absence of RLTs



Using clients' residence at discharge from the programme as a measure of effectiveness was also resisted by the care managers themselves. Care managers often felt that clients who entered residential care at discharge from the programme would be seen as a 'failure' despite clients having explored all options open to them through the rehabilitation programme. The care manager's quote below is typical:

*'Mr A wished to live in sheltered accommodation. However, during the programme he decided to go into residential care as he may be isolated in sheltered housing. The decision is the client's. He has, through the options given to him by the RLT, come to terms with this; he is now empowered to make the decision'*

Clients' empowerment in the decision making process was clearly a very important part of the rehabilitation process and was further illustrated in the goal setting process by which clients' set their own rehabilitation goals with the care manager. The resistance to using residence at discharge also connects with the aim of the RLTs to avoid *unnecessary* admittance to hospital or long term care. For Mr A residential care was necessary but the programme explored all possibilities before both the client and the care manager came to this conclusion.

## **Time Scale**

### *When to evaluate?*

Deciding when the evaluation takes place is particularly significant for new and/or complex schemes, such as those requiring significant interagency working or a change in culture (Sanderson, 2001). The RLTs required both significant interagency working and a change in culture. The RLTs began to accept clients in July 2000 and the early phase of the service development was a notably stressful time for care managers and the programme's co-ordinators; a time of steep learning curves. As one of the RLT team noted:

*'It's like driving a car over a motorway that's not been built yet'* (Reid et al, 2002, p25).

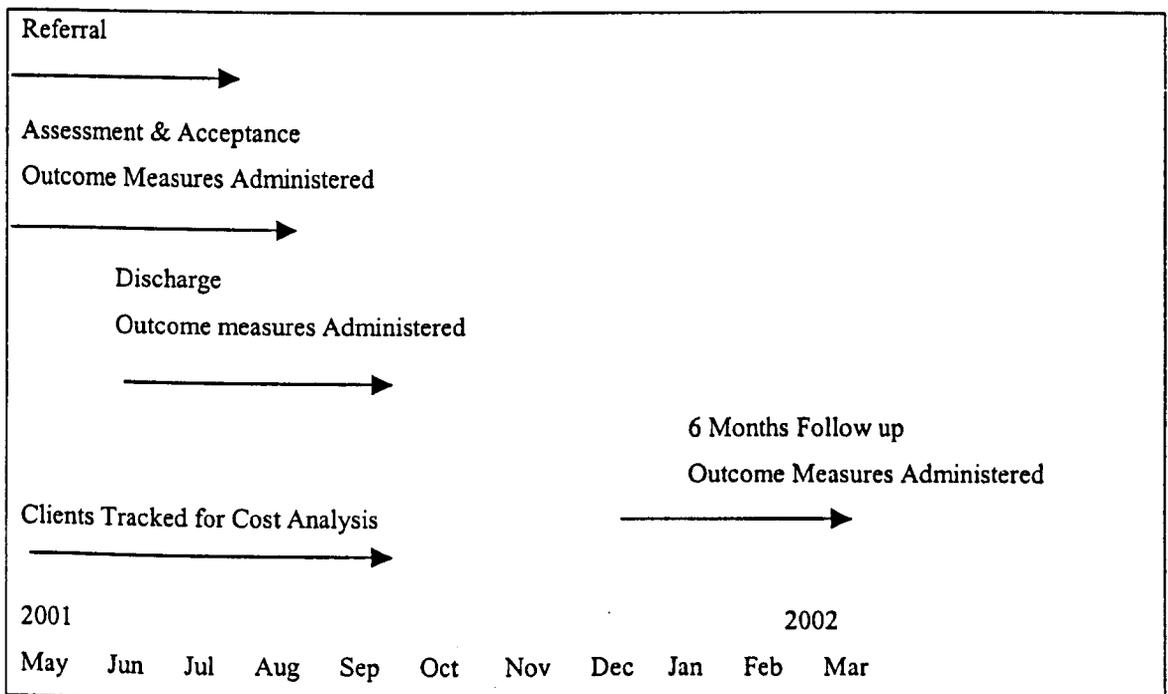
During this early phase posts within the RLTs remained unfilled, which had knock on effects in terms of the numbers of clients the teams could accept. In addition during this period a large amount of time was spent in team training. During the period July 2000 – April 2001 a total of 19 days 'out of office' training was undertaken by each team member.

It was agreed that data collection, for both effectiveness and costs would begin in May 2001 in order to allow a bedding down period. It was envisaged that data collected at this time would provide a more accurate reflection of client outcomes from a more established and experienced team and would also be a truer reflection of the costs as by this time team members would be carrying representative or 'normal' caseloads. This was important given the primary interest of the cost analysis is the cost per client of rehabilitation programmes using a bottom-up approach to costing.

By May 2001 the programme had been running for approximately 10 months. This time period is slightly less than 12-18 months that Sanderson (2001) suggests as the period in which longer-term effects will be apparent but it was calculated that this was the latest time the project could commence and incorporate a 6-month client follow up.

### *Planned Duration*

**Figure 2: Original Evaluation Timetable**



When designing an effectiveness evaluation an important consideration is whether the outcomes are sustained over time; do the benefits of the intervention increase, hold steady or diminish over time? (Gold et al, 1996). It was initially envisaged that rehabilitation programmes would last approximately six weeks. Using this as a

guideline in order to ensure that any benefits were sustained over time the evaluation chose to follow clients from assessment to discharge and then at a follow up period of six-months after discharge from the programme. It was felt that this time period was sufficient to provide an indicator of sustainability and would be feasible in the time period of the project. The original evaluation timetable is outlined in Figure 2.

### *Actual Duration*

However, from the outset many individual rehabilitation programmes exceeded the envisaged six weeks period. In retrospect the County Rehabilitation Co-ordinator acknowledged that the expected six week rehabilitation time period was ill-conceived given an acceptance criteria of clients with complex medical, psychological and/or social problems who were likely to require protracted rehabilitation programmes.

A further factor that led to the prolonged duration clients spent on rehabilitation programmes was the shortage of mainstream home care. The RLTs had a number of home care workers dedicated exclusively to RLT clients. For clients who utilised this home care as part of the rehabilitation programme and who required continuance of home care post discharge, often discharge had to be delayed until mainstream home care became available. The shortage of mainstream home care remained a constant stumbling block (Reid et al, 2002).

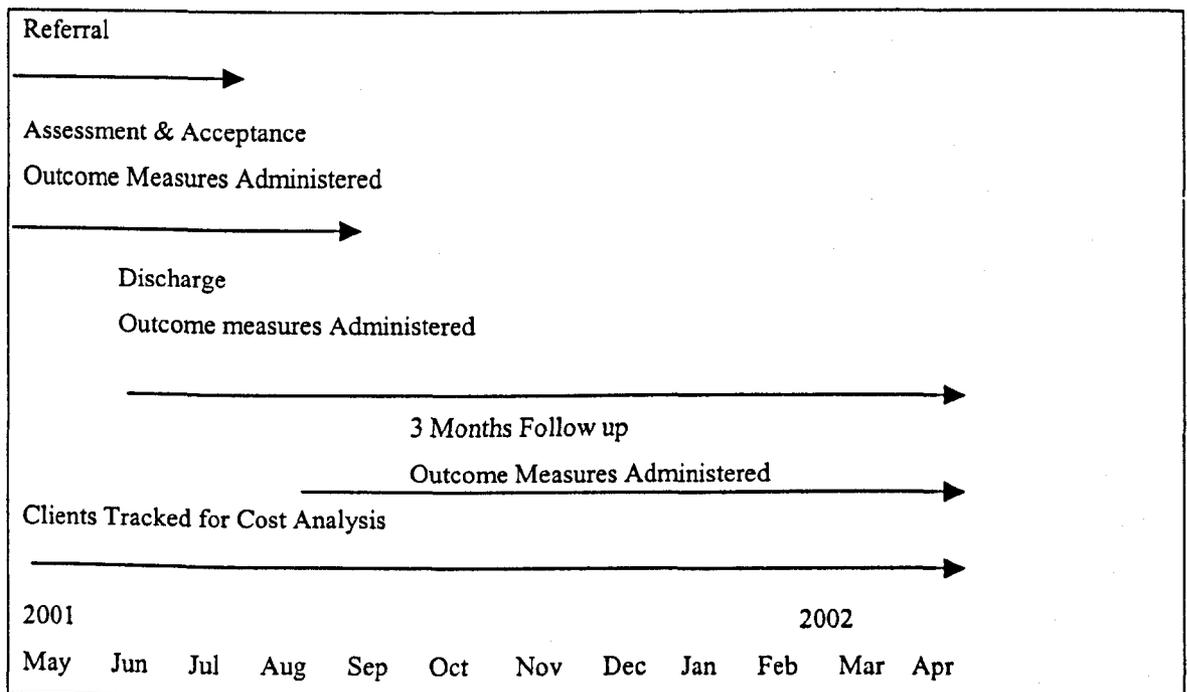
In addition to a longer than expected duration of rehabilitation, in a small number of cases, there was a protracted time between referral and the programme start. Clients were typically assessed within 48 hours of referral but there could be a much longer time span (up to 10 weeks) between the referral and programme start dates. This is illustrated by the case of Mr B:

The Intensive Health Support Service (IHSS) referred Mr B to the RLT. IHSS provides short-term care to people with an acute health need in their own home, or in a residential or nursing home (East Cheshire NHS Trust, 1999). Mr B had been admitted into a residential support centre under IHSS following a fall at home. He had previously been independent but as a result of the fall had limited mobility. He wished to return home. Following discussions with IHSS it was agreed that an assessment would be

undertaken once Mr B was medically fit for rehabilitation and at this time, if Mr B fit the RLT criteria, they would arrange a rehabilitation programme including support to allow him to return home. The time period between referral to the programme and starting the programme was five weeks.

The prolonged duration of rehabilitation and the protracted time periods between referral and starting the programme meant that the original timetable was unworkable. Despite a reduction in the follow-up period to three months only a small proportion the sample completed the follow up outcome measures (25% of the sample). This small number meant that the nature of any conclusions drawn from the data would be tenuous and thus evidence of the sustainable nature of the outcomes achieved was lost. The actual project timetable is shown in Figure 3.

**Figure 3: Actual Evaluation Timetable**



### Sample

Data for both cost and effectiveness that made up the cost consequence analysis related to the same sample group. Having client specific data on both costs and outcomes is attractive for analysis and internal validity (Drummond et al, 1999).

The study recruited clients referred to the RLTs over a 13-week period who had subsequently been accepted on to a rehabilitation programme and given consent for their records to be accessed by the research team. There was no randomised selection process – all clients who consented to take part were included in the study.

The difficulties and limitations experienced by any non-randomised evaluation are relevant for this study. It is not apparent whether clients who consented to take part are representative of the client population accepted onto the scheme; whether the group of clients who gave consent to participate in the research project were biased in some way.

There was no statistically significant difference in age between clients who gave consent and those who did not and the only indication of differences in initial health states was captured in the reasons why clients did not complete the consent to be included in the programme. These reasons were elicited from the care managers. While only 11 clients in fact refused consent, of the remainder 18 were too ill, anxious or had cognitive problems; five experienced a very short programme; five withdrew from the programme; three were admitted to hospital; and three died. Whilst these figures could be indicative of a lower initial health state for this group (and thus may indicate a higher resource use and cost during the rehabilitation process) this can only be a speculative conclusion.

#### *Non-consent and selection bias*

The consent form was included in the outcomes measures booklet and there was an initial reluctance by care managers to use the outcome measures despite piloting the measures with a number of care managers' prior to their use in the evaluation. This was in part due to their perception that parts of the booklet duplicated data they had already collected, albeit in a different and sometimes less systematic manner. In addition informal discussions revealed that those care managers with a social sector background were far less comfortable using the outcome measures than those from the health sector. These care managers found quantification of outcomes inconsistent with social sector culture.

This reluctance was addressed by means of a workshop explaining the rationale and potential of the outcome measures and following further support and guidance from the County Rehabilitation Co-ordinator, the teams became more consistent in their use of the outcome measures (Reid et al, 2002). However, it is possible that this reluctance is reflected in the clients for whom consent has and has not been obtained. If the care managers, who recruited clients to the study were 'cherry picking' clients (if so what were the criteria?) then the study may suffer from selection bias.

Despite these problems the sample consisted of 73 clients which represented 56% of clients accepted on to the programme.

### **Costing Method**

Cost analysis is a process of three basic steps: identification, measurement and valuation. The resources considered in the identification process will depend on the perspective of the study. Thus, if the study is from the perspective of the service provider, as it is in this study, only those resources used in the provision of that service will be included. Two strategies by which costs could be measured and valued were considered: micro-costing and gross-costing (bottom-up costing and top-down costing). Micro-costing is a detailed analysis of changes in resource use due to a particular intervention (similar to time and motion studies) whilst gross costing allocates a total budget to specific services (Raftery, 2000).

#### *Gross-costing*

The cost analysis addresses the question of how much the programme costs. The programme was allocated a budget of £1.2 million per annum over a two-year period at the end of which time the programme commissioners would enter into discussions regarding the continuation of the service.

The budget included the cost of team members (including administration staff), home care and support centre stays and, thus excluded the cost of accommodation, office costs such as telephones and stationery and overheads. These excluded costs were absorbed across the three geographic locations into the overall Health Authority budget and such

were hidden. These hidden costs meant that use of a top down approach in the cost analysis was not feasible.

### *Micro-costing*

In order to answer the question 'how much does it cost?' the evaluation used a bottom-up or micro-costing approach. This approach is generally acknowledged as the most accurate method by which to identify resource use. In fact micro-costing can be seen to reflect the ideal of identification, measurement and valuation of resources (Gold et al, 1996). This approach was thought to be the most appropriate method of identifying and measuring costs for a number of reasons:

- Accuracy/precision (seen as the gold standard).
- Relative ease of collection: data of client outcomes were to be collected prospectively; identification and measurement of resource use could be collated contemporaneously.
- The scheme introduced an innovative care management programme based on interdisciplinary, interagency working; it was perceived that the primary resource use would be staff time and thus it was important to record this time accurately.

Thus, details of resource use for each client were identified, measured and valued in order to provide a cost of rehabilitation per patient estimate.

### *Identification*

The RLTs kept records detailing all clients referred the rehabilitation programme; these records were updated daily and detailed acceptance onto the programme. Care managers invited clients accepted on to the programme to take part in the evaluation. These records have been used to identify those accepted on to a programme that had consented to take part in the study.

The care managers, who undertook clients' assessments and instigated the individual tailored rehabilitation programmes, were asked what services had been commissioned in order that resources were identified. For example, had home care provision or a stay in a

support centre been arranged? Had the care manager asked an occupational therapist or physiotherapist to visit the client? Was the client admitted to hospital during the course of the rehabilitation programme? In addition to the care managers responses resources were identified from client running notes and social services data.

### *Measurement*

In order to measure the resources identified practitioners were asked to recall time spent on client cases. The data collected was divided into three distinct categories: time spent with the client, travelling time and 'non-contact' time. Non-contact time included time spent in client associated activities and included time spent writing up notes, telephone calls, talking to relatives and arranging services. Care managers used appointment diaries and client running notes to provide this data. This process was repeated, typically on a weekly basis until the client was discharged from the rehabilitation programme.

Those practitioners not employed by the RLTs but who were commissioned by the care managers were contacted by letter to ascertain their input into each client's care. This often resulted in a delay in asking for information.

Level of recall was one area of potential concern; were the care managers' and practitioners' recall of time spent on clients' cases accurate? Use of this method of measuring time inevitably produced estimates. In a small number of cases the practitioners commissioned by the RLTs voiced the opinion that the information they gave was not particularly accurate. However, the large number of geographical locations precluded visiting each professional on a weekly basis to obtain information.

An alternative method of collecting this data would have been to ask care managers and practitioners to record time spent in diary form. However, this method would have placed an additional burden on practitioners and it was not always apparent at the outset which practitioners would be involved in each client's care. For example, the care manager may ask for a physiotherapist to visit a client but may be unaware until that visit which physiotherapist it is.

Client stays in community support centres and home care provision were recorded on a Social Services database. This database was cross-referenced with clients' notes to measure resource use for these services.

### *Valuation*

Although many analysts favour micro-costing, it tends to be costly and runs the risk of being specific to particular contexts (Raftery, 2000). In order to counter the risks outlined by Raftery, valuations placed upon the resources that had been identified and measured are not specific to the workplace from which they have been taken. They are cost estimates compiled by the Personal Social Services Research Unit at the University of Kent (Netten et al, 2001).

The analysis could have used actual salary costs of individual practitioners within the RLTs but obtaining the salary details of practitioners commissioned by the RLTs would have proved to be time consuming and was not feasible in the time available. Use of these standardised figures increases the generalizability of the evaluation. Whilst this would appear to be less specific to the service providers it should be noted that the unit costs incorporate wages/salary, salary oncosts, overheads and capital overheads. By valuing resources in this way, the analysis incorporates some of the hidden costs that were not included in the RLTs annual budget but absorbed into the Health Authority budget and increases the accuracy of the cost analysis.

### *Assessment*

Use of the cost estimates may have improved the generalizability of the study but costs can vary across locations and as such may not be a true reflection of the cost of this service. This form of micro-costing may have led to the omission of important variables or resources used as part of the delivery of the programme. This is especially pertinent for the assessment component of the service

The service provided by the RLTs is a rehabilitation and assessment service. Whilst the analysis includes the resources used in the assessment of those clients accepted on to the programme it does not include the cost of the assessment of those clients not accepted

onto a rehabilitation programme. Had the analysis adopted a top down approach the cost per client would have included the costs of these assessments.

### **Evaluating a New Service**

As previously outlined the first 6-9 months of the programme was characterised as a period of learning and development. As such data collection began in May 2001 to allow for this bedding down period but even at this stage the teams were still developing. During the data collection period new care managers were recruited to take up unfilled positions or replace staff who had moved on. The breadth of the care managers' role and new responsibility meant that on going staff training and development was crucial. The learning curve is probably best illustrated by a quote from a care manager in December 2001:

*'I think you don't realise what you have learnt, until you start to question.... At the beginning it was hard, but now you are doing things more automatically. You know, care management, CRISS (client database held by social services) – they were all nightmares, but now they don't pose a problem' (Reid et al, 2002, p27).*

Steep learning curves often characterise new services but this poses the question of whether the costs would be lower had the evaluation been undertaken six months later? Does the micro-costing method underestimate the cost of setting up this type of service? It is likely that the mean per patient cost was higher in the first nine months of the service. In addition one-off costs such as the initial cost of recruitment advertising when the team was set up were ignored.

The steep learning curve means that the marginal cost of new staff is also likely to be high. Over the first nine-months in which the teams were in operation in addition to specific professional development team members took part in 19 days of formal training. Much of this training was as a consequence of the team and the service being new but training also centred on equipping team members with the skills necessary to undertake their new roles. In addition informal training was on going; the role undertaken by care managers is a good example of this. Over the first nine months the learning areas for the care managers included: learning to be a care manager, new

decision making skills, coping with new types of stress; developing a new identity; setting up care packages; interagency working and team working (Reid et al, 2002).

Within the UK, the National Service Framework for Older People (DoH, 2001) and Department of Health guidance in the intermediate care setting (DoH 2001a) have emphasised the need for interdisciplinary, interagency working. This points towards an increase in the type of service offered by the RLTs. As more practitioners become familiar with interdisciplinary and inter-agency working and practitioners' roles expand to include areas outside their own professional boundaries the marginal cost of training and development for newly recruited staff is likely to fall.

### **Inclusion and Exclusion Criteria**

#### *Resources*

Much of the inclusion and exclusion criterion were decided at the outset. All human resources commissioned as part of the rehabilitation programme were to be included in the cost analysis. This included health authority therapists, home care workers and local authority occupational therapists. The cost of in-patient stays be they hospital in-patient stays or support centre stays have also been included.

Services that were on-going or had been commissioned prior to clients' acceptance on to the rehabilitation programme were excluded. This included, for example, visits to/by chiropodists; it was assumed that these services and visits would have taken place if the client had not taken part in the rehabilitation programme.

Within the client records held by the care managers were records of all hospital admissions. It was decided at the outset to record all admissions and the results of the cost analysis have been presented to show the cost of rehabilitation with these in-patient days and without them because it was felt to be unrealistic to predict whether the admission would have or would not have taken place had the client not been included in the rehabilitation programme. Within the study sample all hospital in-patient days arose from emergency admissions. Reasons for these hospital admissions were diverse and

included admissions as the result of falls and admissions due to deteriorating existing medical conditions.

Hospital outpatient visits have been excluded. Typically the purpose of these visits was to address existing conditions and for the purpose of the study it was assumed that these visits were part of clients' on-going health care programme and would have taken place had the client not been included in the programme. For the same reason GP and district nurse visits were excluded.

Initially data relating to home aides such as perching stools and commodes supplied to clients were recorded for inclusion in the cost analysis. However, it became apparent early during the course of the evaluation that data relating to the loan or purchase of these aides tended to be somewhat haphazard and the cost of these aides would prove only a tiny proportion of the cost of the rehabilitation programme. In addition it was not possible to predict with any degree of certainty that these aides would or would not have been required had the client not been included in the rehabilitation programme. Therefore home aides have been excluded from the cost analysis.

#### *Cost of travel*

The cost of travel (cost per mile) has also been excluded. The majority of practitioners involved in the rehabilitation programme travelled to the client (whether to the client's home, to the support centre or residential placement). Whilst inclusion of these costs would have given a more informed analysis it became apparent mid-way through the study that the data collected would not provide sufficient detail as often practitioners provided aggregated estimates of the time spent with each client rather than detail each individual visit. In retrospect this is a deficiency in the data collection process. However, practitioners did apportioning travelling time if they were to visit more than one client in a particular destination and this travelling time is included in the analysis.

#### *Client contributions*

The analysis includes clients' contributions to the cost of their care. The services supplied by the Health Authority were free of charge but aspects of care packages were

chargeable to the client, notably home care packages, residential care and support centres. The rehabilitation programme allowed for a period of up to 14 days in a community support centre that was free of charge to the client. Stays in excess of this period were chargeable and clients' means tested to determine their contribution to these stays. Similarly, for those clients who had not had a period stayed in a support centre but required home care a period of 14 days home care was provided free of charge. The cost of any home care outside of this free period is means tested to determine clients' contributions.

The analysis illustrates the rehabilitation programme costs with and without these contributions. This is to increase the generalisation of the study; to allow readers to make comparisons between the levels of client contributions to care in their area and those in the study.

The cost analysis identified individual clients' contributions to the services provided using data provided by Cheshire Social Services Income and Charging Department. This data allowed the analysis to present true representations of the cost of provision of these services for this client group rather than use countywide estimates. It should be noted that for six clients this information was not available and for this group the calculation of estimates, using the sample group, have been presented in a transparent fashion.

#### *Start-up costs*

The cost analysis did not attempt to include start up costs and, had these costs been included, it is likely that the cost per client would have been significantly higher.

The service was developed in response to national policy initiatives (DoH, 1997) and a review of rehabilitation services for older people commissioned by East Cheshire NHS Trust and undertaken in 1998-99. The findings from the review were published in an internally circulated document 'A Service without Walls' (East Cheshire NHS Trust, 1999). This led to the introduction of a Joint Investment Plan for Older People, Assessment and Rehabilitation, a collaborative enterprise headed by Cheshire County Council and South Cheshire Health Authority in the same year. In December 1999 a

County Rehabilitation Co-ordinator was appointed to drive forward, oversee and develop the interdisciplinary assessment and rehabilitation teams followed by the appointment of the three RLTs team leaders (January-March, 2000). Recruitment for the teams began in March 2000 and training for home care assistants started in February 2000. Once care managers and practitioners had been recruited an intensive training programme was undertaken to address not only individual competencies and new ways of working but also issues of team development and inter-agency working.

This brief early history of the RLTs serves to illustrate the number of resources used in the development of the service. The evaluation, undertaken from the perspective of the service providers provides analysis of the cost per client using the service but excludes start up costs and this inevitably limits the results presented. However in terms of the purpose of the evaluation for Cheshire County Council and South Cheshire Health Authority the results presented are pertinent to their decision to continue the service. Many of the costs associated with developing the service can be viewed as one-off costs, whilst others such as the cost of recruitment could be included in everyday running costs (assuming staff turnover is in line with other services).

## **Results**

The constraints facing the evaluation process and how they have been addressed are inevitably reflected in the results. The first part of this chapter has outlined how the constraints influenced study design and the data collected. The next part considers how the constraints have influenced the results.

## **Effectiveness**

### *Outcome measures*

The effectiveness results are limited by the study design. Whilst the results show statistically significant improvements in all but one indicator (the EQ-5D self-valuation) it is not possible to say, from these indicators alone, with certainty that the results would have differed in the absence of the RLTs or if the results are better or worse than those obtained in the previous rehabilitation practice.

### *Use of the EQ-5D*

The data collected that details the experience of using the EQ-5D with older people also highlights the need for careful interpretation of quantitative scales and use of this type of scale in isolation. The data collated indicate that 58% of the sample required some form of help, explanation or clarification when completing the EQ-5D. Twenty seven percent of respondents experienced difficulty in completing the visual analogue scale. Comments ranged over a number of areas. For example, two respondents told the care managers that they had really enjoyed completing the outcome measures whilst for a further two clients the care manager felt that asking the questions increased the respondent's anxiety levels. Despite the disparity in many of the comments four themes emerged.

Sixteen percent of the sample qualified or contextualised their answers. The care managers noted that respondents often found the statements too restrictive - they did not accurately reflect the respondents' situation. For example, one respondent at assessment chose the statement that read 'I have some problems walking about' but asked the care manager to note next to this statement that her main mobility was using a wheelchair. The respondent felt her situation was more extreme than 'I have some problems walking about' but as a wheelchair user she was not confined to bed (the alternative statement). Another respondent (who self completed the measure), again a wheelchair user, ticked the statement 'I am confined to bed' but added 'to an electric wheelchair'. This produces an anomaly. The respondents may have very different diagnosis and prognosis and in each case it was the respondent's decision of which statement to choose, but as wheelchair users they are neither 'confined to bed' or 'have some problems walking about'.

The care managers' felt that for 15% of respondents the answers the respondent had given were not realistic. The care managers' perception of the respondent's health differed to that of the respondent him/herself. This was particularly pertinent to the visual analogue scale where a number of respondents placed themselves at 100 on the scale (best imaginable health state) despite complex health problems. This difference in perceptions when valuing quality of life has been the subject of much literature and

debate. Carr et al (2001) define health related quality of life as the gap between a persons expectations of health and their experience of it. If those expectations come from experience then each individual's perception of health related quality of life will necessarily differ as their experiences differ. Thus, it may be argued that some difference between the respondents' perceptions and the care managers' perceptions should be anticipated.

However, the care managers adhered to the edict that all responses should be the respondents and if their assessment of quality of life was at odds with that of the client, the client had the final word (Addington-Hall and Kalra, 2001). Despite this, an emerging theme in the data was whether the answers given by respondents were the respondents own. Even though the majority of the measures were interview administered care managers noted that in some cases the opinion of others was sought and advice given.

The final theme that emerged from the data collated was that care managers felt that in a number of cases the respondent had a limited understanding of the EQ-5D; again this was particularly with regard to the visual analogue scale. The phrases 'best imaginable health' and 'worst imaginable health' could be interpreted in a number of ways. Is 'best imaginable health' the best the respondent imagines they could become or is it perfect health? Despite the reservations held by the care managers who administered the measure the self-reported description and the self-rated valuation (VAS) show statistically significant correlations at both assessment and discharge. In addition both scores show statistically significant correlations with the Modified Barthel Index at assessment and with HADS anxiety and depression scores.

#### *Further evidence of outcomes*

The weak study design and the evidence presented relating to the experience of using the EQ-5D with older people limits the interpretation of the effectiveness results. There is a need to supplement these quantitative measures of effectiveness. Interviews with clients and their carers (n=36) were undertaken by researchers approximately three months after discharge as part of the wider evaluation of the service. Interviews followed a structured format and focus lay with the level of support provided by the

RLT, degree of client centredness, achievement of goals and experience of care management (Reid et al, 2002). This qualitative data provides additional evidence of the effectiveness of the programme. It should be noted that not all of the interviewees are clients recruited within the cost effectiveness study and interviews were not conducted with the specific aim of ascertaining the level of effectiveness of the programme but they provide, however, a way to complement the data provided by the quantitative outcome measures.

The results report that:

*Clients and carers held a highly positive perception of the RLTs and experience of the services provided. The RLTs appeared to be meeting client needs through the provision of well co-ordinated and organised rehabilitation care programmes. Focus on client centred goal setting wherever appropriate provided clients with the opportunity to make choices and decisions about their own future. In the majority, the services co-ordinated through the RLTs enabled clients to return to their own homes and better adapt to their new circumstances. Carers were also well supported, being more able to cope and continue with the caring role. Only a minority of clients did not feel that they had benefited from rehabilitation (Reid et al, 2002, pvi).*

This positive perception may be illustrated using quotes from clients and carers. The quotes often refer to differences between the RLTs and services they have received in the past. This serves to reinforce the difference in outcomes between the new service (the RLTs) and the previous practice. One client with a chronic condition explained that despite having been in contact with a range of health and social care professions in the past she had not before felt fully informed and supported (Reid et al, 2002). A selection of these quotes, taken from Reid et al (2002, p58-69) is shown in Box 6.

### Box 6: Outcomes: client and carer quotes

*'Oh, yes...I got what I needed... Their co-ordination (made a difference) more than anything because what the care manager said was happening - it did. When you are on your own these things are vital, that you know who's coming and when'. (Client)*

*'It was marvellous. (the care manager) came and wanted to know how much I could do...brought me home the week before to make sure I didn't have a high bed... got me a commode and got me a perching chair for the bathroom and we arranged to get into the bath you see. .... The care manager arranged that the home care should start right away. X gave me the times they were going to come in the morning...told me what it entailed. Everything was laid on beautifully for me really. As soon as I got home the next morning the carers were there to see to me and help with dressing then. I couldn't get my stockings or knickers on. Now I can do that for myself.' (Client)*

*'The main goal was to get her home and see how she could cope being in her own surroundings. That's what I wanted. I wanted her to be given the chance to return home if at all possible. I think (the care manager) at the time had some reservations over whether she would be capable, ...But I felt she needed the chance. I wanted her to be given the chance, but if things couldn't work out, we'd have to have a rethink. But they gave us the chance to get her back home and everything was put in place to help her, to enable her to stay at home.' (Carer)*

*'It's keeping me independent'. (Client)*

*'Knowing someone is coming in is everything you know'. (Client)*

*'It helped me a lot because I'm moving again...yes, it's got me going and I'm gradually building up my muscle in my legs and that to get the strength back in my legs.' (Client)*

*'When I came out of hospital I got 2 weeks (home care) free – half an hour every morning. I was unable to wash my back because I was too stiff. At the end of the two weeks I'd made a good recovery. I was able to do things.' (Client)*

*'Since she has gone back into her own flat, she now can dress herself... she can get out of bed and put her clothes on and get her face washed. She also decided, about 5 or 6 weeks into the programme that she was going to cook her own meals...she does her own meals in the microwave. She learnt to use the microwave.' (Carer)*

*'Yes I do (think it made a difference). I certainly think she needed to go to the CSC. She needed that time and she needed the extra visits when she came home. Although she is a lot frailer and a lot weaker, this is inevitable. Every time something happens she goes down a bit more. But it's got her to the level we anticipated, going back to her original package'. (Carer)*

*Taken from Reid et al. 2002, p58-69.*

The comments are indicative of not only satisfaction with the service but also improvement in functional ability, increased confidence and regained independence. They provide a more rounded picture of the benefits and drawbacks of the service that is not transparent from the outcome measures alone. The quote below is illustrative of the small number of clients (n=3) that did not feel the service had made any difference to them.

*'To tell you the truth, I don't find them any help at all (home care) but I'm careful what I say. I don't want to upset the carer who's done a lot of work for me ...but I only get 10 minutes. What can you ask anyone to do ...if I want clothes and that ...there isn't time to wash me and sort my clothes out. This morning, I had to get something and I made a hell of a mess and I just asked her to put it right. I said, "I don't want any breakfast, I can manage that, but if you do the other things I can't do"' (Reid et al, 2002, p66).*

### *Future Consequences*

The evaluation presents little indication of the future benefits arising as a result of the rehabilitation programme to clients. Only seventeen clients completed outcome measures in the follow up period (three months after discharge from the programme). This represents only a small proportion of the original sample. The mean age of these clients at referral to the programme was 80.91 years. At follow up 15 clients lived in their own homes and two were in residential care.

Within this small sample the Barthel scores were sustained over time (mean score of 83.8 at discharge and 84.21 at follow up). Similarly the mean HADS anxiety scores showed improvement between discharge and follow up (6.35 and 4.87 respectively). The mean HADS depression scores showed a small deterioration (4.59 and 5 respectively). The EQ-5D self reported description single score shows a small improvement (0.6 and 0.61), as does the self-valuation (64.44 and 66.06). Whilst the figures appear to show sustainability of client improvements affected during the course of the rehabilitation programmes they have not been included in the results due to the small sample number and to the problem of selection bias. No data is available to indicate why the other clients included in the original sample were not approached to complete the follow up measures.

Interviews conducted with clients post discharge complement this limited evidence but whilst the rehabilitation programme may be seen to be successful at discharge, for this older people group confounding factors, such as multiple medical problems, are likely to have a significant influence over sustaining outcomes in the longer term.

## **Perspective**

The benefits or consequences resulting from the evaluation focus on client outcomes. Rehabilitation services typically have consequences that reach beyond the immediate recipient of the service at that time. Within the context of this study this is evident from interviews conducted with clients and their informal carers.

Whilst the traditional base of economic evaluation rests on welfare analysis (Drummond and McGuire, 2001), with the aim of maximising societal utilities, cost effectiveness is based upon a social decision approach and aims to maximise whatever the decision maker wants to maximise. The service providers (South Cheshire Health and Cheshire Social Services) wished to address the questions ‘does it work?’ and ‘how much does it cost?’ Within the context of these questions the focus lay upon clients’ outcomes and the cost per client to those agencies providing that service. But consequences and costs resulting from the programme are likely to be more far-reaching across both time and society. For example, the future consequences and costs to informal carers of clients remaining at home.

## *Informal Carers*

The rehabilitation programme is likely to have consequences for the carers of clients on the programme. These consequences are excluded due to the perspective used by the evaluation. The outcome measures provide no indication of what those consequences may be or their extent. However, the interviews conducted with carers give an insight into the impact of the rehabilitation programme on that group.

The carers’ response to the rehabilitation service was primarily positive and when asked about the impact the service had had on them acknowledged that the continuous support

enable them to cope with their caring role. The quotes in Box 7 (Reid et al, 2002, p58-69) illustrate some of the benefits of the service to the informal carers.

**Box 7: Carers' consequences; quotes**

*'It's me who's falling apart if they're not there. I take a day off if I know they're looking after her'*

*'Its meant all of us have been able to carry on with our lives'*

*'No I don't have any complaints. I mean, it's so much so that I'm going on holiday now and she hasn't got any qualms about going in to the CSC while we're away. That is how much she liked the service that she got in there. I never thought she would go in somewhere like that'*

Taken from Reid et al, 2002, p58-69.

There were consequences that were not perceived as benefits. One carer felt that whilst the client had achieved her goal of returning to her own home and leaving the residential home where she was staying, this was at the cost to the carers *peace of mind*. The carer felt the client was now at risk, which meant she had to visit more regularly, despite services being provided.

These quotes can give an insight into some of the consequences of the service that fall on or to the carer. They are not comprehensive but merely build a picture of some of the potential outcomes and pose the question of how to value items such as 'peace of mind'.

The wider evaluation did attempt to explore the experiences of carers using a validated measurement tool – the Carers Assessment of Difficulties Index (CADI). In all twenty seven were returned but unfortunately they were poorly completed and offered little scope for analysis or insight.

## Sample

### *Sample size and power calculations*

Only 44 clients of the 73 in the sample completed the outcome measures at assessment and discharge. Whilst this is not considered statistically as a small sample ( $n > 30$ ) no power calculation was undertaken to determine sample size which limits the results obtained.

Under ideal conditions, every evaluation would perform a sample size determination and then design a study to collect data on the required number of subjects (Hennekens and Buring, 1987). Power calculations were not undertaken for a number of reasons. These included the absence of a control group (although sample size could feasible have been determined using improvements between baseline assessment and discharge); the multiple outcome measures used in the study; time and funding constraints; and, perhaps most importantly, the availability of prospective subjects.

If there is more than one outcome variable, the sample size is usually calculated for the primary outcome (Peat, 2002). In terms of the economic evaluation if the EQ-5D were to be considered the primary outcome (as a measure of health related quality of life) a decision would still be required as to which of the three measures to consider; the self-reported description, the self-reported single index or the self-valuation (VAS). There is little existing literature outlining guidelines for sample size calculations for the EQ-5D. Whilst Roset et al (1999) outline methods by which sample sizes may be calculated using two reference populations and a range of effect sizes they acknowledge there is a lack of information regarding what type of effect size corresponds to a minimally important clinical difference.

Whilst acknowledging the obvious benefits of ensuring an adequate sample size (increasing the chance of finding a clinically important difference and minimising the chance of type I or type II errors (Peat, 2002)) in view of the constraints a pragmatic approach was taken. The evaluation was designed to allow the maximum possible time frame for recruiting subjects to the study that took into account factors such as time for follow-up and the bedding in of the service. All tests of statistical significance were

undertaken taking the view that statistically the sample was not considered small ( $n > 30$ ).

### *Sample bias*

The results show improvements in all effectiveness indicators between assessment and discharge. However, only 60% of the sample completed the measures in both periods (all of whom had completed their rehabilitation programmes) and this may have introduced a bias into the results. Did only those who completed both measures affect an improvement over the course of their programmes?

For one client outcome measures were administered only at discharge; the client consented to take part in the study, did not wish to complete the measures at assessment but agreed to complete them at discharge. Of the 28 remaining clients, data was collected from the care managers (who administered the outcome measures) to identify the reasons why outcome measures were not completed at discharge. Twelve clients had completed their rehabilitation programmes, 16 had dropped out.

Of those who completed the programme six clients were discharged by phone (the care manager did not make a home visit with the client at discharge) and two clients moved to residential care outside the area and thus the care managers were unable to complete the measures. In two cases it was not possible to ascertain the reason for not completing the measures. Of the remaining two one was blamed on constraints on the care manager's time and the other due to the client's fluctuating health state. The majority of these explanations do not appear to be indicative of a worse health state than those who completed the measures in both time periods.

None of the clients who dropped out of the programme completed discharge outcome measures. The reasons for dropping out were generally indicative of a worse health state than that of the clients who completed the programme. Five clients had been admitted to hospital, four clients dropped out because they had not complied with their rehabilitation programme, and two clients dropped out due to a deteriorating cognitive state. Three clients had died, one had a deteriorating medical condition and one went into residential care before completing the programme.

It would appear that there may be a sample bias in the effectiveness results in as much as the explanations for non-completion of outcome measures for those who dropped out of the programme are indicative of worsening health states. However, this bias is by no means unique to this study and although the attrition rate is approximately one in five (22%) this is not unexpected given the sample demographics (mean age of 80.83 years and acceptance criteria of complex medical/psychological/social problems).

### **Duration**

An area highlighted in the discussion of the design of the evaluation concerned the shortage of mainstream home care. For clients who utilised home care as part of the rehabilitation programme and who required continuance of home care post discharge, often discharge had to be delayed until mainstream home care became available. Similarly, for a small number of clients, shortage of home care meant discharge from a community support centre/residential care to home whilst on the programme was delayed. If the primary effect of this shortage was to prolong the duration of the programme it begs the question of whether the outcomes recorded could have been or were actually achieved earlier. Unfortunately it is not possible to ascertain if this is true.

For those clients whose discharge from the programme was delayed it can only be assumed that the rehabilitation was complete and the care manager believed that the client targets had been achieved. But did those clients' outcomes improve further during that delay? For one client, whose discharge from residential care to home was delayed, the care manager felt the delay had had a detrimental effect on her progress within the programme.

### **Cost Analysis**

The cost analysis attempts to present the results of the evaluation in a transparent and concise manner. The identification, measurement and valuation of resources used in the programme have been presented separately to allow the reader to make meaningful comparisons between this programme and other, similar services. The micro-costing allows for a more accurate analysis than use of estimates based on average *per diems* (or daily costs) which are thought to produce the least precise estimates (Drummond et al,

1999). However, hospital in-patient stays are valued using cost per in-patient day taken from Netten et al (2001). Whilst level of recall was one area of concern the method by which data was collected was thought to allow the most accurate measurement of resources.

For this strand of the evaluation the absence of the previous rehabilitation practice with which to compare the programme was perhaps the single biggest constraint or hurdle. This hurdle is overcome using a counterfactual and thus all the comparisons are necessarily hypothetical situations based upon subjective opinion. This is not an ideal method of evaluation but a pragmatic solution to the absence of a comparator group. The methods used in the evaluation and some of the practical difficulties encountered will necessarily have an impact on the results presented and some areas of concern are highlighted here.

### *Duration*

In the same way that the shortage of home care may have affected outcome measurement so too may it have an effect on the cost analysis results. The delay in discharge from the rehabilitation programme due to the shortage of home care is likely to have increased the number of days spent on the programme and thus the cost of individual programmes. However, the shortage of home care is not an uncommon problem and, in keeping with the pragmatic nature of the evaluation, to provide an accurate reflection of the cost of the programme no allowances have been made for it.

### *Simplicity of alternatives*

The counterfactual analysis provides a method by which the cost of hypothetical alternative courses of action may be compared with the mean cost of the rehabilitation programme. This allows the cost of the programme to be placed into some form of context and be compared against other likely scenarios. It is recognised that this is not in line with the ideals espoused in the methodological texts but this approach arose as a consequence of the constraints placed upon the study. The results therefore, although limited by the selection of alternative with which to compare it, can be seen as illustrative rather than exact. Interpretation of those results will similarly be limited.

One potential area of concern is the simplicity of the alternative courses of action. The previous section outlined the inclusion and exclusion criteria and put forward the reasoning behind those decisions. There is however another exclusion to the cost analysis that should be made explicit. The costs of the alternative scenarios are based upon the costs of residential care, cost of a home care package, and average cost per hospital in-patient day. The costs of the rehabilitation programmes include not only these costs but also the cost of other services such as visits with physiotherapists or occupational therapists. Non-inclusion on a rehabilitation programme does not preclude clients' access to these types of services.

The lack of informative data relating to previous practice meant that it was not possible to estimate the level of these services used by clients in the absence of the RLTs. If these were to be included the cost of the alternatives would increase thereby moving the balance of the cost comparison in favour of the rehabilitation programme.

Similarly, this type of resource used by those on a rehabilitation programme post-discharge have not been recorded (for example, continuing physiotherapy after discharge) although the analysis has allowed for home care packages for those who are resident in their own homes after discharge.

### *Response bias*

The alternative hypothetical scenarios may be subject to response bias and thus have a detrimental effect upon the results. For example, did the care managers' responses to the 'what if?' question outline the worse case scenario rather than the likely course of action and thus inflate the cost of the alternative against which the rehabilitation programme has been compared?

Whilst it is possible that there may have been response bias the results of the analysis lends weight to the accuracy of the care managers' responses. The highest mean cost is associated with those clients who, it was thought probable, would have been admitted to residential care and the lowest to those clients who were likely to have gone home with

an increased home care package. The outcome scores at assessment show similar results as illustrated in table 27.

**Table 27: Differences between outcome scores at assessment**

<b>Counterfactual Scenario</b>	<b>Barthel Total</b>	<b>HADS Anxiety Total</b>	<b>HADS Depression Total</b>	<b>EQ-5D Single Health Score</b>	<b>EQ-5D Self Valuation</b>
<b>Residential Home</b>	64.38	7.44	6.78	0.33	58.56
<b>Hospital Admittance /Delay</b>	70.14	6.6	6.73	0.46	51.21
<b>Increased Home Care Package</b>	66.5	5.6	5.36	0.52	56.87
<b>Other</b>	75	4.33	5.67	0.52	71.67

With the exception of the EQ-5D self valuation scale, the initial scores from the outcome measures are poorest for those clients for whom it was suggested residential care was likely in the absence of the RLTs. Differences between groups, as with the cost analysis, are not statistically significant.

### **Future Savings**

The effectiveness analysis attempted to reflect the sustainability of client outcomes through a follow up visit 3 months after clients had been discharged from the programme. The cost analysis measured resource use only for the duration of the programme and this again limits the results.

When presenting the results of the analysis to the service providers it was suggested that the net savings would be far greater in the long term in view of the high cost of residential care. If, as the results suggest, the programme has succeeded in its aim to avoid unnecessary admittance into long term care, over the course of a year the net savings to the service providers will accrue. However, it was felt that the nature of the client group in terms of age and the complexity of problems make this type of assumption unfeasible. In addition within the confidence intervals presented (to account for uncertainty) net savings will accrue but the break-even points differ.

## Conclusion

This chapter has addressed the constraints imposed upon the economic evaluation. It has explored why and how those constraints limited the design process, the methods by which the rehabilitation programme was evaluated and the results.

The limitations in the design process are those of the perspective of the study, how the effectiveness or outcomes resulting from the rehabilitation programme are to be measured to reflect the aims and outputs of the service and lack of data relating to the previous rehabilitation practice. Further limits were imposed by the multiple outcomes inherent in a rehabilitation programme with diverse acceptance criteria, time and non-randomisation. These constraints will necessarily influence what comes out of the economic evaluation - the results.

The results are open to accusations of sample and response bias and over-simplicity. The discussion has explored all these areas and attempted to show how supplementary information, in the guise of subjective opinion from interviews with clients and carers, can provide valuable information to broaden the perspective of the study and complement data derived from standardised quantitative outcome measures. The limited interview data available to the evaluation provides further evidence of the effectiveness of the programme. Data from these sources can also provide information about the wider consequences of the rehabilitation programme. In this study interviews with carers provided a valuable insight into the emotional cost imposed on them as a result of the programme.

The study provides an in-depth analysis of the resource use and cost of the programme; but whilst using a method (micro-costing) that is acknowledged to be the most accurate method of undertaking a cost analysis, it is open to accusations of over simplicity and bias. This stems primarily from the lack of comparison with another rehabilitation service or programme and the subsequent use of a counterfactual, the 'what if?' alternative. The alternatives outlined are necessarily hypothetical and draw upon subjective opinion but they do provide indications of the cost of feasible alternative courses of action and place the cost per client of a rehabilitation programme into context.

Chapter Ten draws on three of the limitations identified; those of a narrow perspective, the exclusion of the assessment component of the RLTs and the use of multiple outcome measures. It explores how changes in the parameters of the evaluation may alter the results of the analysis and the interpretation of those results.

## Chapter 10

### A Case Study: Changing the Parameters

#### Introduction

The evaluation's pragmatic design was in response to or as a result of the constraints presented both during the design stage and during the process of evaluation. The previous chapter explored how the constraints shaped the evaluation and consequently the results of the evaluation. This chapter continues that analysis by exploring how those results would differ had the evaluation taken a slightly different direction.

Model one explores how the results change if the perspective of the study changes. Model two considers the consequences of including the assessment component of the RLTs for those clients not accepted onto a rehabilitation programme. The final model looks at the use of a single outcome measure to reflect the multiple outcomes.

The chapter explores the significance of the approach taken but still within the confines of many of the limitations imposed; for example, there is still no data available by which to compare the RLTs against the previous rehabilitation practice.

#### Model 1: Change of Perspective

The perspective or viewpoint from which a service is evaluated is determined at the outset. An economic evaluation that confines itself to a narrow perspective could determine the mix of interventions that would maximise health outcomes within that budget but this would not necessarily maximise the welfare of society within the resources available (Byford & Raftery, 1998). However it is difficult (and often impractical) to consider every cost and outcome or consequence and often there may be far reaching ripple effects over sectors and across time.

## **Informal Carers**

The rehabilitation programme was evaluated from the perspective of the service providers: South Cheshire health Authority and Cheshire Social Services. Use of this narrow perspective excluded an unpaid resource employed by the RLTs in the rehabilitation process: informal carers. The rehabilitation programme is likely to have consequences for informal carers of clients on the programme that are outside the perspective of the evaluation although their input may be reflected in improved client outcomes. A wider societal perspective would embrace these costs and consequences.

Unfortunately, outside the small number of interviews conducted with carers, no data was collected that enabled analysis of the number of clients who had informal carers or the nature of the care provided.

## **Informal Carers in the UK**

It is estimated that one in eight people in Britain is now a carer and half of all carers look after someone aged over 75 (DoH, 1999). Within the UK the value of the contribution made by carers (using 2000 prices) is thought to be £57.4 billion (Carers UK, 2002). The consequences of caring are multiple; carers face physical, emotional, social, and financial problems (Travers, 1996) and experience higher than average levels of stress (DoH, 1999).

In general carers have poor financial status (Travers, 1996). The monetary cost can be seen in terms of carers' foregone income as a result of caring and low level benefits paid to the carer. This in turn will have effects upon the wider economy.

The physical, emotional and social consequences to the carers themselves are illustrated within the interviews undertaken with carers. Consequences of the rehabilitation programme upon carers were both negative and positive. For example one carer noted:

*'It's meant all of us have been able to carry on with our lives'* (Reid et al, 2002a, p136)

Conversely another felt that although the client had achieved her goal and returned home it was at the cost of the carer's *peace of mind*.

This type of negative consequence was illustrated further when the outcome measures were chosen. The care managers expressed reluctance to administer the Carers Assessment of Difficulties Index (CADI) to informal carers and focus on the difficulties and strains of caring. Some care managers felt that it would be counterproductive to identify the difficulties and strains associated with caring when there was little they could do to address them – it was outside the remit and resources of the RLTs.

There have been moves by the Government towards the recognition of the value of work undertaken by carers the details of which are set out in The National Strategy for Carers (DoH, 1999). The strategy contains three distinct elements encompassing information for carers, support and care for the carers themselves and attempt to address the adverse consequences of caring. But while the public profile of the work carers do is increasing, evaluations using the perspective of the service providers will exclude both voluntary agencies and informal care. It should also be noted that carers are more likely than non-carers to have a longstanding illness or disability (Travers, 1996) and this *does* have financial consequences to the service provider within the remit of the 'narrow perspective'.

### **Voluntary Agencies**

Whilst the evaluation was undertaken from the perspective of South Cheshire Health Authority and Cheshire Social Services input into the rehabilitation programme was received from the Red Cross.

A integral part of the original JIP model was development of multi-agency, interdisciplinary assessment and rehabilitation teams to work across agencies; to create a network of health, social and voluntary agencies working together across organisational boundaries (Cheshire County Council Social Services and South Cheshire Health, 2000). The British Red Cross in Cheshire provides a Community and Hospital Support Service to which RLT clients can be referred as part of the of

rehabilitation process. Model one explores what happens if the perspective of the study is broadened to include voluntary agencies involved in the rehabilitation programme.

### **Voluntary Sector in the UK**

The voluntary sector has a large economic presence in the UK; the workforce of the sector in 2000 numbered almost 563,000 representing 2% of the UK workforce (Jas et al, 2002). The sector's contribution to GDP was £5.4 billion in 2001 and it is estimated that the activity of volunteers contributed the equivalent of £15.4 billion to the sector.

The profile of voluntary agencies has been raised further by recent government initiatives that include examining the role of the voluntary sector in public service. The 2002 Spending Review being undertaken at the present time is exploring further ways in which central local Government can work more effectively with the voluntary sector on public service delivery ([www.hm\\_treasury.gov.uk/newsroom\\_and\\_speeches/press\\_109\\_01.cfm](http://www.hm_treasury.gov.uk/newsroom_and_speeches/press_109_01.cfm), accessed 23 May 2002). The review will examine best practice in effective partnerships between the voluntary and public sector.

The RLT philosophy dovetails with this emphasis. Rehabilitation programmes were envisaged to be joint initiatives across sectors:

*'to work across health, social care and voluntary agencies to provide an inter-disciplinary and co-ordinated approach to the assessment and rehabilitation of older people'* (RLT Mission Statement, 2001).

Thus the British Red Cross was to be an integral part of the programme.

## **British Red Cross**

The British Red Cross is a registered charity that utilises the skills of some 55,000 volunteers across the UK. In the British Isles it supports the statutory services at the scenes of major emergencies by providing first aid and welfare services to victims and their families. Their remit includes delivering services to vulnerable people in local communities; these services include helping the elderly or infirm on discharge from hospital ([www.redcross.org.uk/](http://www.redcross.org.uk/), accessed 22 May 2002).

The Cheshire branch provides a countywide Community and Hospital Support Service. The aims of the service are to help people remain at home following a sudden change in circumstances to return home following short term residential care and support people returning home after a period of time in hospital. The service is time-limited, free, available seven days per week, open to people in the county of Cheshire and manned by volunteers.

The service was set up using monies from a bequest given to the Red Cross. In this case study, in acknowledgement of the support provided by the Community and Hospital Support Service to older people across the County, a grant of £60,000 per annum was given to the British Red Cross by JIP. This allowed the service to expand. The monies were provided towards administration costs and travel expenses. Clients were referred to this service from a number of agencies and programmes including the RLTs.

### **Identification: Resource Use**

In order to widen the perspective of the evaluation, to include the contribution made by the British Red Cross, data were collated of time spent by Red Cross volunteers with clients referred to them by the RLTs.

Of the clients included in the evaluation 13% (n=9) had some input from the Red Cross. Thirty two visits were made to these clients and 19 telephone calls. In total this equated to 57 hours of volunteers' time.

## Valuation

The volunteers' main tasks are providing companionship and emotional support, relieving social isolation, shopping, accompanied shopping/walks/hospital appointments, carer relief and help with meals. In order to value the volunteer time a number of job specifications showing similar roles and tasks were considered to obtain a market wage rate in terms of paid equivalents. These included the community care worker within the RLT and home care assistants. The role of the community care worker, *prima facie*, seemed to tie in with the role of the volunteer. However, upon close inspection, this role included aspects of case management, monitoring and organisation and maintenance that were outside the role assumed by the Red Cross volunteers. The role most closely allied to that of the volunteer was the role of the home care assistant. The overt aspects of the home care assistants' role, areas such as helping with domestic chores, overlap (although do not coincide) with the outlined Red Cross tasks. In addition the less explicit role played by home care assistants, for example, relieving social isolation *is part* of the volunteers' remit. Although the roles differ in their emphasis on practical and social assistance there are many direct comparisons. This comparison is borne out by a Red Cross volunteer:

*'The service is meant to complement home care input...although we regularly did short term intensive support whilst statutory cover was being organised'* (correspondence received from the British Red Cross Assistant Community Services Manager, dated 25 March 2002).

The hours of volunteer time have therefore been valued using the market wage rates of home care assistants taken from Netten et al (2001).

## Costs

The total cost of Red Cross time within the sample is £622. Table 28 shows the changes to the mean costs of the rehabilitation programme if Red Cross time is added.

Statistical differences between the groups including and excluding Red Cross costs are reported using transformed data (natural logs) as the cost data is non-parametric. Paired

sample pair t-tests show that the difference between mean costs excluding and including Red Cross data is statistically significant ( $t=-2.282, p=0.026$  when in-patient days are included;  $t=-2.327, p=0.023$  when excluded). However these statistical differences should be treated with caution.

**Table 28:** Costs of rehabilitation programme including Red Cross resources

	Cost of programme including hospital in-patient stays, less client contribution, including Red Cross	Cost of programme including hospital in-patient stays, less client contribution	Cost of programme excluding hospital in-patient stays, less client contribution, including Red Cross	Cost of programme excluding hospital in-patient stays, less client contribution
<b>Mean</b>	£2232.87	£2224.11	£1869.83	£1861.07
<b>SD</b>	£2056.27	£2058.79	£1535.86	£1537.94
<b>Median</b>	£1367.90	£1360.11	£1360.11	£1347.81
<b>Range</b>	£267.95 to 9200.19	£267.95 to 9200.19	£267.95 to 7425.30	£267.95 to 7425.30
<b>CI (95%)</b>	£1907.49 to 3093.07	£1736.80 to 2711.41	£1506.29 to 2233.36	£1497.04 to 2225.09

The costs changed only for those clients who received Red Cross input. Thus, using the paired sample t-test, costs for the remainder of the sample stayed the same and comparisons of their means equate to zero. For the nine clients the shift in costs when adding the cost of Red Cross involvement in their programme is necessarily upwards (for all clients the cost of the programme increases). So for these clients the costs, if Red Cross data is included, will be higher and whilst the result is *statistically* significant Red Cross data adds less than 0.004% to the total costs of the programmes.

Statistical significance is not an indication of the importance of a result, but an indication that the null hypothesis is probably false. One way to gauge the importance of the statistical significant result is to use a measure analogous to the squared correlation co-efficient that estimates the proportion of variance in costs explained by whether the client costs include Red Cross costs (Witte and Witte, 2001). Using

Cohen's guidelines (Cohen, 1988) when the squared point biserial correlation ( $r_{pb}^2$ ) is around 0.01 the estimated effect is small and could lack importance.

The squared point biserial correlation ( $r_{pb}^2$ ) focuses not on differences between group means, but on the correlation between pairs of observations, once client programme costs have been paired with arbitrary numerical codes (zero, for those clients for whom no Red Cross costs are added and one, for those clients for whom these costs are added).

The costs data yields a result of 0.00267 suggesting that whilst the inclusion of the Red Cross costs is statistically significant (when comparing means) only 0.267% of the variance in costs is explained by the inclusion of Red Cross costs. However, once again the results should be treated with caution. This test is typically used when the sample size is large and it is suspected that the large sample size has produced a statistical significance that is not important. In this case the sample size is 71, which although statistically can be considered large is not excessively so.

### **Cost Comparison**

For those clients for who it was thought likely they would be admitted to residential care the mean cost of the programme has increased slightly from £2722.24 to £2728.79. The increase is not statistically significant.

The increase in the mean cost of the rehabilitation programme for this group of less than £7 makes no discernible difference to the comparison with the cost of residential care. This holds for the comparisons at the lower and upper ends of the confidence intervals. The conclusions drawn remain the same.

For the clients who it was thought probable that they would return home with an increased care package the mean cost of the programme has increased from £1377.02 to £1398.84. Again the difference is not statistically significant.

The mean cost of the programme including the costs of the Red Cross volunteers still show the rehabilitation programme to be less than the cost of a high care package over

the same period (£2165). The net resource saving over the period of the programme is reduced from £788 per client to £766 per client. The confidence intervals of the costs including Red Cross data (£861.10 - £1936.59) continue to show net savings over the term of the programme.

None of the clients for whom it was thought likely that their hospital discharge would be delayed or that they would be admitted to hospital utilised the services of the Red Cross and thus the mean cost of the rehabilitation is unchanged.

### **Outcomes**

It is not possible to extrapolate the effect of Red Cross input upon client outcomes from that of the RLTs. However, the RLT care managers' note that:

*'The Red Cross are good. I think they are able to finish off. I find that quite helpful because often people have been independent in shopping but because of what has happened to them they can't do it. I've found Red Cross quite good, really very responsive, really quite crucial'* (Reid et al, 2002a, p39).

### **Conclusion**

The inclusion of the British Red Cross costs, whilst making a statistically significant difference to the cost analysis, forms only a small part (<0.004%) of the mean cost per client of the programme indicating that the programme does not rely heavily on volunteer input. Figures provided by the British Red Cross show, for areas covered by two of the RLTs, a total of 666 referrals over a two year period (April 2000 to March 2002) which resulted in 2230 visits using 4225 hours of volunteers' time. Of these referrals, the RLTs made only 72. As the Red Cross note:

*'The RLT referrals comprise only a small percentage of the overall total – this in spite of the fact that all teams prioritised their work on requests from the RLTs'* (correspondence received from the British Red Cross Assistant Community Services Manager, dated 25 March 2002).

These notes are indicative of little or no opportunity cost to other programmes or services benefiting from Red Cross input.

The Red Cross received a grant of £60,000 per annum from the JIP. This begs the question of whether the service is a volunteer service when they have received monies from the JIP.

The service provided by the Red Cross was in existence prior to the monies contributed by the JIP, however, in the view of the County Project Co-ordinator, not on such a large scale. Although no specific obligations were stipulated as conditions when making the grant, the Red Cross agreed to take referrals from the RLTs and this could be interpreted as the JIP paying for the services provided by the Red Cross to the RLTs. However, it is not possible to assume that the RLTs would not have made these referrals, or that the Red Cross would not have accepted those clients, had the financial contribution not been made.

The Red Cross service does not appear to have been utilised as widely as was anticipated. A gap exists between the service the Red Cross *could* provide and the RLTs take up of that service. Whilst the model takes a pragmatic approach in terms of measuring only the voluntary services used, findings from the wider evaluation of the RLTs are pertinent to the generalisability of the model. Whilst evaluating the input of the Red Cross was outside the scope of the study the researchers noted, during focus group discussions with care managers and clinicians that:

*'Little of the discussion related to the involvement of voluntary organisations. That which did occur reflected an awareness on the part of care managers, that there was a need to become more familiar with the different services on offer and to begin to utilise them more frequently. Care managers noted that the large size of the voluntary sector had impact on the speed with which they had been able to learn about and start to use the services on offer'* (Reid et al, 2000, p46).

These views were echoed by a Red Cross worker who wrote:

*There were some instances when we had calls from wards regarding a client who was also referred to the RLT and the team did not refer to us which led us to feel that there were possibly more clients which we could have helped (correspondence received from the British Red Cross Assistant Community Services Manager, dated 25 March 2002).*

The RLT co-ordinators felt that:

*'much greater potential lay in partnership working with the voluntary services. Whilst much good work had been achieved, the impact of Red Cross in particular had been limited by lack of volunteers on which to draw on' (Reid et al, 2000, p46).*

However, the Red Cross felt this perception of lack of volunteers was inaccurate:

*'I think perhaps problems arose in the early stages when there was a shortage of home care provision to support the RLTs. Our service is meant to complement home care input, not to replace it with intensive seven days a week support' (correspondence received from the British Red Cross Assistant Community Services Manager, dated 25 March 2002).*

*'At times during the project, I felt a tension between the need to remain within Red Cross guidelines, the knowledge that our volunteers could not replace paid workers, and the desire to help the team with their workload' (correspondence received from the British Red Cross Assistant Community Services Manager, dated 25 March 2002).*

These comments imply that the Red Cross was not being used in the way the RLTs envisaged and set out in its Mission Statement. When the RLTs were conceived it was anticipated that the Red Cross would play a large part in clients' rehabilitation process. However, in retrospect, the County Rehabilitation Co-ordinator perceived the original plan to be flawed; the nature of the service (a rehabilitation service for older people with complex problems) meant that clients were too severely impaired and/or too highly dependent to be referred to the Red Cross.

The data for this rehabilitation programme shows a wider perspective that includes voluntary agencies (in this case the Red Cross) does statistically significantly alter the

mean cost per rehabilitation programme although in practical terms it forms only a tiny proportion on the costs. In terms of the service the Red Cross offers in Cheshire, their input into the RLTs appears to have no opportunity cost to other services.

The conclusions drawn from the cost analysis through comparison of the rehabilitation programme with hypothetical alternatives remain the same.

The data available that reflects the Red Cross input on client outcomes is indirect. Although the practitioners found the service the Red Cross provided helpful, responsive and even crucial, no conclusions can be drawn as to whether their input added to the effectiveness of the programme.

However, a number of issues arise. Firstly, both the RLTs and the Red Cross volunteers felt that the Red Cross service had not been fully utilised. This should be taken into account when considering the generalisability of the costs of the programme from a perspective that includes the Red Cross.

Secondly, the JIP gave a grant to the Red Cross. This begs the question of whether this should be treated as payment of the service provided by the Red Cross, as a charitable donation or as a transfer payment. In line with the bottom up costing approach the Red Cross service was costed using time spent making visits and calls to individual clients in the sample. However this does not reflect the monies given to them (especially as the service was under-utilised).

The use of Red Cross volunteers by the RLTs did not appear to have been detrimental in terms of the effect on other services and programmes using the service. However, if the RLTs were to utilise the service more in line with initial expectations this may increase the opportunity cost to other services. In addition the opportunity cost may change significantly if a grant was no longer paid to the Red Cross.

## **Model 2: Cost Analysis**

In order to answer the question 'how much does it cost?' the evaluation used a bottom up or micro-costing approach. This approach is generally acknowledged as the most

accurate method by which to identify resource use. In fact micro-costing can be seen to reflect the ideal of identification, measurement and valuation of resources (Gold et al, 1996). Costs are derived from information about the quantity of health care resources used by each patient and the quantities of each resource used are multiplied by fixed unit sum values and are then summed over the separate types of resource to give a total cost per patient (Thompson and Barber, 2000). However, as discussed in the chapter nine, use of this method led to the omission of important resources, specifically the assessment component of the service.

The rehabilitation link teams were developed to provide an Assessment and Rehabilitation Service as outlined by the Joint Investment Plan for Older People. It was anticipated the aims of the plan (to avoid unnecessary admission to long term care of hospital and to enable people to remain safe and well at home by maximising their independence) would be achieved in a number of ways and this included access to inter-disciplinary assessment prior to continuing care/long term care placement and scheduled reassessment. This is in line with National Service Framework – for Older People, Standard Two which states:

*'NHS and social care services treat older people as individuals and enable them to make choices about their own care. This is achieved through the single assessment process, integrated commissioning arrangements and integrated provision of services, including community equipment and continence services'* (DoH, March 2001, p23)

All clients referred to the RLTs underwent some form of screening or assessment. The nature of this screening or assessment was recorded by the RLTs. Each referral was placed in one of six possible categories:

- *Client not accepted at referral:* Clients who do not meet the criteria and whose needs may be better met elsewhere. Typically the referral is discussed in an allocation meeting and may involve talking to the agency/person who made the referral.
- *Client not accepted at screening/initial assessment:* Following a visit with the client to carry out an initial screening assessment the care manager decides that a care manager programme is not wanted or not needed

- *Client assessed and given advice:* Following a screening/initial assessment the care manager offers advice. This may involve several visits
- *Client assessed, given advice and support:* Following a screening/initial assessment the care manager offers advice and support this will include sign posting on to appropriate services
- *Client accepted for a rehabilitation package*
- *Client screened for nursing home placement:* this was initially undertaken by the RLTs to ensure all avenues for rehabilitation had been explored

Whilst the analysis includes the resources used in the screening and assessment of those clients accepted on to the programme no account is taken of the cost of the assessment and screening of those clients not accepted onto a rehabilitation programme. Had the analysis adopted a top down approach the cost per client would have included the costs of these assessments.

Unfortunately, for reasons outlined in the Chapter Nine, it was not possible to undertake a gross-costing method and a micro-costing method was believed to be both superior and better suited to the evaluation. This model explores how the results of the evaluation change if the cost of screening and assessment for those clients *not* accepted for a rehabilitation programme are included in the analysis.

### **Cost of Assessment and Screening**

The data collected (resource use) within the evaluation relates exclusively to those clients undertaking a rehabilitation programme who gave consent to be included in the study and it is this data that is used to estimate the cost of assessment and screening for those clients not accepted onto a rehabilitation programme.

Of the 73 clients in the sample, data of the resources used in the screening and assessment process is available for 72. Table 29 shows the time spent by the care managers in assessment and screening and includes time spent with the client (contact time), time spent in client activities associated with the screening and assessment process (for example, talking with the referrer) and travel time.

**Table 29:** Care managers' time; assessment and screening

	Contact time (minutes)	Non-contact time (minutes)	Travel Time (minutes)	Total time (minutes)
<b>Mean</b>	82.57	78.92	43.08	204.57
<b>Median</b>	60	60	30	170
<b>S.D.</b>	49.72	85.81	36.52	127.64
<b>Range</b>	20 – 270	0 – 450	0 – 180	30 – 625
<b>C.I. (95%)</b>	70.89 – 94.25	58.75 – 99.08	34.5 – 51.67	174.57 – 234.56

The mean time spent with clients is approximately 1 hour 20 minutes; similarly the mean non-contact time is approximately 1 hour 20 minutes and the mean travel time is just under 45 minutes.

The care managers who undertook the screening and assessments were drawn from a wide range of professions: social worker (n=22<sup>1</sup>), health authority occupational therapist (n=25), district nurse (n=14), community psychiatric nurse (n=9) and nurse consultant (n=2). The time of these practitioners has been valued using Unit Cost of Health and Social Care 2001 (Netten et al, 2001) in line with the evaluation.

The mean cost of assessment and screening is shown in Table 30. In addition to the total time the table shows the costs of the individual components (contact time, non-contact time and travel time).

**Table 30:** Cost of assessment and screening

	Non-contact time cost (£)	Contact time cost (£)	Travel time cost (£)	Total cost (£)
Mean	26.43	28	14.19	68.62
Median	21	21	10.5	58.62
SD	29.45	17.16	11.69	42.8
Range	0 – 157.5	6 – 94.5	0 – 63	15.5 – 218.75
CI (95%)	19.51 – 33.35	23.97 – 32.03	11.44 – 16.94	58.56 – 78.68

<sup>1</sup> n = number of clients assessed

## Referrals

Three hundred and twenty four referrals were made to the RLTs over the thirteen-week period, 21<sup>st</sup> May–17th August 2001. Table 31 illustrates the nature of the assessment and screening process each client referred underwent in each of the categories.

The first category (not accepted at referral) includes those clients who were not seen by a care manager. The cost of this screening process has been estimated using only the mean cost of non-contact time, £26.43. Thus, for the 45 clients not accepted at referral this equates to a total cost of £1189.28

**Table 31: Assessment and screening of referrals**

Action	East %	West %	Central %	N
Not accepted at referral	12.2	14.3	15.3	45
Not accepted at screening/initial assessment	29.6	27.6	24.3	88
Assessed and advice	15.7	10.2	17.1	47
Assessed, advice and support	0.9	2	7.2	11
Accepted for rehabilitation programme	41.7	42.9	36	130
Screened for nursing home	0	3.1	0	3
<b>Total (N)</b>	115	98	111	324

The mean cost of the process for all other clients who were *not* accepted onto a programme is assumed to be the mean cost of the total time. For each of these clients the assessment process includes one or more visits by a care manager and thus is inclusive of contact time, non-contact time and travel time. The mean cost of the total time is £68.62. For this set of 149 clients this equates to a total cost of £10224.20.

It is been assumed that the cost of assessment and screening for those clients accepted onto a programme but not included in the evaluation sample is the same as for those included in the evaluation.

This gives a total estimate of £11413.48 for the assessment and screening for those clients not accepted for a rehabilitation package (n=194) and adds a cost of £87.80 to each client accepted onto the programme (n=130). Table 32 shows the cost of the programme if this cost is added.

**Table 32:** Costs of rehabilitation programme if assessment and screening for those not accepted to programme are included

	Cost of programme including hospital in-patient stays, less client contribution, including assessment and screening	Cost of programme including hospital in-patient stays, less client contribution	Cost of programme excluding hospital in-patient stays, less client contribution, including assessment and screening	Cost of programme excluding hospital in-patient stays, less client contribution
<b>Mean</b>	£2311.91	£2224.11	£1948.87	£1861.07
<b>SD</b>	£2058.79	£2058.79	£1537.94	£1537.94
<b>Median</b>	£1447.91	£1360.11	£1435.61	£1347.81
<b>Range</b>	£355.75 – 9287.99	£267.95 – 9200.19	£355.75 – 7513.10	£267.95 – 7425.30
<b>CI (95%)</b>	£1824.60 – 2799.21	£1736.80 – 2711.41	£1584.84 – 2312.89	£1497.04 – 2225.09

The cost data is not normally distributed and, as in previous tests, the data has been transformed into natural logs to detect any statistical differences between the samples with and without the added cost of the assessment and screening for those not accepted onto the programme. Paired sample t-tests show a statistically significant difference between the groups when the additional costs of assessment and screening for those not accepted onto the scheme are included and excluded ( $p < 0.05$ ). This holds for both scenarios (when in-patient days are included and when they are excluded). Once again these statistical differences should be treated with caution but, at a practical level, they do represent an additional cost per client that equates to around 4% of the mean cost of the programme. The squared point biserial correlation co-efficients are indicative (using Cohen's rule of thumb) of small estimated effects which, whilst statistically significant, could lack importance.

## Cost Comparison

The methods used to calculate and incorporate the cost of assessment and screening for those clients not accepted on a rehabilitation programme result in an increase in the mean costs of the programme for each hypothetical alternative of £87.80. For each of the alternative scenarios the increase is statistically significant (t test,  $p < 0.05$ ). However, the squared point biserial test was not undertaken on these sub-groups to provide an indication of the importance of the statistically significant result due to the small sample sizes.

For those clients likely to be admitted to residential care the mean cost of the programme has increased to £2810.04. The increase makes no discernible difference to the comparison with the cost of residential care and the conclusions drawn in the original analysis still hold. For estimates made at the bounds of the confidence intervals the conclusions drawn at the upper bound remain the same (the rehabilitation programme is the least costly alternative at fourteen weeks after discharge) but the conclusions drawn at the lower end change. The rehabilitation programme is the least expensive at three weeks post discharge not at two weeks as in the original model.

For those clients who it was thought probable would return home with an increased care package the mean cost of the programme has increased to £1464.82. The inclusion of the additional costs show the rehabilitation programme remains the less costly alternative (the cost of a high care package over the same period is £2165). The net resource saving over the period of the programme is reduced from £788 per client to £700 per client. The new confidence intervals (£928.14 - £2001.51) continue to show net savings over the term of the programme.

The mean cost for those clients who it was thought likely that would have a delayed or that they would be admitted to hospital, the mean cost has increased to £2448.86. This is equivalent to the cost of seventeen days in hospital (increased from 16.4 days). The new rehabilitation programme confidence intervals of £1193.06 – £3704.66 are equivalent to 8.28 days at the lower bound and 25.72 days at the upper. This has increased slightly from 7.67 days and 25.11 days respectively.

## Conclusion

The cost of the assessment and screening process have been estimated from the assessment and screening undertaken for those clients accepted on to a rehabilitation programme using the definitions of the assessment and screening process, supplied by the RLTs, as a guideline. Data of resource use were not available for the actual assessment and screening of this group of clients. However, the detailed data held relating to the evaluation group was deemed to be a comparable indicator (using knowledge gained from the data collection process and the definitions provided).

For this evaluation the addition of the costs of assessment and screening for those clients not accepted on to a rehabilitation programme while significant statistically have little impact on the interpretation of the results. The comparison between the costs of the rehabilitation programme compared with the hypothetical alternatives still appear favourable, even within the upper bounds of the revised confidence intervals.

Thus, on its own, exclusion of the cost of assessment and screening is unlikely to change any decisions made using the results. There are, however, a number of other exclusions made as a result of practical constraints, for example, the exclusion of travel costs (although travel time is included) and capital costs. Had *all* these resources been included it is possible that the results would look less favourable. Conversely a number of resources have been excluded from the cost of the hypothetical alternatives (for example, the cost of physiotherapy) and had all these resources been included it is possible the costs of the rehabilitation programme would look more favourable. It is this dilemma that is the essence of the pragmatic or real world evaluation. What should be included versus what it is possible and feasible to include?

This study is evaluating both the cost and effectiveness of a method of service delivery in which the primary resource used is practitioners' time. Although focus lay on that area of data collection the study attempts to identify all resources and set out clearly inclusion and exclusion criteria together with justification for that criterion.

In terms of a comparator group, the inclusion of hypothetical alternatives in the absence of a comparator group has meant that a number of assumptions have been made but the

comparators are indicative of the cost of alternatives courses of action rather than actual costs and are presented as such.

### **Model 3: Use of Single Outcome Measure**

Cost consequence analysis is a disaggregated type of study that makes few assumptions and puts a relatively greater burden on the consumer of the analysis than cost effectiveness analysis. It is based on the premise that users of the study can and should make the value judgement tradeoffs necessary to integrate a disparate list of pros and cons (Gold et al, 1996). This begs the question of whether decision-makers are sufficiently knowledgeable and able to undertake this task.

Within the context of this study all outcomes measured showed improvements. In the absence of available data relating to the previous rehabilitation practice, the service providers (who were to be the users of the study) did not need to rate the relative improvements across the multiple domains. However, had one or more of the indicators not shown an improvement then it is likely that some form of value judgement would need to be made when using the results.

Generally cost effectiveness is pursued to test the null hypothesis that the mean cost effectiveness of one health care intervention is different from the mean cost effectiveness of some competing intervention (Drummond and McGuire, 2001). This should be presented in a ratio form known as an incremental cost effectiveness ratio (ICER). However, in this case, the effectiveness of the alternative (hypothetical) course of action is not known.

Whilst the calculation of ICERs is not possible the results can be presented as cost per (single) outcome. However, this presents a problem because the programme has multiple outcomes and no single outcome is considered to be primary. The ideal solution would be to focus on a measure of well-being or quality of life that encompasses these outcomes. There is however some controversy of the ability of current generic measures to capture the full range of impacts that an intervention may have on an individual's life (Byford and Sefton, 2002).

The EQ-5D used in the evaluation aims to measure health related quality of life and is frequently used in economic evaluations of health interventions. This final model considers use of the EQ-5D as the primary outcome measure to represent the benefits of the rehabilitation programme in the form of a CEA. It explores the results obtained and conclusions drawn from the analysis had the EQ-5D been the sole outcome measure.

As outlined previously, the EQ-5D may be used as a profile, as a single index of self-report health or a single index of self-rated health. The single index of self reported health is typically used in economic evaluations to present an ICER on its own or as the basis for a ratio of cost per QALY. The results of all three measures are presented but focus lies upon the use of the single index of self-reported health to form a cost per effect ratio and to explore the use of a single measure to reduce the burden placed upon the user of making value judgements.

### **Sample**

The cost of the rehabilitation programme and outcomes for the 43 clients who completed measures in both periods have been analysed in order to present a cost effectiveness ratio. The mean age of these 43 clients is 81.39 years; approximately two thirds (67.4%) of the clients are aged 80 years or over. 76.7% of clients are female. The client characteristics are similar to those 30 clients not included in the sub-group. There is no statistically significant difference in age between the two groups (t-test  $t=1.088$ ,  $p=0.28$ ) and of the remaining 30 clients not included in the sub-group approximately two thirds (63.3%) are aged 80 years or over and 80% are female.

All clients in the sub-group completed their rehabilitation programmes but less than half (46.7%) of the 30 clients not in the sub-group completed their rehabilitation. The mean time spent on the programme by those in the sub-group is 75.28 days. No statistical difference in time spent on the programme between the two groups was evident (Mann-Whitney  $U=604.5$ ,  $p=0.65$ ).

Forty one clients in the sub-group lived in their own homes at discharge from the programme and two in residential care. Of those not in the sub-group 18 lived in their

own home, eight in residential care, one client was in hospital and three clients had died.

## EQ-5D Outcomes

### *Self-Reported Health Score*

The self-reported health index shows an improvement between assessment and discharge moving from a mean score of 0.45 to 0.62 (Table 33). The difference was statistically significant (Wilcoxon Signed Ranks  $Z=-3.644$ ,  $p=0.00$ ). In total 37 clients were assigned scores at both assessment and discharge; of these clients 29 showed an improved score over the period, three clients' scores stayed the same and three deteriorated.

**Table 33: EQ-5D self-reported health score at assessment & discharge**

	<b>Assessment</b>	<b>Discharge</b>
<b>Missing data</b>	4.7%	9.3%
<b>N</b>	41	39
<b>Mean</b>	0.45	0.62
<b>Median</b>	0.52	0.69
<b>SD</b>	0.26	0.21
<b>Range</b>	-0.24 – 0.81	-0.06 – 0.88
<b>CI (95%)</b>	0.37 – 0.53	0.56 – 0.69

The clients not included in the sub-group do not show a statistically significant difference in self-reported health scores at assessment (Mann-Whitney  $U=477$ ,  $p=0.334$ ) to those who were included.

### *Self-valued health score (visual analogue scale)*

The self-valuation shows an improvement between assessment and discharge (Table 34). The mean score moves from 59.83 to 67.33 but the improvement is not statistically

significant (Wilcoxon Signed Ranks  $Z=-1.711$ ,  $p=0.087$ ). 41 clients were assigned scores at both assessment and discharge. Of these clients 21 recorded improved scores over the period, 13 recorded deteriorated scores and seven recorded the same score at assessment and discharge.

The scale end points are 0 and 100 and it is interesting to note that the range of scores recorded at assessment and discharge cover almost the whole range (5-100 at assessment and 2-100 at discharge).

**Table 34: Self-valuation Health Score at Assessment & Discharge**

	Assessment	Discharge
Missing data	4.7%	0%
N	41	43
Mean	59.83	67.33
Median	55.00	70
SD	21.11	19.42
Range	5 – 100	2 – 100
CI (95%)	53.17 – 66.49	61.35 – 73.30

The clients not included in the sub-group do not show statistically different self-valued health scores at assessment (Mann-Whitney  $U=426$ ,  $p=0.161$ ) to those who were not included.

### *EQ-5D profile*

#### *Mobility*

Forty one of the clients completed this question at assessment. While one client was confined to bed 92.7% reported some problems in walking about. At discharge 42 clients completed this question, whilst again one client reported being confined to bed the proportion reporting some problems in walking about had reduced to 78.6%.

*Self-care*

All clients completed this question at assessment. None reported extreme problems but 85.7% reported some problems with washing or dressing. At discharge 42 clients completed the question. Again none reported extreme problems and half of the respondents reported no problems with self-care.

*Usual Activities*

Forty two clients answered this question at assessment. Of these two-thirds (66.7%) reported some problems in performing usual activities and 31% reported extreme problems. The same number of clients responded at discharge and the profiles show only 16.7% reporting extreme problems and 61.9% reporting some problems.

*Pain/discomfort*

Forty two clients responded at assessment; four clients (9.5%) reported extreme pain or discomfort and 73.8% some pain or discomfort. Of the 42 clients who responded at discharge none reported extreme pain or discomfort and 39% reported no problems in this area.

*Anxiety/depression*

Of the 42 clients who responded at assessment 45.2% reported no problems with anxiety or depression and only one client reported an extreme problem. At discharge 41 clients responded; none reported extreme problems and 39% reported no problems.

**Costs**

The costs of the rehabilitation from the 43 clients who completed outcome measures at both assessment and discharge are shown in Table 35. Whilst the mean costs are lower for this sub-group than the mean costs for the sample of 71 (as presented in the main results section) the difference in mean costs for those in the sub-group and those excluded is not statistically significant (t test  $p > 0.05$  in each cost category).

## Cost Comparison

In answer to the question 'what would have happened to the client in the absence of the *RLTs*?' it was thought likely that 18 clients would have been admitted to residential care, 13 returned home with an increased home care package and eight admitted to hospital or had their hospital discharge delayed. Four responses did not fit readily into any category.

**Table 35:** Cost of rehabilitation programme (sub-group)

	Cost of programme including hospital in-patient stays	Cost of programme excluding hospital in-patient stays	Cost of programme including hospital in-patient stays, less client contribution	Cost of programme excluding hospital in-patient stays, less client contribution
<b>Mean</b>	£2248.94	£1977.69	£1978.92	£1707.67
<b>SD</b>	£2522.48	£2207.68	£1912.17	£1447.47
<b>Median</b>	£1347.81	£1347.81	£1269.71	£1269.71
<b>Range</b>	£298.51 – 12967.57	£298.51 – 12967.57	£267.95 – 7969.18	£267.95 – 6524.82
<b>CI (95%)</b>	£1472.64 – 3025.25	£1298.26 – 2657.11	£1390.44 – 2567.40	£1262.21 – 2153.14

## Cost per Effect Ratio

The mean self-valued health score is 59.83 at assessment and 67.33 at discharge, an improvement of 7.5 points over the period of the programme. Using a mean cost of £1978.92 this equates to a ratio of 1:264; the estimated cost of raising the self-valued health score by one point is £264.

The self-reported single health score is the indices typically for use in cost effectiveness studies (Roset et al, 1999). The mean score at assessment is 0.45 and at discharge 0.62. Over the period this gives an improvement of 0.17. The mean cost of a rehabilitation programme (including client contributions and in-patient days) is £1978.92. This

equates to a ratio of 0.1:1164. The estimated cost of raising the self reported health score by 0.1 is £1164.

### *What does the ratio tell us?*

Within the context of the study, without a comparator the ratio tells very little. Theoretically the ratio could be compared against services or treatments in different areas; but any comparisons should take into account the costing methods used and the inclusion and exclusion criteria.

### **Change in Outcomes**

Without the comparator group, in order to draw any conclusion from the results presented, it is necessary to determine whether the changes in the index scores are meaningful.

Unlike the Barthel Index and the HADS which both allow for a clinically relevant classification of their index scores to date the EQ-5D indices have no such interpretation. For example, a move from 70 to 80 on the Barthel Index may be seen as a move from a moderate dependency level to a mild dependency level. The move from 0.45 at assessment to 0.62 at discharge on the self-reported description shows a positive improvement that is statistically significant but there is no interpretation of whether the change is clinically important. To address this the size of the effect should also be considered. Cohen details an effect size index that allows classification using the size of difference between means. The effect size index is calculated as the difference between the means divided by the standard deviation of either population. A small change is 0.2, a moderate change 0.5 and a large change 0.8.

The self-reported description indices show an effect size of 0.6575 (i.e. the means differ by 0.6575 of a standard deviation) indicative of a moderate to large change in scores between assessment and discharge. The self-valuation indices show a smaller effect size

of only 0.3551 indicative of a small to moderate change. These results are in line with the results from tests showing whether the changes were statistically significant.

### **Does the EQ-5D represent *all* Client Outcomes?**

The ratio provides a concise presentation of the study results but, when presenting the results this way, is the analysis as informative as the cost consequence analysis that details the individual and more condition specific results of the Modified Barthel Index and the HADS?

The two EQ-5D indices, in line with a priori expectations, were significantly correlated both at assessment and discharge (Spearman's Rho  $\rho=0.351$ ,  $p=0.026$  and  $\rho=0.364$ ,  $p=0.023$  respectively). Both indices purport to be measures of health related quality of life albeit that one is a self-valuation whilst the other is a self-reported description converted into a weighted health state index by applying scores from value sets elicited from general population samples ([www.euroqol.org/eq5d](http://www.euroqol.org/eq5d), accessed 14 November 2001). However, it should be noted that despite this correlation only the change in the self-reported description was statistically significant.

#### *Modified Barthel Index*

The Modified Barthel Index does not correlate with either of the EQ-5D indices at assessment. At discharge there is a statistically significant correlation with the self-reported description indices at 0.05 level but not at the 0.01 level (Spearman's Rho,  $\rho=0.357$ ,  $p=0.045$ ). No significant correlation is evident with the self-valuation indices. Whilst it may be feasible to expect a correlation given that the indices cover many of the same domains it may be more useful to explore the relationship between the individual areas of functional ability covered by both the indices. For example, the Barthel covers areas such as personal hygiene, bathing and dressing that are included within the domain of 'self-care' in the EQ-5D self-reported description. Similarly the domains of 'mobility' and 'usual activities' are covered by both indices albeit that usual activities are not explicit but rather a composite of functional ability within the Barthel.

Eleven tests were carried out using the baseline assessment outcomes to determine whether there were statistically significant relationships between domains common to both measures. The relationships explored are shown in Table 36.

**Table 36:** Correlations between EQ-5D self-reported description scores and Barthel scores.

Relationship	Spearman's Rho (p)
EQ-5D, self-care & Barthel, personal hygiene	-0.407 (0.007)*
EQ-5D, self-care & Barthel, Bathing	-0.124 (0.446)
EQ-5D self-care & Barthel, dressing	-0.450 (0.003)*
EQ-5D usual activities & Barthel, eating and drinking	0.072 (0.654)
EQ-5D usual activities & Barthel, getting on and off the toilet	-0.168 (0.293)
EQ-5D mobility & Barthel using the stairs	-0.035 (0.835)
EQ-5D mobility & Barthel chair-bed transfers	-0.101 (0.528)
EQ-5D mobility & Barthel ability to walk	-0.137 (0.404)
EQ-5D mobility & Barthel total score	-0.111 (0.524)
EQ-5D usual activities & Barthel total score	-0.131 (0.447)
EQ-5D self-care & Barthel total score	-0.348 (0.037)*

The relationships all show a negative relationship as expected (the Barthel scores rise from unable to do task at zero to fully independent at ten whereas the EQ-5D self reported description rises from one for no problem to three for extreme problem) with the exception of the relationship between the EQ-5D scores in usual activities and the Barthel scores for the assessment of ability to eat and drink.

Three relationships (marked by an asterisk) are statistically significant. However this falls to only one, the EQ-5D self-care and Barthel dressing, if the Bonferroni correction is applied. The Bonferroni method controls for the familywise error rate by correcting the level of significance for each test such that the overall type I error rate ( $\alpha$ ) across all

comparisons remains at 0.05 (Field, 2000). In this study there are 11 tests and thus the level of significance is 0.0045

These results are not in line with previous studies (see for example, Coast et al, 1998) which find significant correlations between a number of the Barthel and EQ-5D domains even when the Bonferroni correction was applied.

### *Hospital Anxiety and Depression Scale (HADS)*

At assessment there are statistically significant correlations between the HADS depression total and both of the EQ-5D indices (Spearman's Rho,  $p < 0.05$ ) whilst only the EQ-5D self-reported description indices shows a statistically significant correlation (Spearman's Rho  $\rho = -.461$ ,  $p = 0.004$ ) with the HADS anxiety totals. The correlation coefficients are negative in line with a priori expectations. The correlations at discharge show similar results.

At assessment the relationship between the EQ-5D self-reported description concerned with anxiety and depression and the HADS scores all show significant correlation (Spearman's Rho  $p < 0.01$  for all). The correlation co-efficients are  $\rho = 0.487$  for the depression scores and  $\rho = 0.597$  for the anxiety scores. These compare with correlation co-efficients of  $\rho = 0.51$  and  $\rho = 0.44$  recorded by McDowell and Newell (1996).

### **Conclusion**

The cost per effect ratio tells us little in isolation and is hampered by the absence of a comparator intervention. However, presentation of the results in this form allows generalisation and comparison outside the immediate study location. In essence the results of the study remain the same; the intervention is shown to be effective and the cost of the hypothetical alternatives may still be compared.

### *Bias*

Use of the sub-group of those clients who completed outcome measures at assessment and discharge and for whom cost analysis was undertaken reduces the sample number

and lays open the problem of bias in as much as those clients included all completed the programme whilst almost half of those excluded did not. The larger sample number included in the main study may have reduced some of the problems of bias.

### *Interpretation of outcomes*

Despite the increased scope for generalisation there are a number of issues that arise when using only the EQ-5D as the only outcome measure. The primary difficulty appears to be that of interpretation of the results. Interpretation of changes in the indices is vague. Whilst movements up the scale represent improvements users of the study have no reference point to place those changes into any clinical context. Analysis can show if changes are statistically significant but these changes may not be 'meaningful' in terms of *how much* a client's health or quality of life has improved or the magnitude of those changes. Use of Cohen's effect size index provides a method by which changes in the indices may be classified as small, moderate or large.

The Modified Barthel Index provides a visual overview of clients' functional ability pointing to areas of need and potential action. The total score may be interpreted in terms of dependency levels ranging from total dependency to minimal dependency/independent. Similarly, the HADS scores may be interpreted as possible, definite or 'non-case' of depression and anxiety. Whilst the EQ-5D indices do not allow for this type of interpretation (except at the end points) the profile derived from the self-reported description allows some insight into improvements made between assessment and discharge in terms of movements between no problems, some problems and extreme problems within each of the five domains.

Of the outcome measures chosen in the main study the EQ-5D appeared to best represent the multiple effects arising from the rehabilitation programme (the Barthel only records changes in functional ability and the HADS only changes in anxiety and depression). Use of the EQ-5D as a single outcome measure, within the context of this study, does not alter the results of the analysis. The rehabilitation programme may still be viewed as cost effective and the analysis allows a cost per effect ratio to be presented that may, theoretically, be compared across other studies. However, a cost per outcome

ratio was already contained within the findings presented in the body of the main study albeit in an implicit rather than explicit manner.

The analysis addresses the question of whether use of multiple measures adds anything to the study – do the multiple measures duplicate work increasing the burden upon those administering the measures and the respondents? In order to answer this question the relationship between the measures were analysed. In line with other studies the HADS scores show significant correlations with the domain of anxiety and depression within the EQ-5D self-reported description. However the correlations between the Barthel and the EQ-5D self-reported description are not so clear. This is not in line with previous studies (see, for example, Coast et al, 1998). Thus, given the relationship between the EQ-5D and the HADS could one of these measures be dropped with no loss to the depth of the effectiveness results?

Was the EQ-5D to be dropped and only the HADS and Barthel administered as measures of effectiveness of the service a further difficulty arises. In order to carry out a cost effectiveness analysis there should be one ambiguous objective of the intervention or, if there are many objectives, that the alternative interventions are thought to achieve this to the same extent (Drummond et al, 1999). The programme aims are to enable clients to live independently and to avoid unnecessary admission into hospital and long term care. These aims are clearly dependent upon clients' physical, emotional and psychological well being. Thus, it is feasible within this study to interpret the aims of the programme to be to improve clients health related quality of life and thus use the EQ-5D as the primary outcome measure.

However, was the EQ-5D to be excluded, the primary outcome is not clear. If alternative programmes achieve the objectives to the same extent then the cost effectiveness analysis may be undertaken without using either the HADS or Barthel as primary outcome measure. However, use of one measure over the other would require a value judgement of the importance of changes in functional ability versus changes in anxiety and depression.

Another area that clouds the issue is that of the interpretation of the indices. Both the HADS and Barthel provide an interpretation of the scores obtained from the indices.

Not only do baseline scores allow users of the study to make comparisons with other sample groups but also, within the context of service delivery, the HADS was used by the care managers as an indicator of potential anxiety/depression problems. When client scores were indicative of possible or definite cases of anxiety or depression the case was referred to the community psychiatric nurse.

The relative merits in using the EQ-5D as the sole outcome measure against using multiple outcome measures will also depend upon how the results of the study are to be used. Consider, for example, whether the results are to be used for making comparisons between different forms of rehabilitation programmes thought to be administered to similar populations. The scores obtained from the multiple outcome measures would provide a depth of analysis that allows direct comparison between programmes in terms of, for example, baseline assessment of functional ability and anxiety/depression. Users of the study may be able to discern whether their programme accepts clients with more severe anxiety/depression problems but who have a greater functional ability. The EQ-5D profile, whilst providing some detail in terms of problem/no problem/extreme problem, does not provide this level of analysis.

If, however, the study is used within policy decision making then users may be interested primarily in the cost per outcome. Use of the EQ-5D allows comparison across different services, interventions and technologies whose outcomes may differ considerably.

## **Summary**

Within the context of this case study widening the perspective of the analysis to include the costs of the Red Cross changed the mean costs of the programme little. Although the change in mean costs was *statistically significant* in practical terms it accounted for less than 0.004% of the total costs of the programme. However, interview data from the Red Cross and the RLTs themselves indicates that the Red Cross was under-utilised. With respect to the impact of the Red Cross upon the effectiveness of the programme, interview data indicates that the service they provided was valued. However, the data available is not sufficient to determine if their input contributed to the effectiveness of the service.

Whilst the analysis did not include the costs or consequences to clients' informal carers resulting from the rehabilitation programme clearly there exists a large number of informal carers within the UK. The perspective of the study excludes these costs and consequences. Data were not collected with regard to the numbers of informal carers nor the hours devoted to caring. The small amount of interview data gave conflicting views of the consequences to the carers of clients on the rehabilitation programme and provided little insight into their contribution to the effectiveness of the programme.

The second model explores differences in costs if the assessment element of the programme for those clients not accepted onto the programme is included. The addition of these resource costs brought a statistically significant increase in mean costs and represent around 4% of the total costs of the programme. However, despite this increase in costs the comparisons between the rehabilitation programme and the hypothetical alternatives are still favourable and any decisions based upon the original analysis are unlikely to change as a result of this inclusion.

The final model considers the use of only one outcome measure (the EQ-5D) rather than the three used in the original analysis. The use of this measure alone continues to show the intervention to be cost effective but introduces a number of constraints.

The outcomes presented within the two index scores allow little interpretation other than determining whether changes are statistically significant, although this can be remedied to some degree through use of Cohen's index of effect size. In addition the profiles are particularly general (no problems, some problems and extreme problems) and thus have limited use for comparison of individual rehabilitation programmes. The use of this measure does, however, allow comparison of interventions, programmes and services that have different aims and objectives and thus differing outcomes.

The case study has highlighted a number of limitations resulting from the practical and conceptual constraints imposed upon the study design, process and analysis. Whilst the constraints have been addressed and difficulties overcome the resultant CCA can be seen as a hybrid in terms of the theoretical ideals underpinning economic analysis of a health care intervention. Chapter Eleven draws on the case study together with the findings from the appraisal of the existing literature described in Chapter Five. Existing

evaluations of rehabilitation interventions show how economic evaluations are *actually* carried out and how this differs from the text book ideal. The case study lends insight into the constraints and limitations that influence study design and, thus the results of the analysis. Using this evidence a developmental framework is presented by which economic evaluations of rehabilitation interventions may be carried out. The framework aims to be sympathetic to the constraints and limitations imposed upon the evaluation process but allow the multifaceted components of the rehabilitation process to be meaningfully reflected. The chapter ends with a critical analysis of the strengths and weaknesses of the thesis together with recommendations for future research.

## Chapter 11

### Discussion and Conclusions

#### Introduction and Overview

The aim of the thesis was to determine if the complexities of rehabilitation interventions are reflected in economic evaluations and if those evaluations conform to the standards set down for economic evaluation in this field; that is, to compare the textbook ideal with *real life* economic evaluation. The thesis focused on a number of key areas.

- The concept of rehabilitation was defined and a model of rehabilitation presented together with the characteristics inherent in rehabilitation interventions that constrain economic evaluation
- An appraisal of existing economic evaluations of rehabilitation interventions sought to determine how these evaluations fit with the *ideal* economic evaluation laid out within methodological texts and whether the interventions themselves conformed to model of rehabilitation as a complex intervention
- The constraints to economic evaluation in this field were identified within the context of a case study of an economic evaluation of a rehabilitation programme

This chapter brings together these findings. It provides a discussion and critique that focuses upon barriers to carrying out an economic evaluation in line with the methodological texts. It considers how the deficiencies in economic evaluation arising as a result of these barriers or constraints may be addressed in order to present a framework whereby rehabilitation and, in principle other interventions may be meaningfully evaluated. A developmental framework, based on the thesis findings, is outlined.

#### Rehabilitation and Complexity

Rehabilitation and rehabilitation interventions are viewed as complex. Campbell et al define complex interventions as *those that include several components* (2000, p694).

Definitions of rehabilitation and the model of the rehabilitation process presented are indicative of this complexity. They show rehabilitation affecting changes in both health and social functions and rehabilitation interventions that have multiple inputs and outputs.

The interventions identified by the literature search (Chapter Five) conform to these definitions and the model of rehabilitation presented. Eighty seven percent of the papers show rehabilitation interventions undertaken by a multidisciplinary team and one third of the interventions include input from sectors outside the health sector. Eighty nine percent of the papers indicate that patient outcomes are multiple and 78% that the expected outcomes pertain to changes in both health and social function. Forty two percent of studies indicate that the rehabilitation intervention affects patients' family, friends and informal carers.

These findings are reinforced by the case study. The rehabilitation programme chosen for the case study included input from health and social services together with input from the voluntary sector (Red Cross). The nature of the acceptance criteria for inclusion onto the programme meant that anticipated outcomes were likely to be multiple. The evaluation results, together with data from interviews and focus groups, are indicative of outcomes affecting health and social functions that accrue to patients and their informal carers.

### **Ideal and Actual Economic Evaluations**

Using methodological texts, methodological papers and a selection of appraisal guidelines the key elements of an *ideal* economic evaluation were identified. A number of economic evaluations of rehabilitation interventions were then appraised against this ideal in order to determine whether the economic evaluations conformed to the methodological and theoretical texts. The findings show a gap between the practice and the ideal economic evaluation.

Within the economic evaluations appraised a number of trends were identified. It was found that economic evaluations of rehabilitation interventions typically took a narrow perspective or viewpoint (that of the service provider or the third party payer). In

contrast a societal perspective is advocated within health economics texts. A narrowing of perspectives leads to the exclusion of the costs and consequences to other sectors of society. Indeed 42% of the studies indicated that the rehabilitation process would have effects upon friends, family and informal carers.

The studies showed that, in line with economic evaluation in the field of health, the use of CEA (including CCA, CUA and CMA) is prevalent with few evaluations employing CBA. Evaluations typically took the form of CCA. Although rehabilitation interventions may be seen to aim to effect improvements in quality of life or health related quality of life little use was made of this type of measure or of CUA.

The methodological texts advocate the use of RCTs. However, the studies employed a variety of study designs across different settings. In addition very few of the studies used power calculations to determine sample size.

Explorations of effectiveness were well presented but explorations of costs were much less so. Studies generally gave a poor description of costs and cost analysis within the papers. The methods employed to carry out the cost analysis were mixed and the level of detailed analysis equally so. While the cost boundaries appeared to be in line with the perspective chosen, marginal costs were rarely reported (only two studies reported the difference between average and marginal costs). Ratios were rarely used when presenting results. Similarly, few studies considered opportunity costs within the analyses

Studies typically presented little statistical analysis. When statistical analysis was carried out it was usually centred on the consequences/outcomes rather than costs. Little use was made of modelling and very few studies took uncertainty into account.

On the positive side, the studies conformed to the methodological text in a number of areas. The hypothesis or study questions were typically well defined, phrased in a way that considered both costs and consequences and clearly states the perspective of the evaluation. The perspective of the evaluations fitted with the form of economic evaluation used and clinical effectiveness evidence was generally well presented (even

when RCTs were not used). Discounting was used where appropriate and 60% of studies presented some form of inclusion and exclusion criteria.

The overall trend was thus one of diversity. This diversity was evidenced in a number of areas:

- Variety of study designs: these range from RCTs to ‘before and after’ type designs. Whilst RCTs are at the top of the study design hierarchy (the gold standard), only 38% of the evaluations used this design
- Sample size: this ranged single person studies to those crossing multiple centres with 1000+ participants
- Variety of outcome measures: these include validated specific and general measures, indicators and proxies. Few of the studies used quality of life or health related quality of life scales.
- Diverse costing methods: This, again, ranged across the hierarchy, from the most accurate (micro-costing) to the least accurate (gross-costing). Costing methods were unclear in 16% of the evaluations.
- Diverse cost reporting. This ranged detailed comprehensive analysis to cost analysis presented in one paragraph

### **Barriers and Constraints**

The findings from *actual* economic evaluations evidence diversity. Whilst some of the studies conform closely to the textbook ideal many did not. The studies themselves provided little insight into why the evaluations took the form they did or why the methods outlined in the textbooks had not been adhered to.

The complexity of rehabilitation interventions makes it very difficult to carry out a systematic assessment of costs and outcomes (Sefton et al, 2002). The constraints or barriers this complexity imposes are likely to influence how economic evaluations are carried out. The case study identified and explored a number of constraints to the evaluation design, process and analysis.

The constraints or barriers explored below should not be seen in isolation. They are inter-related or even interdependent. For example, an economic evaluation is shaped by a lack of high quality data relating to the previous practice. This lack of data affects the way in which outcomes can be and are reflected and measured, the effectiveness study design (for example, in the case study, the use of a 'before and after' study) and the choice of comparator for the costs of the service (again, in the case study, use of a counterfactual). The lack of quality data may influence all stages of an evaluation design, process and analysis.

### *Perspective of the study*

The choice of the perspective of any economic evaluation is linked to the study question. However where possible the evaluation should take a societal perspective in order to incorporate all costs and health effects. Typically economic evaluations take a narrow perspective that necessarily limits the inclusion of costs and consequences resulting from the programme that are outside this perspective. For example, within the case study the narrow perspective placed a constraint upon the evaluation that inevitably led to bias within the results of the analysis. This was illustrated by an informal carer who felt that although the client had achieved her goal of returning home this was at the cost of the carer's peace of mind (Reid et al, 2002). For this population group whose mean age is over 80 years the role of the carer is particularly important given that half of all carers in Britain look after someone aged 75 or over (DoH, 1999).

### *Reflecting outcomes*

Allied to the perspective of the study is the measurement of outcomes: that is, the marrying together of the methods and tools by which the evaluation measures the extent to which the programme's objectives are met. The aims of the rehabilitation service are multiple and address medical, psychological and social problems and needs. This brings about a dichotomy. Use of multiple outcome tools will help ensure all these aims are reflected but then place a burden upon participants in the study and users of the study. Multiple questionnaires place an increased burden upon the respondents and those administering the measures. Users of the study are required to make value judgements about the relative importance of each outcome. Conversely, use of a single measure

reflecting changes in quality of life would provide a more general overview, but is unlikely to capture the full range of impacts that an intervention may have on an individual's life (Byford and Sefton, 2002). This was illustrated within the data collected relating to the use of the EQ-5D. Of the 73 clients in the sample 11 qualified or contextualised statements within the EQ-5D. It is also questionable whether it provides sufficient detail on changes in, for example, areas such as anxiety or depression to the client's practitioner.

### *Comparative analysis and study design*

Economic evaluation is a comparative analysis. The selection of any alternative for comparison should be appropriate in order to provide a meaningful analysis. Any constraint upon the choice of comparator will limit the results of the evaluation. This is clearly shown within the case study. The study design was constrained at the outset by the absence of available data relating to the previous rehabilitation practice. In order to select an alternative with which the rehabilitation programme could be meaningfully compared a number of options were explored. However, the choice within these options themselves was constrained by time and funding. These constraints allowed only a before and after type design for the effectiveness component of the analysis. The cost comparison thus used a 'hypothetical' comparator and this meant that the study was susceptible to sample and response bias.

### *Costs*

The economic evaluation used a micro-costing method and, in line with best practice, highlights the inclusion and exclusion criteria. However, despite the methods used for clients on the rehabilitation programme the costs of the alternative courses of action (the hypothetical situations) may be too be simplistic. Identification, measurement and valuation of alternative action are constrained by the absence of data detailing the previous rehabilitation practice. This can be seen to be primarily due to the nature of rehabilitation and rehabilitation services. Rehabilitation is seen as a function of services (for example, OT, physiotherapy, and home care) and not necessarily as a service in its own right (Nocon and Baldwin, 1998) intimating that rehabilitation services are often

disjointed. But, the absence of a baseline for comparison is also common when evaluating new policy initiatives (Sanderson, 2001).

### *Time scale*

The question of when to carry out an economic evaluation is particularly significant for a new service. There may be a bedding down period during which time the service may not be running at full capacity and is characterised by steep learning curves. This then suggests the need for a long lead-time. In the case study time was a constraint. A finite time was allocated to evaluate the service and this meant that the evaluation was undertaken only 10 months after the service's inception. This is less than the time frame (12-18 months) recommended (Sanderson, 2001).

Time may also prove to be a constraint in terms of the follow up period, especially as extended follow up may be required to assess effectiveness and costs accurately. In the case study, in order to provide evidence of the sustainability of client outcomes, a six months follow up was planned. However, this proved not to be feasible in the time scale as many clients spent far longer than the predicted six weeks on the rehabilitation programme. Although the follow up period was reduced to three months few follow up assessments were undertaken and this limited the results of the evaluation.

### **Discussion**

The general methodological literature identifies a number of constraints to the evaluation process. In particular problems associated with developing, identifying and reproducing the intervention (Campbell et al, 2000). These problems are echoed in the economic literature of health and social welfare. These include the degree of user involvement, the complexity of the intervention, the complexity of outcomes, the perspective, scope and time scale (Byford and Sefton, 2002). Similarly Coast et al (2000) outline conceptual and practical difficulties with the economic evaluation of services crossing the interface between health and social services. The case study reinforces the validity of many of these constraints or difficulties.

*Perspective*

Rehabilitation interventions are likely to have a wider impact than purely medical interventions. Costs and consequences may accrue to a wide number of sectors. In order to capture these costs and consequences, to enable a comprehensive picture of the rehabilitation intervention to be presented a wide perspective needs to be employed. This presents a challenge when undertaking the evaluation. Whilst the economic evaluation ought to be driven by the study question, practical limitations such as the availability of data (Coast et al, 2000) and the time and money available to carry out the evaluation will constrain the evaluation and the extent to which it is possible to reflect all costs and consequences.

Advocates of CEA put forward the theory that by carrying out analysis that maximises health subject to a budget constraint it is likely that society will arrive at a Pareto optimal position. However, in the case study, restricting the perspective of the study led to the omission of costs and consequences resulting from the rehabilitation process. For example, clearly there may be a burden to informal carers both in costs and, possibly, health outcomes resulting from clients returning home as a result of the rehabilitation process. Informal care may be crucial to the success of any rehabilitation intervention. Voluntary agencies may influence client outcomes but their input in terms of both costs and consequences are omitted. If analysis is based only upon, for example, immediate costs to the health sector and those outcomes accruing only to the patient these costs and consequences are ignored providing only a partial picture of the cost effectiveness of the rehabilitation intervention.

In the case study the perspective or viewpoint of the case study was determined by the service providers. The RLTs required that the evaluation answer 'does the service work and how much does it cost the service providers?' In order to address these questions the evaluation was carried out from the perspective of the service providers. Chapter Ten explored widening this perspective. The findings indicated that the inclusion of the costs of the Red Cross showed little difference to the costs or to the interpretation of the results. However, the qualitative data from interviews with informal carers were indicative of costs and consequences excluded by the perspective of the study.

### *Selection of alternatives*

A further constraint was the selection of alternatives: finding an appropriate intervention to compare the rehabilitation programme against in line with methodological ideals. If economic evaluation is defined as a comparative analysis, this begs the question of whether an economic evaluation that uses the sample group as their own comparator can be considered a true economic evaluation.

Within the case study the lack of intervention with which to compare the rehabilitation service and the lack of quality data culminated in the use of a before and after type design. The service was not phased in gradually. All eligible clients were accepted on to the programme from the beginning. The previous practice prior to the inception of the service was a non-coordinated, disparate rehabilitation service and data in respect of both costs and outcomes had not been collated in a way that allowed direct comparison. Whilst these problems may be particularly associated with evaluating a new service, the problems posed are unlikely to be unique to new services.

### *Design*

Many of the economic evaluations appraised within the thesis do not consistently meet the criteria laid out in methodological texts. Whilst RCTs are considered to be the gold standard, this does not mean that results garnered from other study designs do not have merit in their own right. There is a need to look 'outside the box'. The evidence they present may be as meaningful or useful than those that conform to the ideal. Even within those analyses that conform to the model set out in economics text the use of narrative or qualitative data is likely to enhance those evaluations not carried out from a societal perspective.

For example, Walker (1996) presents a single person case study that evaluates home health care as an alternative to institutionalisation. The paper presents a narrative describing the rehabilitation process including the support of the patient's informal carer. The narrative supplements the quantitative measures used to provide a comprehensive picture of both the rehabilitation process and outcomes. Whilst the costs include only those of the service provider the narrative is indicative of the costs to the

carer. It is unlikely that the results are generalisable, even within the service outlined given the individualised nature of the rehabilitation process. They do however provide an indication of the costs and consequences outside of the narrow perspective of the service provider.

### *Time scale*

The time at which the evaluation is carried out influences evaluation results. Rehabilitation typically takes part over a number of settings and over a long period. Consider for example, a degenerative disease for which the individual requires on going rehabilitation. This prolonged type of rehabilitation presents a challenge. Will the economic evaluation be meaningful if only part of the rehabilitation process is presented? Similarly, the timing of any impact may be uncertain (Sefton et al, 2002).

The time when the evaluation is carried out may also constrain the evaluation process (Coast et al, 2000; Sanderson 2001; Byford and Sefton, 2002). When the evaluation takes place is particularly significant for new and/or complex schemes (Sanderson, 2001). For example, if the intervention is not working at full capacity when the evaluation is carried out when this may inflate the costs associated with provision of that intervention.

Within the context of the case study time also influenced the sample size. The finite time available to carry out the economic evaluation, the anticipated length of time spent on the programme and the follow up period meant that recruitment to the study could only be over a fixed time period. The sample size would be determined by the number of clients recruited over this period. Thus, the design of the study was driven by the time constraints. This time constraint together with the use of multiple outcomes measures used meant that no power calculation was carried out. This absence of a power calculation was also typical within the appraised studies.

The constraints described do not relate exclusively to economic evaluation or to the evaluation of rehabilitation interventions but serve to illustrate how constraints may inform the methods and processes by which economic evaluations of rehabilitation interventions are carried out.

### *Multiple Outcomes*

Choice of outcome measures is critical. The most important factor is how to accurately reflect all important outcomes, but other considerations also need to be taken in to account. These include the burden upon respondents (given the ethical considerations of any study) and the burden upon those administering the measure.

As part of the move towards evidenced based practice there is increased focus upon incorporating validated outcome measures into routine practice to provide on-going evaluation and clinical audit. However a delicate balance exists between the use of measures the clinician feels are relevant to their practice and outcome measure 'overload' where measures are perceived as a burden on clinician time.

There may also be resistance to the use of outcome measures by those involved in patient care, as experienced in the case study. Findings from the case study showed that care managers were initially reluctant to use the outcome measures, not because of their lack of relevance but a perception that the outcome measures duplicated data they had already collected, albeit in a less systematic manner. Furthermore, informal discussions revealed that those care managers from the social sector were far less comfortable using outcome measures than those from the health care sector. These care managers felt that the quantification of outcomes was not part of the social services culture. This illustrates the limited use of outcome measures in the social care sector (MacDonald, 2000; Nocon and Qureshi, 1996).

The outcome measures used will also be dictated in part by who commissions the study and what the study is to be used for. For example, will the clinical results inform practice? The case study explored the use of a single quality of life measure (EQ-5D). The findings show that use of this measure alone limits the clinical use of the study. Whilst the three levels of no problem, some problem and severe problem give an indication of the characteristics of the patient group, changes in the scores derived from the measure have no clinical interpretation, nor do they provide a detailed analysis of the patient's condition. However, the EuroQol group do advocate the use of other

measures in conjunction with the EQ-5D and the measure can be converted into QALYs allowing comparison with other studies.

Findings from the economic evaluations appraised show that there is little conformity in the outcome measures used. The prevalence of multiple outcome measures within studies suggest that there is some way to go towards use of more universal measures such as quality of life measures.

### *Form of Evaluation*

The use of multiple outcome measures to capture the range of changes resulting from rehabilitation interventions is reflected in the form of economic evaluation employed. Fifty eight percent of the studies were cost consequence analyses.

Ideally cost effectiveness analysis should be used if there is one single or major outcome or if interventions are thought to achieve multiple outcomes to the same extent. Clearly rehabilitation interventions can result in a number of diverse outcomes; it is the extent to which these outcomes are achieved that the evaluation should reflect.

Methodological texts advocate the use of CUA or CEA using some form of quality of life measure rather than CCA which may levy a cognitive burden upon users of the study; but, as determined in the case study the quality of life measure (in this case the EQ-5D) had limited clinical use. This poses the question of whether there could be a compromise between use of a battery of outcome measures in an attempt to capture all perceived outcomes or a smaller number that may focus on only some of the expected outcomes resulting from the rehabilitation process.

### **Addressing the Constraints**

Discussion so far has focussed upon constraints that whilst not unique to economic evaluations of rehabilitation interventions, are associated with complex interventions, integrated care and holistic approaches to health and social care. All served to dictate how the study was carried out and whilst *practical problems must not be allowed to drive the manner in which economic evaluations are conducted* (Coast et al, 2000, p46)

the case study was necessarily dictated by constraints including: the time available to carry out the evaluation and the period over which the intervention takes place; the cost of the evaluation (the 'size' of the programme/service dictates the funds available to evaluate it and the evaluation itself should be cost effective); and the availability of high quality data.

Evidence from the case study has highlighted constraints to the evaluation process in line with those suggested in the literature. These constraints upon the study design, process and analysis led to a 'hybrid' evaluation. The approach taken was pragmatic. Every effort was made to conform to the ideals laid down in the methodological texts but the resulting economic evaluation displayed many of the traits evidenced in the published studies appraised.

The appraised literature highlights a variety of different study designs including both RCTs and before and after type studies. Where reasons were given for not using a RCT all relate to constraints upon the design process. For example, an evaluation of a multidisciplinary day programme for children and adolescents with severe asthma states:

*The present study did not provide for a control group matched for severity of illness but who did not receive this programme intervention. Given the severe and complex nature of the patients referred to this programme, and the difficulties encountered by these families to participate in the programme, there simply was no appropriate control group that could be studied for comparison (Bratton et al, 2001, p187).*

The evaluation compares the cost of the patients' 'medical encounters' prior to and post the intervention and patient outcomes prior and post the intervention. Similarly, an evaluation of the resettlement of people with mild learning disabilities uses patients' costs and outcomes prior to and post the intervention states:

*There may be other cheaper and more effective assessment and treatment programmes, that could achieve (these) results, but no other was available for detailed comparison (Dockerell et al, 1995, p900).*

The lack of an intervention to compare the rehabilitation service against, both in the case study and within the studies identified, influences the study design employed. Although the RCT is considered the gold standard the findings indicate, given the diversity in the types of design used, that it is not possible in many situations to carry out a RCT. Other study designs may be considered to be lower within the hierarchy of study design but this does not necessarily discredit the findings. Rychetnik et al (2002) considers the evaluation of public health interventions, themselves examples of complex interventions. They argue that whilst the RCT is the best method to evaluate interventions there are other equally important factors influencing the evidence derived and that decisions should be based on the strengths, weaknesses and gaps in the evidence. Thus:

*If the research is good enough it will confirm and quantify the causal relationship between the intervention and its effects where such a relation exists. Good research will also help us to understand why an intervention appears to be effective (Rychetnik et al, 2002, p124).*

Within the case study the outcome measures alone provide evidence of improvements; for example improved mobility was reflected in the Barthel Index. However, those improvements could be due to other (confounding) factors, such as the passage of time. Thus further evidence is needed of the causal relationship between the outcomes and the intervention.

It is here that the qualitative data collected, alongside the case study in the form of interviews with clients and carers and focus groups with rehabilitation team members and used in conjunction with the quantitative data, enlarges and provides a more comprehensive picture of the outcomes and consequences resulting from the rehabilitation programme. Campbell et al (2000) advocate the use of qualitative and quantitative evidence when evaluating complex interventions. In fact qualitative and quantitative methods are in most cases complementary rather than substitutes (Sassi, 2000). The data provides evidence of a causal link and details of how, in the clients' and carers' view, the intervention is effective. The interview data confirms that whilst the

design of the study is important there should also be other considerations. As Rychetnik et al suggest:

*That an RCT design may be best used to test a causal hypothesis after satisfactory pre-post single group design has been conducted, and assurance has been obtained that the measuring instruments satisfactorily capture programme implementation processes and outcomes (Rychetnik, 2002, p122).*

### **Other Divergences from the Ideal Economic Evaluation**

Whilst the constraints identified within the case study conformed to those outlined within the literature a number of differences between the ideal and actual evaluations apparent in the studies appraised did not appear. Areas of divergence from the ideal occurred primarily in the cost analyses where, in the appraised literature, costs generally were poorly reported. There was little statistical analyses (and when it was carried out, analysis was usually in respect of the outcomes rather than the costs) and little account was taken of uncertainty.

Although some of the studies appeared to be clinical studies in which costs had been added almost as an afterthought, it was not possible to ascertain why costs were typically less well presented or analysed than the consequences or outcomes resulting from the rehabilitation interventions. This may be considered to be a weakness of the thesis.

Exploring the constraints facing economic evaluation using only one rehabilitation programme limits the scope of the findings. Whilst the rehabilitation programme was chosen to conform to the definitions of rehabilitation and model rehabilitation outlined in Chapter Two, the programme was population specific (older people). It was also a new service. This may have been a confounding factor; the constraints identified may have been introduced or compounded because the service was new.

Few constraints were identified in the cost analysis. Whilst hidden costs precluded the use a top down costing approach, micro-costing was considered more suitable for a

programme whose main costs related to labour resources. Estimates used in the costing process were accounted for using confidence intervals. However, the results of the analysis and levels of statistical significance are constrained by the absence of a power calculation.

Within the literature appraisal the use of published papers describing economic evaluations instead of the original studies may have limited the discussion of the methods used when undertaking cost analyses. The literature search identified peer reviewed published papers. It can be assumed that details of the economic evaluation presented in each of these papers represent a précis of the actual study. Papers must adhere to the word limit set by the journal in which they are published. In addition the journal's focus may dictate that details of the costing methods were forsaken in order to meet these limits and fit with the journal's acceptance criteria.

The debate over word limits and presentation of economic evaluations was recently sparked in the *BMJ* who have issued a policy directive requiring clinical and cost analysis to be submitted together (Smith, 2002). Resulting correspondence (<http://bmj.com/cgi/eletters/325/7373/1124>, accessed 14 January 2003) appears to be in favour of this change along with a concern that the journal papers may become unwieldy. However, it should be noted that the framework use for the literature appraisal was developed using the guidelines for publishing economic evaluations in the *BMJ*. Thus it should be expected that cost analysis be clearly presented.

### **A Framework for Evaluation**

The thesis has illustrated that a gap exists between how economic evaluations are actually carried out and the ideals espoused in the methodological literature. The case study provided a wealth of information that identified and explored the constraints that are imposed when carrying out an economic evaluation of a rehabilitation intervention. These constraints not only mirror many of the constraints identified in the literature but also call in to question the notion that limitations should not dictate the way in which evaluations are carried out. Theoretically this idea is sound but the case study and the literature findings showed that actual evaluations may be dictated by these constraints.

The question this thesis has attempted to explore is whether rehabilitation services can be meaningfully evaluated within the existing framework of economic evaluation. That the *ideal* economic evaluation should be strived towards and where possible the methodology followed is not called into question. The literature appraised has shown that this ideal evaluation *is* possible but that constraints often preclude the attainment of these ideals and thus place limitations upon the study findings and implications for policy and practice.

However, one of the major constraints to a meaningful economic evaluation appeared to be the narrow perspective typically adopted by economic evaluations in this field. The methodological texts ascertain that the perspective should be in line with the study question. Thus if the question posed addresses only the cost to the service provider then, in line with the methodological texts, only these costs will be included. But findings from both the literature appraised and the case study indicate that both costs and consequences almost certainly accrue outside of this perspective and thus it is highly unlikely that results presented a single viewpoint will be comprehensive or indeed meaningful, even working within the tenets of an ideal economic evaluation.

The case study illustrated how qualitative data may be used to complement evidence of effectiveness and identify costs other than those to the service provider and patient. This data whilst not presenting a quantitative value for these costs and consequences, acts as an indicator of potential costs and consequences and facilitates the presentation of a more comprehensive evaluation of the rehabilitation process.

Other constraints presented include: how to reflect multiple and diverse outcomes; the impact of multiple outcomes and their measurement upon the form of evaluation used; and the time scale of the economic evaluation. All of these lead to a divergence from the ideal economic evaluation. Within the context of the case study the narrative data added to the evidence of effectiveness and costs and shed light on the possible causal link between improvements in client outcomes and the rehabilitation programme. However, a weakness of the study lay in the fact that the qualitative did not ask respondents directly about costs (be they financial, emotional or health costs) nor directly about the consequences. The developmental framework presented below addresses not only the

ideal economic evaluation but also how deviation from this ideal can be addressed to provide a more meaningful evaluation.

The framework has been modified from that presented in Chapter Four. The questions posed and design advice in the framework have been formulated to incorporate the constraints to the evaluation process outlined. Any economic evaluation should be designed to answer the study question. But the results and analysis should not be treated in isolation; the findings should be transferable to other settings. For the results to do so there should be clear indications of all important costs and consequences even if all those costs and consequences are not measured.

The findings from the case study indicated that qualitative data can facilitate the presentation of the 'bigger' picture. This requires thinking and analysis that looks outside of the quantitative confines of economic evaluation. The evidence suggests that numerous quantitative outcome measures are used within the economic evaluation of rehabilitation interventions at the present time to ensure a broad spectrum of outcomes are presented rather than single quality of life tools or use of CUA. It may be possible to reduce the number of these quantitative measures or to facilitate the use of single measures through the use of qualitative data.

### **Strengths, Weaknesses and Future Research**

The thesis addresses the difficulties of carrying out an economic evaluation of a complex service drawing upon existing studies and the first hand experience of carrying out an economic evaluation of a complex rehabilitation programme. In doing so analysis and discussion focuses upon the difficulties in conforming to the standards set for ideal evaluation. Whilst it is clear that it is, in some cases, possible to adhere to the ideal the thesis lends insight into why this is not always possible. The thesis has shown how any divergence from the ideal can be compensated for in order to present a meaningful evaluation.

**Box 8: A framework for economic evaluation of rehabilitation interventions**

Is the hypothesis/study question economically important? The hypothesis should include costs and consequences and clearly state the perspective

Is the perspective or viewpoint of the study narrow? If the perspective is restricted (for example, does the perspective only consider costs to the service provider and only patient outcomes?) consider whether there are there likely to be costs and consequences to other sectors outside that viewpoint and, if so, explore how these may be identified

What is the intervention compared with? Consider if this is appropriate, for example, is the intervention compared with previous or current practice? The reason for using the comparator should be clearly explained.

What form does the evaluation take (CEA, CBA, CCA, CUA, CMA)? The form of evaluation should be appropriate to the hypothesis and reflect all potential or likely costs and consequences

Has evidence of effectiveness been presented? The type of study design should be clearly outlined together with the reasons for using that design. Details of the sample and sample selection should be transparent. A power calculation should be used to determine sample size.

In respect to the effectiveness of the intervention, has a causal relationship been evidenced? If not consider using qualitative data to complement quantitative measures

Have all important benefits been included? Consider not only those within the perspective adopted but those to sectors outside that viewpoint. Any valuation methods should be clear and any modelling explicit

Are the methods used for costing transparent? All the inclusion and exclusion criteria should be presented and the evaluation should provide evidence (quantitative or qualitative) of important costs that may fall outside the perspective of the evaluation. Costs and quantities should be presented separately and discounting used if appropriate. Dates of price data should be clear

When presenting the results do they include the duration/length of follow up, summary of findings, and side effects? All costs should include the total intervention and comparator costs, statistical analysis and confidence intervals, duration and any adverse effects or knock on costs. The evaluation should take account of uncertainty and carry out statistical tests to outline differences in sub-populations

Do the results answer the hypothesis or study question? As well as answering the study question consider whether the evaluation results are meaningful. If the perspective is narrow has supplementary data been collected to provide a meaningful indication of costs and consequences outside the narrow perspective that enables findings to be transferred to other settings

The framework advocates identification of inputs and outputs that fall outside the perspective of the study in order to provide a comprehensive picture. Thus, although the economic evaluation may still be carried out from a narrow perspective, potential costs and consequences that fall outside these parameters may be included through the use of non-quantitative data. The framework also advocates the use of supplementary data to establish a causal relationship and reduce the disadvantages apparent when not using a RCT. A case has also been made for the inclusion of qualitative data to look 'outside the box' in order to reflect the multifaceted nature of rehabilitation and rehabilitation interventions. Whilst this idea is not unique the framework and design advice outlined provides a template by which to judge evaluations that steps away from the methodological texts.

There are however weaknesses apparent in the thesis. Constraints in the evaluation process were identified using a single case study. These constraints may be specific to the programme rather than generalisable. However, these constraints mirrored those outlined in the discussion Chapter Two. The constraints influenced how the economic evaluation was carried out and this too is echoed in the appraised papers (Chapter Five).

One constraint identified in Chapter Two is associated with the degree of user involvement. This has not been explored within the thesis. The acceptance criteria for the rehabilitation programme evaluated was such that all clients on the rehabilitation programme wished to regain independence and had a level of memory recall and motivation that allows active participation in the rehabilitation. This meant that only those clients who could actively participate in rehabilitation and were sufficiently motivated were included. Of the sample of 73 included in the evaluation, four clients were removed from the programme due to non-compliance with their rehabilitation programmes. This suggests the degree of user involvement was not a constraint within the case study.

A further weakness relates to the loss of detail caused by appraising published papers rather than original studies. This weakness was highlighted when appraising the cost analysis of the studies. The costs were, in general, badly presented and described but insufficient detail was given to ascertain the reason why. One possible explanation is the word limit imposed by journals that precluded fuller details of the cost analyses.

One way this could have been remedied would have been to contact the authors of the studies direct. However this was not feasible in the time scale.

The use of qualitative data from interviews with clients and carers may be seen as both a strength and weakness. The data was indicative of costs and consequences not included in the quantitative analysis but, in retrospect, it would have been better to have asked questions directly about these areas. The interview data was collected to explore the way in which the care management model was implemented. Thus the findings have been used somewhat selectively to illustrate and to cast light on other perspectives.

The framework presented is very much developmental and whilst it has been developed for rehabilitation interventions it may also be relevant and applied to other complex interventions, integrated services and services that take a holistic approach to health care. For example, Nahin and Straus (2001) outline the difficulties faced when evaluating complementary and alternative medicine (CAM) citing factors such as complex, individualised treatment and lack of standardisation. Similarly, Stone et al (2002) cite challenges in research methodology in complementary medicine that include the influence of the practitioner and user, appropriate outcome measures and variations in experience. These constraints mirror those facing an economic evaluation of a rehabilitation service. Future research will focus upon testing the framework (and therefore the conclusions drawn within the thesis) to determine the feasibility of including other sources of data in terms of both time and funding constraints and to appraise the value added by this data.

### **Concluding Remarks**

In 1992, McKenna Maynard and Wright observed an incapacity to design trials of an adequate size and poor methodology to collect valid cost and effectiveness data. The thesis finds that the trend observed by McKenna et al (1992) a decade ago continues. Whilst *practical problems must not be allowed to drive the manner in which economic evaluations are conducted* (Coast et al, 2000, p46) the complexities inherent in the rehabilitation process together with practical difficulties identified when carrying out an economic evaluation of a rehabilitation intervention are not conducive to the ideal evaluation set out in the methodological text. The findings also showed that qualitative

data can provide corroborating evidence in terms of effectiveness and also be indicative of costs and effects outside the narrow perspective typically employed.

A divergence from the ideal economic evaluation is apparent reflecting the view that *study design alone cannot suffice as the main criterion for the credibility of evidence* (Rychetnik et al, 2002, p121). The ultimate question remains in the face of the constraints identified, how may the evaluation be carried out in a meaningful way? Perhaps the design advice outlined in Box 8 points one possible way forward.

**Appendix One**  
**Template for Evaluation**



**Economic Evaluation****(1)****Is the hypothesis clearly stated?** YES NO

Does it include costs and outcomes? YES NO

Is the perspective stated and justified? YES NO

What perspective has the study been undertaken from?

Service provider / Service provider &amp; patient/family / Third party payer

**(2)****Was selection of alternatives appropriate and justified?** YES NO

What alternative was used for comparison of effectiveness?

Previous study Current/previous practice

**Was this a:**

Control Group 'Historical' comparison before and after (same group)

Another service in different location Hypothetical Situation

Meta-analysis Previous study

What alternative was used for comparison of costs?

Previous study Current/previous practice

**Was this a:**

Control Group 'Historical' comparison before and after (same group)

Another service in different location Hypothetical Situation

Meta-analysis Previous study

Was the same selection of alternatives used for both costs and effectiveness?

YES NO

**(3)****What form of evaluation was used?**

CEA CCA CBA CUA CMA

(4)

**Effectiveness:**

Was the effectiveness evidence presented from:

Previous Study          Collected as part of the study

If collected as part of the study, what type of study was conducted?

RCT    One shot case study    before & After Quasi Experimental

What was the sample size?

Were power calculation undertaken to determine sample size?

How many measures of outcome were used?

What was the primary outcome measure?

(5)

**Benefits:**

Was the primary outcome clearly stated and justified?

Were the outcomes the same as those used in the effectiveness?          YES    NO

Were details of valuation methods (if used) given?          YES    NO    N/A

Were indirect benefits considered?          YES    NO    N/A

If modelling was used was it explicit and clear          YES    NO    N/A

(6)

**Costs:**

What method of costing was used?

Micro          Gross          Mixed          Average per diem Costs          Charges

Were costs and quantities presented separately?          YES          NO

Was discounting used if appropriate?          YES          NO

Was the cost boundary justified?	YES	NO
Was the difference between average and marginal costs reported?	YES	NO
Was the inclusion/exclusion criteria presented?	YES	NO

(7)

**Results:**

Did benefits include:

Duration	YES	NO	
Length of follow up	YES	NO	N/A
Side effects	YES	NO	N/A

Did costs include:

Total costs for intervention and comparator	YES	NO
Statistical analysis including CIs	YES	NO
Duration	YES	NO
Knock on costs	YES	NO

Overall did the study include:

Incremental analysis	YES	NO
Sensitivity analysis	YES	NO
Statistical analysis of differences	YES	NO

Did the results answer the hypothesis?

(8)

**Generalisability:**

Was there sufficient detailed analysis to allow the reader to decide if the results apply to other settings?

	YES	NO
Comments:		

## **Appendix Two**

### **Outcome Measures Booklet**

## Completed either at :

- ASSESSMENT
- DISCHARGE
- 3 MONTH FOLLOW UP

(Circle as appropriate)

### To the Care Manager - About the assessment tool:

- Section 1 asks you, as the care manager, to assess the client's functional ability and complete questions 1 to 11.
- Section 2, 3 & 4 rely on gaining the clients point of view.
- The client can fill the questions in independently. Alternatively, you can read questions out loud to the client and record their answer.
- Section 2 asks the client about whether they are able to do the things they would like to in various aspects of their life.
- Section 3 asks the client about their emotions
- By means of a summary, section 4 asks the client to choose statements which best describe their health

Client name..... Age.....Male/Female

Care Manager..... Date .....

Complete at end of assessment:

Client has agreed to records being used - **Yes/No** (Circle as appropriate)

## SECTION 1

**By placing a tick in each box, indicate which statement best describes the client's functional ability**

### 1. Assess ability to meet personal hygiene needs

- Client passive and dependent in all aspects.
- Assistance required in all aspects but can participate minimally (e.g. can wash own face if given flannel; attempts to comb hair if given comb; applies shaving cream but does not use razor etc.)
- Some assistance required in more than one step of personal hygiene (e.g. client can wash and dry upper half of body but requires help with lower half; may need help with shaving delicate areas e.g. around the mouth; may need help to apply toothpaste to brush or to apply anti-perspirant.)
- Able to conduct own personal hygiene but requires minimal assistance (e.g. in preparing equipment, selecting implements; applying toothpaste to brush; applying cosmetics. )
- Independent in personal hygiene - can wash and dry self without assistance, comb hair, clean teeth, shave/apply cosmetics.

	0
	1
	3
	4
	5

### 2. Assess bathing ability

- Total dependence - client unable to participate, or unsafe to have a bath/shower due to condition e.g. for balance reasons. Presence of another person required.
- Assistance required in preparation of equipment, transferring in to and from bath/shower, washing and drying.
- Assistance required with preparation of equipment, either transfer to and from bath/shower, or with washing and drying.
- Supervision required for safety e.g. in adjusting the water temperature, or in transfers.
- Client may use bath/shower, or have a full sponge bath - must be completely independent in all stages of whichever method without requiring the presence of another person.

	0
	1
	3
	4
	5

### 3. Assess ability to eat and drink

- Dependent in all aspects - needs to be fed.
- Can manipulate an eating device, usually a spoon, but someone must provide active assistance setting up and during the meal.
- Able to feed self with supervision. Assistance required with associated tasks (e.g. putting milk/sugar into tea, salt and pepper, cutting meat, spreading butter, turning a plate.)
- Independent in eating from prepared tray. May need occasional help to cut meat, open milk/juice carton and jam etc.
- Can feed self from tray/table when food is placed within reach - must be able to put on assistive devices if needed, cut food, use salt and pepper, spread butter etc.

	0
	2
	5
	8
	10

### 4. Assess ability to get on and off toilet

- Fully dependent in using toilet. Needs one/two people to transfer to toilet/commode/bedpan: cannot manage own clothing or toilet paper. Cannot flush toilet or empty and clean commode/bedpan. Requires presence of other person for safety
- Assistance of one/two persons required for transfer to toilet/commode and/or management of clothing, can use toilet paper and wash hands with assistance
- Assistance required for transfer to toilet/commode (one person). Can manage own clothes, use toilet paper and wash hands. Unable to empty or clean commode
- Supervision of transfer to toilet required for safety. Independent in all other aspects. A commode may be used at night but assistance required for emptying and cleaning it.
- Independent - able to transfer on and off toilet, manage own clothing, use toilet paper, wash hands without assistance of another person. If uses a commode/urinal at night, able to empty and clean it.

	0
	2
	5
	8
	10

## 5. Assess ability to use the stairs

- Unable to climb stairs.
- Assistance required in all aspects of stair climbing, including assistance with walking aids.
- Able to ascend/descend but unable to carry walking aids and needs supervision.
- Generally no assistance required. At times supervision is required for safety due to morning stiffness, shortness of breath etc.
- Able to go up or down a flight of stairs safely without help or supervision. Able to use handrails, cane or crutches when needed and carry these devices as he/she ascends or descends.

	0
	2
	5
	8
	10

## 6. Assess ability to get dressed

- Dependent in all aspects of dressing and unable to participate in the activity
- Able to participate but remains basically dependent in all aspects of dressing (e.g. can raise arm/leg to assist in dressing, can pull garments over head. Needs help with stockings/socks and shoes)
- Minimal assistance needed in putting on or removing clothing. Needs guidance (e.g. in ensuring garment is put on the right way round and support e.g. to stand up to pull lower garments. May need help to adjust clothing for comfort.)
- Minimal assistance required with fastening clothing such as buttons, zips bras, shoes etc and making small comfort adjustments.
- Able to put on, remove and fasten clothing, tie shoelaces, put on / fasten bra, etc.

	0
	2
	5
	8
	10

## 7. Assess ability to meet bowel needs

- Bowel incontinent.
- Sometimes aware of need to defecate but needs help to assume appropriate position and with bowel movement facilitatory techniques. Frequent episodes of incontinence. (More than half all bowel movements).
- Aware of need to defecate and can assume the appropriate position but, cannot use facilitatory techniques or clean self without assistance. Has occasional accidents.
- Can identify need to evacuate bowels but may require supervision with the use of suppositories or enema.
- Can control bowels and has no accidents.

	0
	2
	5
	8
	10

## 8. Assess ability to manage urinary needs

- Dependent in bladder management, incontinent and unaware of need to pass urine, or has an indwelling catheter.
- Incontinent of urine but occasionally aware of need to pass urine and able to assist with application of external devices.
- Generally dry by day, but not at night and needs some assistance with devices.
- Generally dry by day and night but may have an occasional accident, or need minimal assistance with devices.
- Able to control bladder day and night

	0
	2
	5
	8
	10

## 9. Assess ability to manage chair-bed transfers

- Unable to participate in transfer. Two attendants required to transfer client with or without a mechanical device.
- Able to participate but maximum assistance of one other person required in all aspects of the transfer (includes wheelchair transfers).
- Transfer requires minimal assistance of one other person. Assistance may be required in any aspect of the transfer (includes wheelchair transfers) e.g. help in standing up.
- Presence of another person required either as a confidence measure, or to provide supervision for safety.
- Client can transfer independently. If using a wheelchair, can safely approach the bed, lock the brakes, lift the footrest, move safely to bed, lie down, come to a sitting position on the side of the bed, change the position of the wheelchair, transfer back into it safely.

	0
	3
	8
	12
	15

## 10. Assess ability to walk

- Unable to walk, even with maximum assistance.
- Constant assistance of one or two persons required during walking.
- Assistance required with reaching aids and/or their manipulation. One person required to offer assistance/support.
- Independent in walking up to 50 yards/metres, or may require supervision for confidence or safety.
- Able to assume the standing position, sit down and use necessary walking aids correctly. Can walk 50 yards/metres without help or supervision.

	0
	3
	8
	12
	15

## 11. Assess ability to manage with a wheelchair

Only use this item if the client is rated 1 for walking (question 10), and then only if the client has been trained in wheelchair management

- Dependent in wheelchair ambulation.
- Can propel self short distances on flat surface but assistance required with all other steps of wheelchair management.
- Presence of one person needed and constant attendance required to manipulate chair to table, bed etc.
- Client can propel self for a reasonable duration over regularly encountered terrain. Minimal assistance may still be required in "tight corners".
- To propel wheelchair independently the client must be able to go around corners, turn around, manoeuvre the chair to a table, bed, toilet etc. The client must be able to push a wheelchair at least 50 yards/metres.

	0
	1
	3
	4
	5

## Section 2

The following questions ask how well you feel you are able to do what you want to in areas of your life. To answer each question, tick one box to indicate the extent to which each statement *describes your situation*

**12. I move around my living home as I wish**

Fully describes my situation

Mostly describes my situation

Somewhat describes my situation

Does not describe my situation

	0
	1
	2
	3

**13. I move around my local area as I wish**

Fully describes my situation

Mostly describes my situation

Somewhat describes my situation

Does not describe my situation

	0
	1
	2
	3

**14. I am able to take necessary trips out of town**

Fully describes my situation

Mostly describes my situation

Somewhat describes my situation

Does not describe my situation

	0
	1
	2
	3

15. I am happy with the way my needs are met in areas such as eating and drinking, getting dressed, getting washed and going to the toilet.

Fully describes my situation

	0
--	---

Mostly describes my situation

	1
--	---

Somewhat describes my situation

	2
--	---

Does not describe my situation

	3
--	---

---

16. I spend most of my days doing activity that is necessary or important to me.

Fully describes my situation

	0
--	---

Mostly describes my situation

	1
--	---

Somewhat describes my situation

	2
--	---

Does not describe my situation

	3
--	---

---

17. I am able to take part in recreational activities (hobbies, crafts, sports, reading television, games computers etc) as I want to

Fully describes my situation

	0
--	---

Mostly describes my situation

	1
--	---

Somewhat describes my situation

	2
--	---

Does not describe my situation

	3
--	---

**18. I participate in social activities with family, friends and/or neighbours as necessary or desirable to me**

Fully describes my situation

Mostly describes my situation

Somewhat describes my situation

Does not describe my situation

	0
	1
	2
	3

**19. I assume a role in my family which meets my needs and those of other family members (Family means people with whom you live and/or relatives with whom you don't live but see on a regular basis)**

Fully describes my situation

Mostly describes my situation

Somewhat describes my situation

Does not describe my situation

	0
	1
	2
	3

**20. In general, I am comfortable with my family relationships**

Fully describes my situation

Mostly describes my situation

Somewhat describes my situation

Does not describe my situation

	0
	1
	2
	3

**21. In general, I am comfortable with myself when I am in the company of others**

Fully describes my situation

Mostly describes my situation

Somewhat describes my situation

Does not describe my situation

	0
	1
	2
	3

---

**22. I feel that I can deal with events in life as they happen**

Fully describes my situation

Mostly describes my situation

Somewhat describes my situation

Does not describe my situation

	0
	1
	2
	3

## Section 3

We know that emotions play an important part in how well we feel. This questionnaire asks about how you are feeling. If the Care Manager knows about your emotions, he/she will be able to help you more.

Read each item below and tick the box which best describes how you have been feeling in the past week.

**23. I feel tense or 'wound up'**

Most of the time

A lot of the time

From time to time, occasionally

Not at all

	3
	2
	1
	0

**24. I still enjoy the things I used to enjoy**

Definitely as much

Not quite so much

Only a little

Hardly at all

	0
	1
	2
	3

**25. I get a sort of frightened feeling as if something awful is about to happen**

Very definitely and quite badly

Yes, but not too badly

A little, but it doesn't worry me

Not at all

	3
	2
	1
	0

**26. I can laugh and see the funny side of things**

As much as I always could

Not quite so much now

Definitely not so much now

Not at all

	0
	1
	2
	3

**27. Worrying thoughts go through my mind**

A great deal of the time

A lot of the time

Not too often

Very little

	3
	2
	1
	0

**28. I feel cheerful**

Never

Not often

Sometimes

Most of the time

	3
	2
	1
	0

**29. I can sit at ease and feel relaxed**

Definitely

Usually

Not often

Not at all

	0
	1
	2
	3

**30. I feel as if I am slowed down**

Nearly all the time

Very often

Sometimes

Not at all

	3
	2
	1
	0

**31. I get a sort of frightened  
in the stomach**

**feeling like 'butterflies'**

Not at all

	0
	1
	2
	3

Occasionally

Quite often

Very often

**32. I have lost interest in my appearance**

Definitely

I don't take as much care as I should

I may not take quite as much care

I take just as much care as ever

	3
	2
	1
	0

**33. I feel restless as if I have to be on the move**

Very much indeed

Quite a lot

Not very much

Not at all

	3
	2
	1
	0

**34. I look forward with enjoyment to things**

As much as I ever did

0

Rather less than I used to

1

Definitely less than I used to

2

Hardly at all

3

**35. I get sudden feelings of panic**

Very often indeed

3

Quite often

2

Not very often

1

Not at all

0

**36. I can enjoy a good book, radio or television programme**

Often

0

Sometimes

1

Not often

2

Not at all

3

## Section 4

<b>Describing your own health today</b>
---

By placing a tick in one box for each area below, please indicate which statements best describe your own health today.
---

**37. Mobility**

I have no problems in walking about

	1
	2
	3

I have some problems in walking about

I am confined to bed

**38. Self - Care**

I have no problems with self - care

	1
	2
	3

I have some problems washing or dressing myself

I am unable to wash or dress myself

**39. Usual activities (eg work, study, housework, family or leisure activities)**

I have no problem with performing my usual activities

	1
	2
	3

I have some problems with performing my usual activities

I am unable to perform my usual activities

**40. Pain / Discomfort**

I have no pain or discomfort

I have moderate pain or discomfort

I have extreme pain or discomfort

	1
	2
	3

**41. Anxiety / Depression**

I am not anxious or depressed

I am moderately anxious or depressed

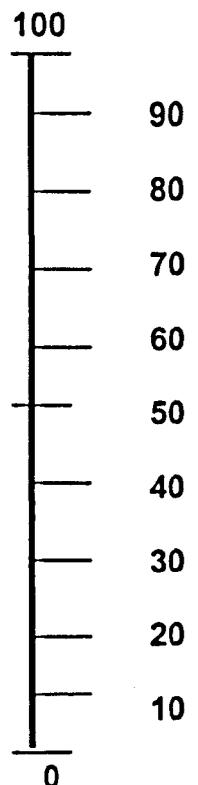
I am extremely anxious or depressed

	1
	2
	3

<b>Best imaginable health state</b>
---

We would like you to mark on this scale how good or bad your health is today in your opinion. The scale goes from 0 to 100. If you felt your health was the best imaginable, you would place a cross at 100. If your health was the worst possible, you mark the 0.

Draw a cross on the scale to say how good or bad you feel your health is.



<b>Worst imaginable health state</b>
--

To the practitioner:

Did you need to explain any of the questions?

Yes/NO (delete as appropriate)

### **Asking permission for notes to be used:**

- The Rehabilitation Link Team is a new service. A research project has been set up to monitor its progress and see whether it is working.
- To do this, information is being collected from client/patient records kept by the Rehabilitation Link Teams.
- By looking at these notes, we can find out what effect the service is having on people's health.
- Would you be happy for the research team to look at your notes?
- If you don't want your records to be used, this will not affect your care in any way.
- All information taken will be kept confidential and your name will not be mentioned in any reports.

**Please sign below if you are willing to let your records be used:**

**Signature.....Name.....**

**Date..... Care manager .....**

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